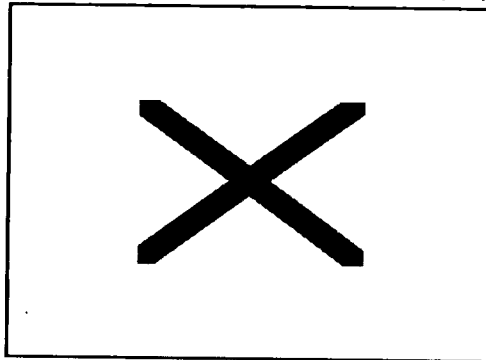


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PHASE I



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P R E F A C E

India can take pride, in being one of the twelve mega biodiversity regions of the world, but the speed of loosing its biodiversity has been quite fast mainly due to its population explosion and consequent need for more land for agriculture, habitation, irrigation, roads, railways, power and industries. While development process cannot be stopped or reversed totally, prudent and judicious planning can certainly reduce the pace of destruction.

It is heartening that the World Bank assisted State Road Project, which is taking up development of more than 3000 kms. of state highways is very keen to prepare a "Biodiversity Action Plan" for the road corridors. Many of the road stretches do pass through eco-sensitive regions or close to them thereby impacting them. This document aims at mitigating these adverse impacts to the extent possible. Considerable effort has gone into locating such critical stretches and suggesting remedial measures.

I shall be happy if the recommendations of this report are implemented in letter and spirit in order to provide a better environment to the wildlife despite the speedy traffic and other developments along the road corridors.

I am thankful to Ms. Neha Vyas Expert, World Bank for her intuition to generate a separate standalone report on Biodiversity Assessment and Management. I am also thankful to Shri J. Nayak, Chief Engineer & Shri P.C. Samal former Chief Engineer, Orissa State Road Project and all other officers of the Project for their support. My thanks are due to Sri Sukesh Gupta, Team leader, Dr. M.K. Jain Environment and all others of the CEG but for whose active involvement preparation of this document would not have been possible. My special thanks are due to Sri G.P.Mohanty, O.F.S.(I) [Retd], but for whose support this plan would not have been possible.

Bhubaneswar
December 20, 2006



(S.K. Patnaik)

EXECUTIVE SUMMARY

- 1.0 Govt. of Orissa through its Works Department (OWD) has with the intention of providing quality road communication system to all these regions of the state has embarked upon a highly ambitious project. "The Orissa State Road Project (OSRP) to improve existing prospective State Highways (SH), Major district Roads (MDR), Other District roads (ODRs) and Rural Development Roads in to 2-lane State Highways so that places of economic importance and areasto develop in future will be well connected by modern two lane State Highways, through World Bank assistance.

Based on Techno Economic evaluation the OSRP of Orissa Works Department (OWD) hve identified 825km of state highways under phase-I programme for development.

The following roads are proposed to be taken up for improvement under the 1st phase programme:

1. Bramhapur – Mohana – Bangi Jn. -J.K.Pur – Raygada, 202 kms (150+52)
2. Chandbali – Bhadrak, 51 kms ✓
3. Bhadrak – Anandapur, 57.4 kms. (up to Godabhanga) ✓
4. Anandapur – Karanjia – Tongabila (Jashipur), 80 kms.(65+15)
5. Aska – Bhanjanagar, 39 kms
6. J.K.Pur – Muniguda – Bhawanipatna, 118 kms (50+68)
7. Bhawanipatna – Khariar, 70 kms ✓
8. Daspalla–Gania–Sidhamula–Narsingpur–Hindol–Mhidharpur–Nuahat(Banarpal), 102kms
9. Jagatpur – Kendrapada – Patamundai–Aul- Baitarani Bridge (Chandbali), 99 kms

The following roads are proposed to be under year-1 programme of OSRP for upgradation out of the 825 kms selected under phase-1 corridors for development. The roads are:

Sl. No.	Name of the Corridor	Road Identification	Length (in Km.)
1.	Berhampur – Mohana - (Bangi Jn)	SH-17	41.00-0to41Km
2.	Khariar-Bhawanipatna	SH-16	68.00-2.0to70Kms
3.	Chandbali –Bhadrak	SH-9	45.00-0to45Kms
4.	Bhadrak-Anandapur	SH-53	48.00-0to 48Kms
		Total	202.00

To provide input under environmental impact and mitigation measures is prepared which shall The Biodiversity Assesment and Management Plan will provide in depth analysis of the individual problems on each road corridor and based on its recommended parameters make provisions for preserving and protecting the wild flora and fauna by suitable change in the design structure that will be blended at the project formulation stage and effective monitoring measures shall be continued there after.

2.0 THE TRACT DEALT WITH:

The State has about three quarters of its area covered by hilly land and a limited area of lower elevation or flat land. Thirty seven percent (37%) of the state land mass is covered with forest of various category covering an area of 58,135.47sq kms.

The total geographical area of the State is 1,55,707 sq.kms. The actual forest cover is 48,366sq.kms of different densities according to the satellite imagery data published by the Forest Survey of India, Dehra Doon.

The climate of the state is tropical and has mainly 'Tropical Dry Deciduous Forests' and 'Tropical Moist Deciduous Forests' with flora and fauna belonging to tropical region. While Sal, Asan, Piasal (Bija), Sisoo, Teak, Mahul, Gambhar, Bamboo are main tree species; tiger, elephant, leopard, gaur, sambar, cheetal, python, peafowl, three species of crocodiles and many water birds constitute fauna. It is also rich in medicinal plants.

3.0 PROTECTED AREAS:

There are 18 sanctuaries, 2 National Parks, 2 Ramsar sites, 1 Biosphere Reserve, 1 Tiger Reserve and 5 Elephant Reserves in the state for preserving its flora & fauna. Another Tiger Reserve, Satkosia is awaiting notification by the state government.

4.0 THE PROJECT BACKGROUND:

The Orissa Works Department (OWD) desires to upgrade 825 kms of State Highway under Phase -1 for economic development based on techno economic evaluation and detail project preparation has been initiated through on site data collection, traffic studies, existing pavement conditions in terms of roughness and design aided by computer based package and ground truthing.

The project preparation also includes the cost estimate, preparation of bid documents and addressing social and environmental issues as required under the World Bank guide lines, statutory requirements of the state and Govt. of India. The project also includes network analysis of remaining 3700 kms of State Highways based on techno economic approach to select 1600 kms of project routes for feasibility studies to plan their development.

The project road corridors of 825 km now proposed for development or improvement will mainly consist of:

1. Raising the formation level.
2. Widening to two-lane from existing single lane and intermediate lane width.
3. Strengthening of the pavement.
4. Up grading to 4 laning in urban areas with provision for drainage, side walks, parking bay etc.
5. To make the top carriage way width of 7 mtrs with provision of soft and hard shoulders of 2.5 mtr on either side.
6. To improve the road geometry on highways.

The roads cover the civil districts of Bhadrak, Keonjhar, Mayurbhanj, Ganjam, Gajapati, Rayagada, Kalahandi, Nuapada, Nayagarh, Cuttack, Dhenkanal and Angul.

The road corridors pass through 22 Reserved Forests in Rayagada, Gajapati and Ganjam districts and four recognized wild life movement corridors for Sloth bear, and elephants on Berhampur-Bangi Jn - Rayagada route. This passes within 10 kms from Lakhary Valley Sanctuary of Gajapati district.

On Anandapur Karanjia-Jashipur route the road cuts across 18 Reserved Forests, Mayurbhanj Elephant reserve, Similpal Biosphere reserve (buffer, additional buffer and transition zone), 7 elephant passages in Mayurbhanj and Keonjhar districts and within the 10 kms impact zone of Similpal Wildlife Sanctuary. Bhadrakh to Anandpur portion of this corridor passes within 3 Km from the Hadgarh Wildlife sanctuary.

On Daspalla-Banarpal route the road passes through 5 elephant movement passages and 5 reserved forests (running across or running adjacent to) in Cuttack, Dhenkanal and Nayagarh

districts. This also meets the NH-42 near Banarpal which is within 10 kms from the pollution hot spots of Talcher and NTPC as declared by the Central Pollution Control Board (CPCB).

Jagat pur-Kendrapada-Aul-Chandbali and Chandbali-Bhadrak route passes within the 10 kms impact zone of the Bhitarkanika Wildlife Sanctuary, habitat of estaurian crocodile, horseshoe crab, various wetland breeding areas of fish, shrimps, crabs, molluscs, amphibians and reptiles. It also crosses some inter-tidal flood plains of river Brahmani and Baitarani.

The J.K.Pur → Muniguda → Bhawanipatna route passes through dense reserved forests of Rayagada and Kalahandi districts besides several Wildlife Crossing points.

5.0 FOREST AND ENVIRONMENTAL REGULATIONS AND POLICIES:

The increase of environmental concern also necessitated appropriate tools to protect the environment. After the Stockholm Conference, the first exclusive Wildlife (Protection) Act, 1972 was enacted by Government of India in 1972 and two years after this, the first exclusive environmental act, Water (Pollution Prevention and Control) Act was enacted in 1974. In accordance with this act Central and State Boards for Prevention and Control of Water Pollution were set up. Later these boards were renamed into Central Pollution Control Board(CPCB) and State Pollution Control Boards(SPCB). Department of Environment was set up in 1980. Subsequently in 1985, it was upgraded to a full-fledged Ministry of Environment and Forests to serve as the focal point in the administrative structure for planning, promotion and coordination of environmental and forestry programmes. The Ministry of Environment and Forests (MoEF) has overall authority for the administration and implementation of government policies, laws and regulations.

For sustainable development and pollution control, MoEF identifies the need to enact new laws and amend existing environmental legislations when required, in order to continue to conserve and protect the environment. At the state level, the Department of the Environment and the Department of Forest implement the authority MoEF.

In 1976, the 42nd Constitutional Amendment created Article 48A & 51A, placing an obligation on every citizen of the country to attempt to conserve the environment. As a result, a number of laws related to environmental conservation were passed to strengthen existing legislation. Environment (Protection) Act, 1986 is the landmark legislation as it provides for the protection of environment and aims at plugging the loopholes in the other related acts.

The Indian forest Act 1927 was replaced by Orissa forest Act 1972. Wildlife protection Act 1972 was adopted in Orissa from 14th August 1974. The wildlife protection act empowered the GoI & GoO to constitute the advisory boards for wildlife with definite responsibilities and duties. It also provided separate provisions under chapter III on ban on hunting, collection of plants and specimens, trading, stock declaration, Plants being the property of Govt. besides protection of animal and plants through declaration of schedule animals and restricted plants. Settlement of sanctuaries and national parks regulations on entry in to them and activities inside sanctuaries and national parks was also provided for.

The state government has also issued Wildlife (Protection) Rules in 1974. Of course this needs amendment with amendments to the act. In order to prevent diversion of forest land for non-forest use Forest (Conservation) Act, 1980 has been enacted and several guidelines provided for its implementation. This is being scrupulously followed by the Government of Orissa.

The plan gives a detailed description of the procedure to be followed to meet the requirement of different legislations.

The corridors most affected will be the reserved forest and protected forest stretches where the roads pass along or within them. Such roads in order of their presence or absences of P.A.'s have been listed below under category A and Category B under revised environmental guide lines issued by MoEF, GoI on 14.09.2006

1. Bhadrak-Anandapur-Karanja-Jashipur -SH -53&49	A
2. Bhadrak-Chandbali-S.H.-9	A
3. Bramhapur-Mohana-Bangi Jn.- Rayagada – SH -17&4	A
4. Daspalla – Gania –Baghdhariya –Narasingpur Jn.-Hindol- Mahidharpur-Nuahata (Banarpall)-SH – 65A&B, 65, 64, 64A&B	A
5. Jagatpur-Chandbali-S.H.9A	A
6. J.K.Pur-Muniguda – Bhawanipatna	B
7. Aska-Bhanjnagar - S.H.-7	B
8. Bhawanipatna – Khariar	B

6.0 METHODOLOGY OF ASSESSING THREATS TO BIODIVERSITY:

In order to assess the threats to biodiversity along different road corridors three types of surveys namely institutional level survey involving field forest staffs, road user level survey involving the drivers and local inhabitants shopkeepers and general public and habitat level survey was conducted in consulting local field forest and wildlife officials. The team constituted of four personnel who were trained and given a questionnaire along with pictures of animals and plants for conducting this survey on all road corridors.

7.0 GENERAL THREATS:

The wildlife, wild animals and biodiversity of the region may suffer due to any road development. Some perceived threats are enumerated below:

Removal of road side trees either avenue or naturally occurring for widening shall deprive the birds, animals, reptiles, orchids, mosses, lizards and insects of their habitat and totally wipe away their population.

Cutting of hill slopes for road making without proper protection may lead to soil erosion and affect moisture retention, thus creating arid condition and loss of food.

The construction work involving, blasting of rocks, crushers, mixers, lighting, road-making machines shall destroy wildlife habitat along the road corridors.

Fast moving traffic and increase in movement of vehicles during the day and night shall obstruct natural passages and corridors of long ranging animals, either by affecting their foraging or causing genetic isolation of small herds.

Due to fragmentation and reduction of natural habitat, animals will enter crop fields and habitation, thereby increasing man-elephant conflict to detriment of both the human population and wild animals.

Many species of plants, which are common to road sides, may vanish if adequate step is not taken to save them. These plants which often host many other plant and animal species may suffer irreparable loss, including those which find 'niches' on them.

Opening and improvement of roads also facilitate poaching of wild animals and collection of parts or whole of endangered vulnerable plants, thereby endangering them further or even resulting in their extinction.

Labour camps in side the forest areas, may not only disturb their habitat, but may also increase forest fire hazard, particularly in summer months, thereby killing the ground vegetation and small animals, birds and others.

Unchecked dumping of solid wastes both by road workers and road users may create problem not only for regeneration, but also for wild animals, who may injest them.

8.0 THE SPECIFIC THREATS TO WILDLIFE:

The plan clearly indicates specific threats to wildlife and biodiversity in each road corridor.

9.0 BREEDING GROUND AND FRAGILE RESIDENTS IN PIA:

Breeding of natural life forms is not like the breeding we see in domesticated insects, dogs, domesticated cattle and human beings. The natural law has a major role to play in the breeding of plants and wildlife through sexual conditions. The other two factors are very very strong.

The conditions required for this natural selection is unbridled movement of the animals, and tranquility of the forests to fight, win and enter into courtship before procreation. All these will be a daydream for wildlife as forests are under threat of shifting cultivation, Maoist movement and illegal settlements along all corridors. The road improvement activity which will continue for more than 3 years if not more will lead to noise, pollution, hectic activity, soil erosion, movement of heavy machinery adding more constraints as a result of which ritual fight and ritual display of plumage, colour, statures and prowess against the adversary and female species in the wild along the corridors will not be there during this period. The stressed wildlife will go without the natural selection in some cases and inbreeding will takeover to weaken the next generations. The valuable plants of timber, ornamental, food and medicinal value or commercial importance may be smuggled along with its seeds and flowers before they mature to earn a few bucks. There is possibility of the leaves, barks, twigs, roots of commercial importance being smuggled and exported outside reducing most of them. The corridors are therefore to be more strictly watched by strengthening check gates during and after the proposed improvement along with monitoring device to follow up the effects and provide further safeguards.

There are several movement corridors across the road by elephants, bears, bisons (gaur), tiger, leopard, ungulates, fishes, amphibians, birds etc. The corridor of roads during development and after will be a formidable barrier for the wildlife and wild flora. However, this document tries to address these issues in a holistic manner.

10.0 MITIGATION MEASURES:

Conflict does arise when we have to address the problems of flora and fauna, while going ahead with development of road corridors for fast moving traffic in order to achieve development.

All these are to be addressed in a holistic manner. It may appear unrealistic to allow free movement of wild fauna across the roads but the barricades will not provide them free access to other part of the habitat. When we forget to find our path in a small town or in a changed landscape we were familiar with, can we expect the wildlife to find out the few under pass we are proposing to provide for them at locations of maximum concentration. Therefore we may have to provide safe passage at more than one place and prevent wild animals to cross over at other places besides, make these passages as closely resemble wilderness as possible. Where it is either not possible to provide safe passage or crossings are too infrequent, awareness

should be created among drivers and other road users to drive slow, watch for wild animal movements to prevent any accident involving them.

The damage to the aquifers, springs, nalas, river basins and river beds, wetlands can be minimized by left or right centric improvement in which case only one side of the trees, shrubs, herbs, Common Property Resources (CPR) Project Affected Persons (PAPS), Rehabilitation & Resettlement Activities (R&RA), habitat loss and habitat improvement will be limited, where the carriageway and ROW is narrow (below 20 mtrs). This may also be economically sound proposition as only one side shall be affected.

The corridor camouflaging for wildlife under pass in such cases can be taken up simultaneously on the undisturbed side and by the time the other side is complete there will be some cover on the undisturbed side with mitigation measures like development of habitat, water holes, salt licks, gully plugging, check damming, improvement of food sources etc. The aviary and roadside micro climax colonies of vegetation and wildlife will not be totally disturbed as one side is still there to shelter and feed them or sustain them.

The erosion on account of diversion, dumping of construction materials, road fills will be much less in phased manner and the progress will be rather faster this way.

The green tunnels are to be spared to the extent possible and in case of compulsions atleast the eastern side of the tunnel has to be retained as a safeguard against perenecious problems of cyclone damage where its character will remain intact as a shelter belt.

Forest fire and communicable diseases are most dangerous for the wildlife. The mass immunization of domestic cattle within 10 kms of the corridor alongwith workshops to prevent forest fire at any cost has to be taken up for the benefit of domestic cattle, forest and wildlife.

11.0 NATURAL WATER SOURCES:

Many wild animals, love to have a bath or swim across large water bodies like river, rivulet and nala during summer. This is more pronounced in case of elephants, large cats and amphibians.

Therefore while developing the under pass care has to be taken to locate the same on the approaches to water sources. But at times failure of rains makes things more difficult for wildlife. Hence alternate artificial water harvesting structures or waterholes may be created on the nala beds to aid in percolation of water under ground and recharge the aquifers in the upper catchments by gully plugging, vegetative and random rubble stone check dams and low masonry check dams down below across the road so that the fear of washout and flash floods is minimised. Within two to three years these nalas will become perennial sources of water at depressions and many of the distressed wildlife can be saved because the improvement in water regime will give a boost to vegetation around with same water availability even during the pinch period.

Few salt licks and guly plugging measures can be taken up in the difficult podu affected areas from day one of starting the project work to ensure this. The local staffs and the DFO of the area has to take up the initiative for planning and execution, while the nala beds outside the forest area will be treated by OWD contractors.

12.0 MOVEMENT CORRIDOR OF WILDLIFE:

As many wild animals move through same passages (wildlife track), unchanged even after generations, this factor has to be borne in mind while providing passage for them across road

corridors. Therefore while developing the roads the exact spots where the wild animals were moving across has to be retained so that the wild animals will not be disoriented.

When on account of limiting the estimated cost on each project we are putting barriers on movement of the animals on these tracks, the nearest culvert or bridge in the vicinity of that area has to be expanded with one extra span and the approach to that place is developed by planting indigenous shrubs and bushes properly during rains and planting them in large pits with sufficient manuring so that the wild animals accept them and easily pass under the culvert. In this case 50m to 150m wide camouflage corridor on either side of the opening has to be planted up with the same species prescribed for the under pass corridors.

13.0 HABITAT DEVELOPMENT:

While developing proper habitat for wild animals besides water availability, availability of food should be looked in to. The most viable and effective alternative is to go for planting of edible plant species which will provide fruits, leaf litter, flowers for the wildlife to consume and provide some intensive protection of the habitat. The trees are indigenous, utility oriented and yield edible fruits such as Kusum, Mahula, Kendu, Jamun, Bahada, Katrang, Mango, Bel, Kaitha, Ficus etc. on the route, Edible grasses should be planted up in sheltered blanks free from grazing by live stock.

14.0 FUTURE DEVELOPMENT STRATEGY:

As the wildlife issues are complex in nature the effect of the habitat improvement, water harvesting, wildlife under pass and movement across the corridors are required to be monitored and evaluated. For this preparation Pug Impression Pads(P.I.P). and taking plaster castings on the under pass route, pug markings at the water holes, nesting and perching on the avenues and closing in or opening of the canopy has to be recorded periodically so that the beneficial effects of the pre-discussed programme of action is examined thoroughly and further improvement and mitigation measures are adopted or corrective measures are initiated before it is too late.

The wildlife wing of Forest department, the local NGOs, VSS units, the tribals and researchers on wildlife from the universities may be invited to take up such project works so that the effects are documented, remedial & further improvement measures are suggested and inbuilt into the FDA (Forest Development agency action plan of the area). The workshops of tribals and target group may be roped in to share their part of the story. The SHG, stake holders and financing institutions to local entrepreneur and farmers may be invited to monitor and evaluate the results of change in crop pattern and yield there from so that the success story of one corridor can be replicated in another where man animal conflict was ruining the inhabitants along forest boundaries, new wildlife conflict zones along the road or where the habitat fragmentation has caused. The monitoring cell has to be with the forest department wildlife and territorial wing under the main banner of the administrative officer or D.F.O who should gather data and furnish reports on each of the indicators:

1. Movement of wildlife.
2. Movement of aviary along the corridor.
3. Situation of procreation and movement across the corridor of road.
4. Water regime and water holes.
5. Any threat from encroaches, squatters and land owners.

A quarterly or half yearly report will suffice to gather information for replacement if any and such reports to be compiled by the forest department jointly with the OWD and researchers.

Funding for future strategy may not be from the budget allocation but from the F.D.A activity only by preparation of the micro plan. There should be liberal plantation of species and land owners given free access to sale their timber, fuel wood etc. direct from the field with removal of restrictions in the name of Timber and Other Forest Produce Transit rules 1980.

Legislation for preventing development of habitation along the road corridors encroaching Govt. land and building housing enclaves in such areas has to be prohibited so as to retain the biodiversity that is still there to be protected.

The enumeration of birds along the corridor, increase or decrease in agricultural output, incidence of diseases and pests, the crop damage by all and sundry has to be evaluated for 5 years during and after the corridor improvement which will show the effects of modern development.

Number of accidents with wild fauna on the corridor due to non-provision of barricade at places will be recorded and brought to the notice of the W/L wing of F/D for remedial measures jointly with O.W.D by inbuilt mechanism in the conditions SH for stage I and stage II clearance.

Monitoring of impact of measures taken:

1. Monitoring of wildlife movement by periodic installation of infrared cameras, collect pugmarks etc in association with research scholars and WWF, WII, local forest administration----FD/- Pr. CCF (WL)/ P.CCF (Gen)/ OWD/ OSRP.
2. Monitoring of forest growth and loss or gain of density of forests or forest cover by FSI, GOI and,
3. Evaluation of periodic wildlife survey made by forest department before and after the corridor development to use it in growth index parameters.
4. Results of habitat development, barricades at yearly interval.

The existing field staff will adequate for the job demand and only the research scholars may be introduced from academic institutions to evaluate the activities along with contractual surveyors.

:

CHAPTER-I **INTRODUCTION**

Orissa state lies between 17°-15' to 20°-30'N latitude and 80°-27' to 87°-29'E Longitude covering 1,55,707 Sq kms of geographical area, on the eastern coast of India along Bay of Bengal, with a long coast line of about 480 kms.

1.1 PAST HISTORY:

The state has a historic past of rich tradition of cultural heritage and architectural wonders in the form of temples, stone carvings, sculptures, rock cut edicts, rock cut caves, palm leaf inscriptions and paintings, patta paintings, handloom designs and use of exquisite colours in handloom clothes, indicating love of nature and its bounties in the form of plants and wildlife.

The temple architecture indicates this, as all the edifices of old temples contain engravings & statues of wild as well as domestic animals serpents including exotic animals from Africa indicating contact with that continent in the past. The inhabitants had developed trade and commerce with Indonesia, (Java, Sumatra, Borneo), Indochina, China, Japan, Ceylone, Singapore, Malayasia and Cambodia across the sea and over the land for centuries spreading religion, culture, temple architecture (Angkorwatt in Cambodia) to all these parts of the world.

The modern Orissa however has remained poverty stricken because of decline in river and ocean navigation systems, difficult hilly terrain of southwest and wetlands of the coastal tracts besides lack of high ways connecting the economic hotspots with rest of the country. This lack of infrastructure has been a stumbling block in development of industry, trade and commerce and resultant low economic growth after the independence of India. The vast potential of mineral resources, like coal, iron ore, bauxite, chromite, tin, manganese, dolomite, monazite to platinum, gemstones like Emerald, Aquamarine, Tourmaline, Garnets, Ruby, Almondine, Topaz, Smokey Quartz, Amethyst, Beryl, Cat's eye, pure Quartz crystals, Sapphire, diamond and Tiger's eye of excellent quality are there to be tapped to fullest potential.

- 1.2** The vast stretch of sea beach, marine and fresh water resources and reservoirs, are ideal tourist destinations for pleasure, knowledge and recreation. The rich diversity of wild flora and fauna, the numerous migratory and resident water birds, the fresh and salt water crocodiles, rare and endangered Olive ridley turtles, horse shoe crabs, elephants tigers, orchids and medicinal plants are assets of the state. Thick forests, tiger and elephant reserves, wetlands, biosphere reserve are unique tourism destinations. But they have remained less explored and in-adequately connected to attract domestic as well as international tourists. The historic sites of Budhism, Jainism, Sanatan Hindu religion and the famous temple architecture of Konark, Khiching, Lord Jagannath in Puri, Lord Lingaraj temple, Mukteswar and Rajarani temple of Bhubaneswar are the epitome of our ancient sculpture and heritage.

1.3 OBJECTIVES:

1.3.0 The Govt. of Orissa through its Works Department (OWD) has with the intention of providing quality road communication system to all these regions of the state has embarked upon a highly ambitious project. "The Orissa State Road Project (OSRP)" to improve existing State Highways (SH), Major district Roads(MDR), Other District roads (ODRs) and Rural Development Roads so that places of economic importance and those to develop in future will be well connected by modern two/four lane State Highways, through World Bank assistance.

1.3.1 As stated above infrastructure development within a state especially faster movement of modern traffic and transport of goods is a crucial factor for economic development. The Orissa Works Department (OWD) has the ambitious objective to upgrade, strengthen/widen such arterial roads with World Bank assistance and have identified 825km of state highways under Year-1 Projects for economic viability based on Techno Economic evaluation. Detailed project preparation has been initiated through onsite data collection, traffic study, existing condition of pavements, designing of the structures through computer based package, preparation of cost estimate and tender documents, social environmental, forestry and bio-diversity studies and preparation of Biodiversity Action Plan. The project also includes network analysis of remaining 3700km of State High ways based on techno-economic approach to select 1600 km of project routes for feasibility studies for subsequent phases. The OSRP thus aims to provide faster mode of transport leading to economic growth of the state. The indirect benefits of the project will be on account of cost savings in terms of travel time and fuel consumption of vehicles, development and expansion of indigenous knowledge base on arts and crafts, agro practices and agro products, tourism and development of sea ports etc.

1.3.2 The improvement works will consist of raising the formation level, widening to two-lanes from exiting single lane to intermediate lane width and, strengthening of pavements in urban areas with four laning cross section and provision for drainage, side walks and project specific social and environmental, biodiversity action plan. The top carriageway width will be 7mtr with provision of soft and hard shoulder having a width of 2.5mtr on either side to tally to a formation width of 12mtrs for improvement of high way-geometry as per IRC (Indian Road Congress) guidelines.

1.3.3 The following roads are proposed to be taken up for improvement under the 1st phase programme- The details are in Table-1.

1. Bramhapur – Mohana – Bangi Jn. -J.K.Pur – Raygada, 202 kms (150+51)
2. Chandbali – Bhadrak, 51 kms
3. Bhadrak – Anandapur, 57.4 kms (up to Godabhanga).
4. Anandapur – Karanjia – Tongabila (Jashipur), 80 kms.
5. Aska – Bhanjanagar, 39 kms
6. J.K.Pur (Bangi Jn.) – Muniguda – Bhawanipatna, 118 kms (50+68)
7. Bhawanipatna – Khariar, 70 kms
8. Daspalla – Gania – Sidhamula – Narsingpur – Hindol – Mahidharpur – Nuahat (Banarpal Jn), 102 kms
9. Jagatpur – Kendrapada – Patamundai – Aul – Baitarani Bridge (Chandbali), 99 kms

1.3.4 The following roads are proposed to be under year-1 programme of OSRP for up gradation out of the 825kms selected under phase-1 corridors for development.

Table-1.1

Sl. No.	Name of the Corridor	Road Identification	Length (in Km.)
1.	Bramhapur – Mohana - (Bangi Jn)-Bangi Jn	SH-17	41.00
	J.K.Pur – Rayagada	SH-4	41.00
2.	Khariar- Bhawanipatna	SH-16	68.00
3.	Chandbali – Bhadrak	SH-9	46.00
4.	Bhadrak-Anandapur(upto Godabhanga)	SH-53	45.40
		Total	241.40

1.3.5 The funding and experience gained from various State Road Projects by World Bank in India has been to a great advantage for the OSRP for utilizing the accumulated experience of the World Bank in adopting the world wide expertise and experience to cater to the modern road management practices and financing. The Biodiversity Report and action plan are all the more necessary in the State of Orissa as roads are either passing through or close to large stretches of forests, wet lands, sanctuaries and Biosphere reserve, hot water spring, elephant reserves, established wildlife corridors of elephant or the upper reaches of the habitat of endangered salt water crocodile, olive ridley sea turtle, horse -shoe crabs, various threatened marine fish breeding habitat or highland sweet water streams.

1.3.6 It is a fact that roads passing through reserved and protected forests hinder the movement of wild life and their reproduction, adversely affecting the status of particular species in that locality. The cutting away of roadside avenues and hills for easing the gradient and road geometry accelerates erosion and use of heavy machinery along with asphalt mixing units releases toxic fumes. The effluents from labour camps, vehicle parking and maintenance sites, quarries and borrow areas all individually and combinedly become the cause of decline of birds, stress to amphibians, reptiles, medicinal herbs, shrubs, trees and beneficial life forms besides organisms like dragonfly, butterfly, fruit bats, land monitor lizards, water monitor lizards, otters, pangolin, frogs, beetles etc. On account of cutting and removal of avenue trees there is loss of green cover and impairment of carbon synthesis. Loss of the food sources, perches and resting ground, feeding and breeding habitats of various wildlife are to be pre assessed and the mitigation measures initiated at the time of design, estimation and implementation of the project to provide the best possible alternative or remedial action plan. The wild life corridors are the passage routes of big animals like elephants, tigers, leopards, sambar, cheetal, nilgai, barking deer, bear etc. in search of food, water and cover during summer, winter and lean months. Due to road widening and movement of heavy and fast traffic the survival strategies of the wildlife will get disturbed, leading to accidents destruction of crop and houses, vegetable gardens of local inhabitants, killing of human beings etc. In other words this may cause more man – animal conflict all along the road corridors and far flung areas to detriment of both.

1.3.7 The Biodiversity Action Plan will provide in depth analysis of the individual problems on each road corridor and based on its recommended parameters make provisions for preserving and protecting the wild flora and fauna by suitable change in the design structure that will be blended at the project formulation stage and effective monitoring measures shall be continued there after.

1.4 THE TRACT DEALT WITH:

1.4.0 The State has about three quarters of its area covered by hilly land and a limited area of lower elevation or flat land. Thirty seven percent (37%) of the state land mass is covered by forest as against minimum 33% average forest land targeted to be retained under National Forest Policy.

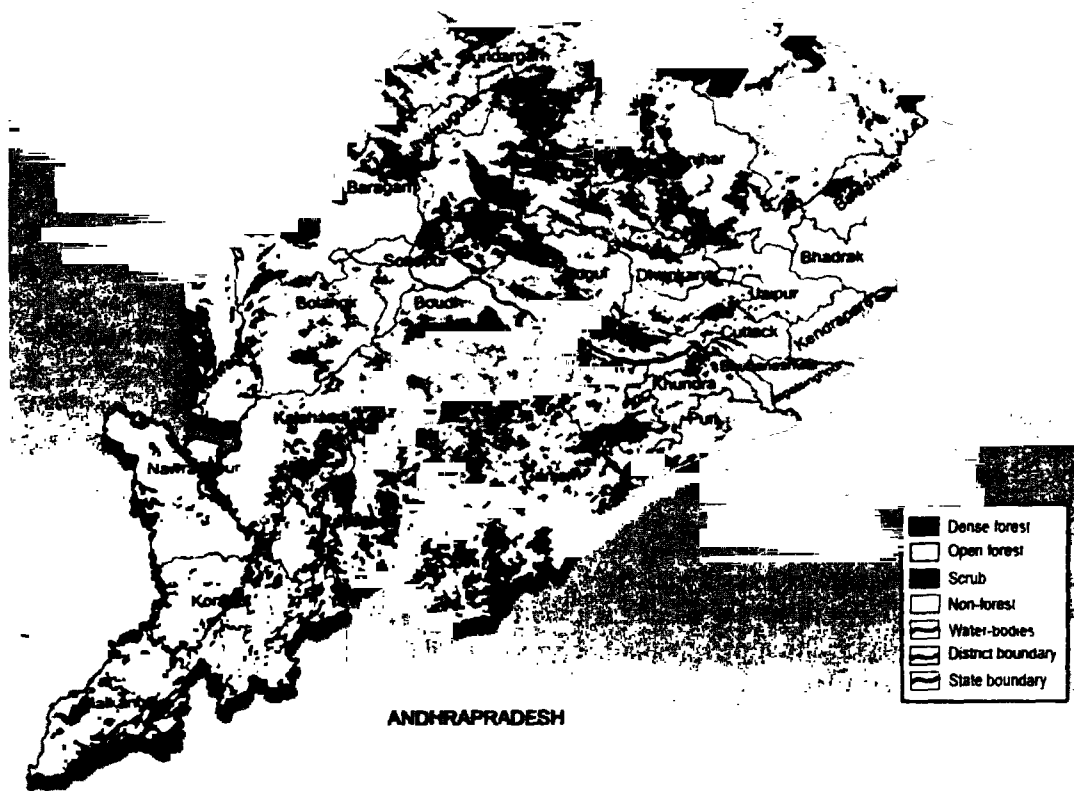
1.4.1 The whole State lie in the tropical zone and has tropical vegetation. The details of land, drainage and forest types are described in Para 4 sub Para 1.4.4 & 1.4.5 below. The major rivers are Mahanadi, Bramhani, Baitarani, Subrnarekha, Budhabalanga, Rusikulya, Vansadhara and their tributaries, which run from west to east and drain into Bay of Bengal.

1.4.2 The total geographical area of the State is 1,55,707 sq kms out of which forest land is 58135.47 sq. km by legal status.

1.4.3 The Forest Survey of India (FSI), Ministry of Environment and Forest (MoEF) in their State of Forest Report for the year 2003 have assessed the forest area by crown cover to be 48366 Sq km. with the break up of the area as under:

(a)	Very dense forest	-	288 km ²
(b)	Moderately dense forest	-	27882 km ²
(c)	Open forest	-	20196 km ²
	Total		48366 km²

The detail of the F.S.I. report is reflected in the state map at Page-5.



DISTRIBUTION OF FORESTS OF ORISSA

1.4.4 The forest area as per the legal status according to the statistical data published by the Principal Chief Conservator of Forests, Orissa for the year 2004 shows

(a)	Reserved Forests (RFs)	26329.12 Sq. Km.
(b)	Demarcated Protected Forests (DPFs)	11685.65 Sq. Km.
(c)	Undemarcated Protected Forests (UDPFs)	3838.78 Sq. Km.
(d)	Unclassed Forests (UCFs)	20.55 Sq. Km.
	Total	41874.13 Sq. Km.
(e)	Forest land under Rev. Department	16261.34 Sq. Km.
		58135.47 Sq. Km.

1.4.5 The forests are the major repositories of various flora and fauna, which would have otherwise been destroyed, manipulated, mutated, made extinct or genetically altered and endangered outside its natural domain.

In other words forests are our safe deposit areas where genetic diversity are safely preserved under indigenous conditions without influence of chemicals, fertilizers, systemic and non-systemic poisons, genetically engineered life forms and undergoing evolutionary transformation in natural way.

Many organisms of flora have been missing from our surrounding outside the natural dense forests. Therefore our activities in and around forests and protected areas warrants very very careful analysis and deep insight into short and long term effects of our activities. Sometime the effects become irreversible. This also leads to destruction or wiping out of several plant and animal life from the earth before their presence and their contribution to our life system and economy is understood, evaluated and appreciated.

Alternatively the diversity of life forms existing under a complex natural eco-system unaffected or little affected by anthropogenic pressure is biodiversity in its pristine form.

- 1.4.6** For the growth and development, wildlife, its habitat and forest resources have diminished to great extent due to non-appreciation of the valuable contribution of nature and its bounties of forests, wild flora and fauna, water sources like rivers, streams, springs and the sea. The effect of forest on atmosphere, on rainfall, controlling of climate, diseases pastes and vast reservoir of genetic resources etc. have been under estimated.

The rail and road projects, hydro electrical projects or vast reservoirs of water, deep mining activities or release of chemically charged effluents into the natural aquifers and drainage basins all have fragmented the habitat and the ultimate sufferer is the biodiversity of the immediate locality and non perceptible long term effects hundreds of kilometers away up stream and down stream.

Highway and transport are the main source of a developing and developed economy but unbridled activity of highway expansion /construction and non-assessment of its impact and non-formulation of suitable alternative plans with mitigation measures only results in a much severe loss.

Therefore the road improvement projects of Orissa State Roads Project (OSRP) of the Orissa Works Department (OWD) as per the advice of World Bank have gone for the Biodiversity impact assessment and mitigation measures study to maintain reasonable balance in its road improvement activity and maintaining natural balance of flora, fauna, and their habitat.

1.5 ADMINISTRATIVE JURISDICTIONS:

- 1.5.0** The civil districts covered under the proposed road improvement activity are:

1. Angul
2. Bhadrak
3. Bolangir
4. Cuttack
5. Dhenkanal
6. Ganjam
7. Gajapati
8. Kendrapada
9. Kalahandi
10. Keonjhar
11. Mayurbhanj
12. Nayagarh
13. Nuapada
14. Rayagada

Table-1.2
The Forest Divisions covered are in the table below

Sl. No.	Name of the Forest/Wildlife Division	Head Quarters	Statutory authority of the state to comment on the project. (CCF (Nodal officer))
1.	BhadraKh Wildlife	Chandbali	D.F.O, C.F, PCCF Wildlife cum C.W.L.W and PCCF (general)
2.	Mangrove Forest Division (Wildlife), Rajnagar	Rajnagar	- do -
3.	Athagarh forest	Athagarh	- do -
4.	Dhenkanal forest	Dhenkanal	- do -
5.	Berhampur forest	Bramhapur	- do -
6.	Parlakhemundi forest	Parlakhemundi	- do -
7.	Bhawanipatna South forest	Bhawanipatna	- do -
8.	Bhawanipatna North forest	Bhawanipatna	- do -
9.	Keonjhar forest	Keonjhar	- do -
10.	Karanjia forest	Karanjia	- do -
11.	Nayagarh forest	Nayagarh	- do -
12.	Rayagada forest	Rayagada	- do -
13.	Khariar forest	Nuapada	-do-

1.5.1 The Physiographic regions through which the proposed road corridors pass through are:

- (a) Central Table Lands
- (b) Coastal Plains
- (c) Eastern Ghats
- (d) Northern Plateau

1.5.2 Parts of Ganjam, Gajapati, Raygada, Kalahandi, Nuapada come under the Eastern ghats. Similarly the coastal areas of Ganjam, Gajapati, Cuttack, Kendrapada, Bhadrak, parts of Nayagarh come under coastal plains.

The Mayurbhanj district and parts of Keonjhar district come under the Northern plateau.

The other part of Keonjhar, Dhenkanal, Angul, Nuapada and part of Kalahandi come under the central tableland.

1.6 THE GEOLOGY ROCK AND SOIL OF PROJECT INFLUENCE AREA (PIU):

1.6.0 The heavy mineral deposits are mostly confined to Mayurbhanj, Keonjhar Sambalpur, Sundergarh, Jajpur, Kalahandi and Angul districts of Northern plateau and central table land. Iron ore, Chromites, Manganese, Graphite mines are in the central table land zone as well as Northern Plateau.

The most fertile and thickly populated are the coastal plains.

The Soils are mostly alluvial in coastal plains, clay and black cotton in Northern plateau and central table land mixed with murrum and lateritic soil. Alluvial flood plain with lateritic soil is encountered with old alluvial formations in coastal tracts. The foothills of Eastern Ghats and the hill portions contain granites, schists and sedimentary deposits, conglomerates, laterite and gravel.

1.6.1 TYPICAL SOILS IN PROJECT INFLUENCE AREA:

Two categories of soils are found in different regions:

- a) **Ultisols** soils are found in Sambalpur, Sundergarh, Keonjhar, Mayurbhanj, Koraput, Ganjam, Puri and Cuttack Districts. Essentially, these are laterite, lateritic red and yellow in nature. These soils are poor in Nitrogen, Phosphate, Potassium and Organic matter. The pH content of the soils ranges between 5.0 to 6.5.
- b) **Altiisol** soils can be further sub-divided into Mixed Red and Black soils, Red earth, Red Loamy soils, Red sandy soils, Red gravelly soils, Older alluvial soils and Deltaic alluvial soils which are restricted to parts of Mayurbhanj, Boudh, Khandmal, Keonjhar, Sambalpur, Sundergarh, Bolangir, Koraput, Cuttack, Puri and Dhenkanal districts. The red soils are light textured, usually devoid of lime and free of carbonates. Sandy clays are common. These are usually deficient in Nitrogen, Phosphate, organic matter and lime.

Both soils are suitable for cultivation of paddy and other crops. The agricultural properties and fertility of the soil of the region are suitable for growth of various kinds of crops. Major crop in the region are, Cereals (Maize and Rice) Pulses (Moong, Black gram and Arhar), Oil seeds (Mustard, Niger and Groundnut), Cash Crops (Sugarcane), Horticultured Crops (mainly Mango, Cashew nut and Guava) and Vegetables.

1.6.2 LOCATIONS PRONE TO SOIL EROSION:

During public consultations, discussion with OWD and reconnaissance survey, locations prone to soil erosion have been identified. These are given below in **Table-1.3**.

Table-1.3
Locations Prone to Soil Erosion

Sl. No.	Project Route	Locations Prone to Soil Erosion	Length (km)
1.	Jagatpur – Kendrapada – Chandbali	Approaches of bridge Baitarani, Kharasrota & Bramhani	12.5
2.	Chandbali – Bhadrak – Karanjia	Km 61 to 63.8 SH-53 and Km45 to 58-SH.53	2.8
3.	Karanjia – Jashipur	None	-
4.	Raygada – Bhawanipatna	Km 21 to 38 of SH-6	17.0
5.	Bhawanipatna – Khariar	None	0
6.	Berhampur – Raygada	Km 41.0 to 60.0 of SH-17 and Km 141.0 to 127.0 of SH-4	33
7.	Aska – Bhanjanagar	None	0
8.	Daspalla-Nuahat(Banarpal)	Hindol – Narsinghpur Ghat section (6 km)-SH-64	6.0

1.6.3 CLIMATE:

The average annual rainfall in centimeters and mean annual temperature in Celsius is furnished on the Table-1.4 below for the districts through which the road corridors pass.

Table-1.4

Sl. No.	Name of the District	Average annual rainfall	Mean annual Temperature	Climate
1.	Angul	140cm	28 ⁰ c	Hot and dry
2.	Bhadrak	157cm	26 ⁰ c	Warm and humid
3.	Bolangir	144cm	28 ⁰ c	Hot and dry
4.	Cuttack	150cm	28 ⁰ c	Warm and humid
5.	Dhenkanal	141cm	28 ⁰ c	Hot and dry
6.	Gajapati	130cm	27 ⁰ c	Hot and humid
7.	Ganjam	130cm	27 ⁰ c	Hot and humid
8.	Kalahandi	138cm	26 ⁰ c	Hot and dry
9.	Keonjhar	154cm	26 ⁰ c	Hot and dry
10.	Kendrapada	150cm	28 ⁰ c	Hot and dry
11.	Mayurbhanj	165cm	18 ⁰ c	Cool and humid
12.	Nayagarh	145cm	27 ⁰ c	Hot and dry
13.	Nuapada	138cm	28 ⁰ c	Hot and dry
14.	Raygada	152cm	27 ⁰ c	Hot and dry

The rainfall and temperature indicates a tropical climate. The precipitation is on account of southwest monsoon and retreating southwest i.e. between 10th June to 15th August and 25th September to 15th November. The rainfall is also most of the time caused by depressions (cyclonic storm) in Bay of Bengal, which brings summer rains or pre-monsoon showers and heavy to very heavy rainfall during monsoon period even though monsoon fails.

The cyclone and resultant rainfall at times turns into catastrophe by flash floods, tidal waves and high wind velocity or tornado with hail storms and lightening. Much damage to life, property and agriculture is caused every year due to this resulting in disruptions in road communication, power supply on account of submergence, road surface damage, damage to bridges, culverts and drainage channels and avenue plantations and vital installations besides houses, agriculture and horticulture. Most such cyclones take place during winter months, particularly October.

1.6.4 THE VEGETATION:

The rainfall pattern is more pronounced in the coastal plains, northern plateau and eastern ghats, where as the central tableland gets less rainfall. This has been reflected in the pattern of natural vegetation, the floristic and faunal composition of the region.

The heavy rainfall in Similipal hills and Eastern Ghats has been the cause of more moist type of forests along the coast and on these hills. According to Champion and Seth's classification of forests the vegetation along these road corridors is:

1.6.5 FOREST TYPES:

1. D-3-C North Indian moist deciduous forests.
2. 3C/c-2E (ii) moist peninsular sal forests.
3. 5B-C2 Northern Tropical mixed deciduous forests.
4. C-3/E moist Bamboo brakes.
5. 5B/E-9 Dry Bamboo brakes.
6. 5B/DS-1-Dry deciduous scrub.
7. 3-C/C-2-(e)(1) moist peninsular high level sal forests.
8. Mangroves.
9. 3-C/D-S-1-moist sal savannah.

1.6.6 THE FLORA:

The list of common plants found in the forests of Orissa is in **Annexure-I**. The list of medicinal plants is also in **Annexure-II**.

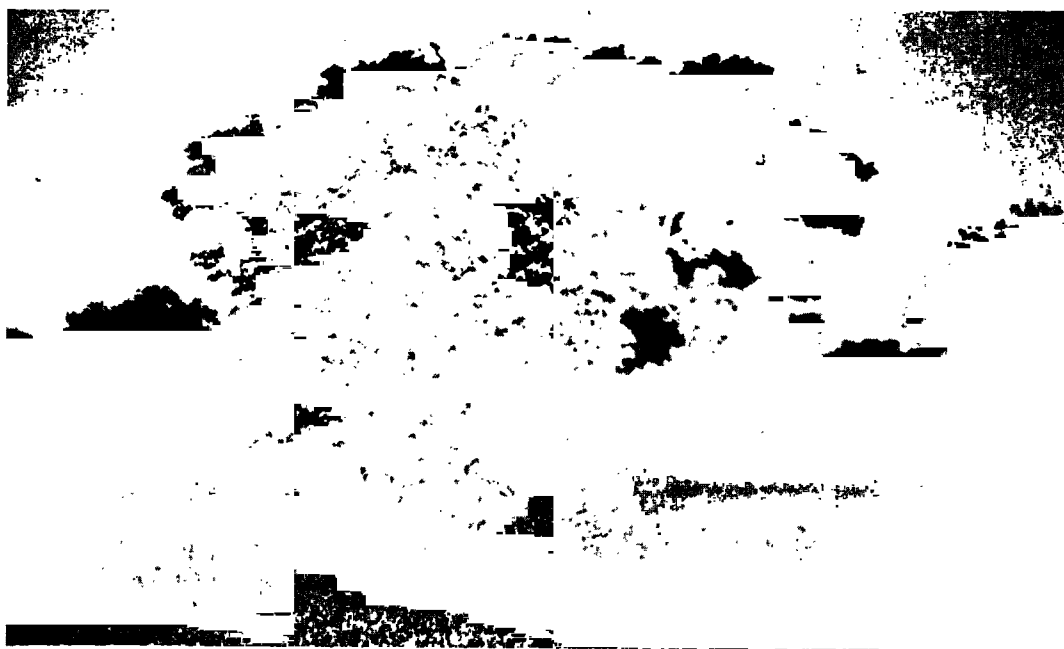


PI

PPALI/BANAPIPALI (PIPER LONGUM)



COLEUS FRESHCOHALI



BARADA/ RAKTA KANCHAN
BAUHINIA PURPUREA



BIDANGA / EMBELIA RIBES



COSTUS SPECIOSUS (KEU)

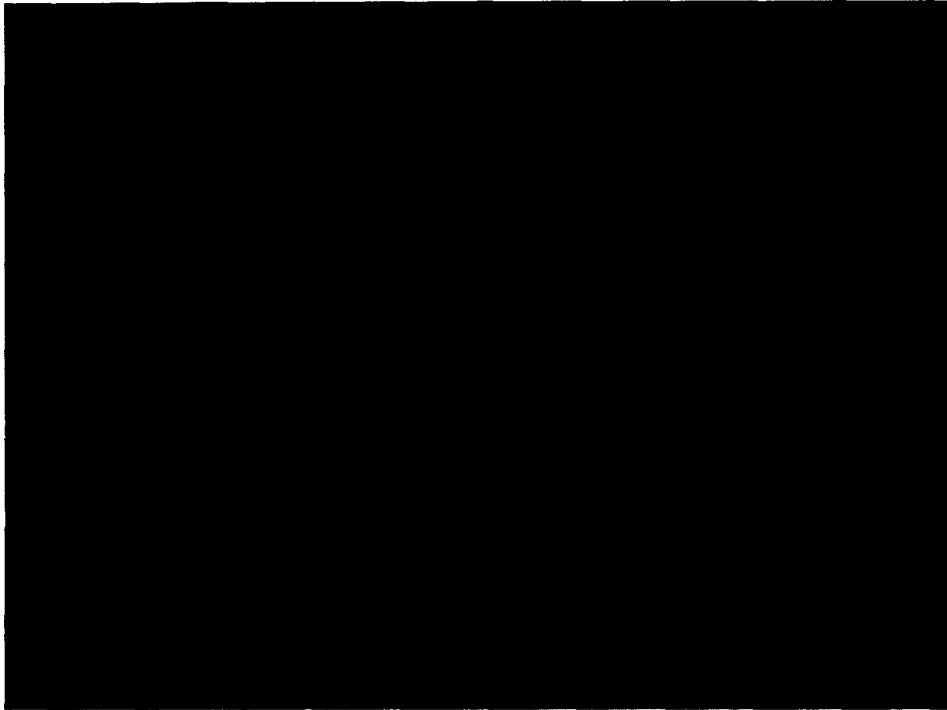


IPOMEA NIL (KANIKHAND)

These are common to the road corridors with few exceptions on account of geo climatic and edaphic factors. The common species are Sal, Bija, Asan, Arjun, Haldu, Teak (Planted), Sisoo, Kasi, Moi, Dhaura, Kangada, Hinjala, Harida, Bahada, Amla, Mahula, Bhalia, Jamun, Asan, Kusum, Tamarind, Phasi, Siris, Karanja, Dharanja, Suam etc.

1.6.7 THE FAUNA:

Though there are many animals common to the moist and dry deciduous forests, like elephant, gaur, tiger, leopard, sloth bear etc. sambar, cheetal, python, cobra, monitor lizard, grey and malbar pied hornbill, peafowl etc are most common. There are some species like the chousingha (4 horned antelope) and neelgai etc. confined to only drier regions. The elusive mouse deer, flying squirrel, giant squirrel are only found in thick forests and pockets of undisturbed or little disturbed areas with tigers, leopards and gaur.



TIGER FORMS THE APEX OF BIOLOGICAL PYRAMID OF ORISSA FORESTS

The coastal plains and tidal swamps, estuarine landscape and wetlands contain amphibian and aquatic fauna quite uncommon in other habitat. The swamps, wetlands are the breeding habitats of many varieties of fish, shrimps, crabs, mollusks, frogs, toads, spiders, dragon fly and butterfly. The lizards, civets, otters, water fowls, cormorants always find suitable sites to breed nearby.



ORISSA HAS A RICH AVIAN DIVERSITY

Bats, egrets, herons, king fishers, rollers, eagles, kites, owls, Owlets, brahminy kites, geckos, water snakes, sweet water turtles, horse shoe crabs and mud skippers all proliferate in these coastal zone nearer to tidal swamps, mangroves and wetlands.

The list of common fauna found in the state is at **Annexure-III**. Photos of some of the wild animals, birds and reptiles are enclosed in **Annexure-IV**.

In addition to the local fauna the wetlands and large irrigation tanks, MIPs & reservoirs are visited by thousands of migratory birds from different countries and different provinces during winter and dry season.

We come across them in the wetland habitats of the road corridor from Jagatpur to Chandbali, (Baitarani Bridge) and Chandbali to Bhadrak SH-9 as well as in several ponds and wetlands along canal irrigated areas through which the different road corridors pass.



LARGEST POPULATION OF CENTRAL INDIAN ELEPHANTS IS FOUND IN ORISSA

“Baga-gahana” of Bhitara Kanika wildlife sanctuary is one such place where birds in thousands nest during rains and fly away with their young ones at the end of the season. On the road sides nearer to water bodies and wetlands several Mango, Arjun, Hinjala, Aswatha

and Bara trees can be seen having the nests of these water birds along with the common Mynah.

The crows, vultures, kites, hawks, eagles, cormorants, however don't nest in mixed groups and seek separate, solitary tall trees for nesting along the avenues and nearer to habitations or their food source. The parakeets, pheasants and owls nest in the hollowed out old tree trunks.



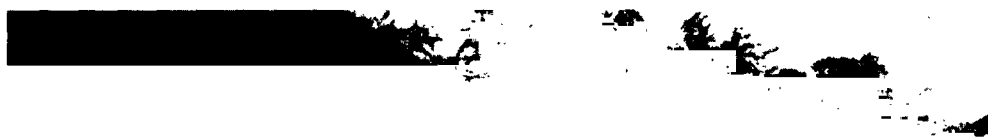
KING COBRA OF BHITARKANIKA

CHAPTER – II

THE PROJECT BACKGROUND

- 2.0 The Orissa Works Department (OWD) desires to upgrade 825 kms of State Highway under Phase -1 for economic development based on techno economic evaluation and detail project preparation has been initiated through on site data collection, traffic studies, existing pavement conditions in terms of roughness and design aided by computer based package and ground true thing.

The project preparation also includes the cost estimate, preparation of bid documents and addressing social and environmental issues as required under the World Bank guide lines, statutory requirements of the state and Govt. of India. The project also includes network analysis of remaining 3700 kms of State Highways based on techno economic approach to select 1600 km of project routes for feasibility studies to plan their development.



BANGINALA ON CORRIDOR SH 17

The project road corridors of 825 km now proposed for development or improvement will mainly consist of:

- (1) Raising the formation level.
- (2) Widening to two-lane from existing single lane and intermediate lane width.
- (3) Strengthening of the pavement.
- (4) Up grading to 4 laning in urban areas with provision for drainage, side walks, parking bay etc.
- (5) To make the top carriage way width of 7 mtrs with provision of soft and hard shoulders of 2.5 mtr on either side.
- (6) To improve the road geometry on highways.

The detail network of different roads in Orissa and the Phase I ORSP Roads to be taken up for development / improvement under World Bank funding is at **Anexure -XI**.

The roads in thick blue colour indicates the phase-I roads and the importance of each road as per the forest environment, ecology and biodiversity point of view is assigned with Environmental and Biodiversity Sensitivity Grading as indicated in the Table-2.1 below which is also reflected on the map.

Table-2.1

Sl. No.	Corridor	Environmental & Biodiversity Grading
1	Aska → Bhanjanagar	Medium
2	Banarpal → Hindol → Narasinghpur → Gania → Daspalla	High
3	Chandbali → Bhadrak	High
4	Bhadrak → Anandapur	Medium
5	Anandapur → Karanjia	High
6	Karanjia → Jashipur	Medium
7	Bramhapur → Mohana → Bangi → (J.K.Pur) → Rayagada	High
8	J.K.Pur → Muniguda → Bhawanipatna	High
9	Bhawanipatna → Khariar	Low

Depending on the Ministry of Environment and Forests guidelines and the World Bank Categorization of the project road corridors as category 'A' the roads have been chosen as year-1 and year-2 projects on the basis of protected areas such as reserved forests, sanctuaries, national parks, elephant reserves and biosphere reserve coming within the project or its impact zone of 7 kms.

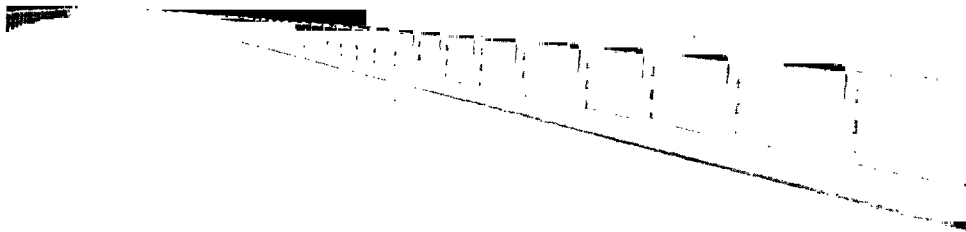


GHODA NADI SH 17

The project corridors pass through or adjacent to several reserved, protected and village forest lands, protected areas, such as elephant reserves, elephant corridors, wildlife movement zones, ecologically important wetland and tidal inundated habitats, buffer and transition zone of Biosphere Reserve, within 7 km impact zones of wildlife sanctuaries, many rivulets, streams, nallahs, rivers and water spread areas. These are repository of vast natural flora and fauna of Orissa and require special attention under the prevailing central and state acts and

rules, guidelines and executive instructions issued by the Ministry of environment and forest (MoEF) Govt. of India, National Board for Wildlife, State Board for Wildlife, State Pollution Control Board, Chief Wildlife Warden and Principal Chief Conservator of Forests. The roadside avenues and green tunnels also require specific study and action plan.

- 2.1 The Biodiversity action plan therefore is a detail documentation of the individual project road corridors, the description of habitats of wild flora and fauna, wildlife movement corridors, threatened or endangered species of plants, animals and crustaceans, their nesting, perching and breeding ground, habitat development plans, soil erosion, soil conservation, wetland management, green tunnels and road side avenue, management of feeding and breeding habitats, man animal conflict with under laying factors. Impact of the corridor development on the environment, forests, wild flora and fauna and detail long term and short-term mitigation measures on visualized direct and indirect negative effects are incorporated in this plan.



BANSADHARA BRIDGE

The action plan deals with threat perceptions, avoidance, amelioration and minimization measures, alternate habitat improvement and management principles, animal under pass or over pass corridors to prevent fragmentation of the corridors, prevention of pollution and environmental as well as ecological degradation, removal of man animal conflict by judicious farming and agricultural practice, Organic farming, development of food parks, sacred groves, common property assets and wildlife assets like large ponds, water holes, salt licks, mounds of dismantled debris, treatment of wetlands, creeks, nala and river beds while going for construction of bridges, culverts and diversion of roads etc.

To formulate the above action plans within the frame work of relevant environment acts and guide lines, Forest Conservation Acts, rules, Wildlife (Protection) Act and Rules, biosphere reserve management principles the individual road corridors are classified under high, medium or low risk zones from the above considerations and Biodiversity impact points (the maximum number allotted being 10 points). (Table – 2.2). Network of phase-I roads in **Anexure –XI**.

The statements of chainage in road corridor, location indicating of the reserved forests, sanctuary, deer park, reservoir, elephant corridor, causeways, flood zones, submergible areas, wetland and green tunnel locations, soil erosion sites, sloth bear and wild animal crossings, proposed road under pass/over pass, via ducts, fencing and barricading zones, road signage and design of road side drains to prevent rodents, small animals, amphibians and frogs, reptiles getting killed under the wheels are recorded.

A biodiversity survey is conducted for the above said purposes for recording the views of forest officials, road users, villagers and other stake holders and the analyzed data has been used for planning, execution of preventive measures and monitoring activity for future development and action plan.

2.2 DESCRIPTION OF THE ROAD PROJECT:

The roads cover the civil districts of Bhadrak, Kendujhar, Mayurbhanj, Ganjam, Gajapati, Rayagada, Kalahandi, Nuapada, Nayagarh, Cuttack, Dhenkanal, and Angul.



ROAD WITH OLD AVENUE PLANTING

The road corridors pass through 22 Reserved Forests in Rayagada, Gajapati and Ganjam Districts and three recognized wild life movement corridors for Sloth bear, and elephants on Berhampur-Bangi Jn - Rayagada route. This passes within 7km from Lakhary valley Elephant sanctuary of Gajapati district. **Anexure-V.**

Table - 2.2

Sl. No.	Name of the Corridor	Length	Identification Status	Districts	Environment Grading
1.	Chandbali → Bhadrak	51 km	SH-9	Bhadrak	A
2.	Bhadrak → Anandapur →	46 km	SH-53	Bhadrak	A
3.	→ Anandapur → Karanjia	76 km	SH-53	Kendujhar	A
4.	Karanjia → Jashipur()	15 km	SH-49	Mayurbhanj	A
5.	Bramhapur → Mohana → Bangi Junction(J.K.Pur) →	150 km	SH-17	Ganjam	A
6.	→ Bangi → Rayagada	51 km	SH-4	Gajapati, Rayagada	A
7.	Daspalla → Gania → Baghdharia →	102 km	SH-65A-23 km SH-65B-18 km	Nayagarh, Cuttack	A
	→ Narasinghpur Jn. → Hindol → -Hindol—Mahidharpur --		SH-65-6.3 km SH-64-25.0 km	Cuttack, Dhenkanal, Dhenkanal	
	→ Mahidharpur → Nuahat (Banarpal)		SH-64A 12.0 km SH-64B 18.0 km	Angul	
8.	Aska → Bhanjanagar	39 km	SH-7	Ganjam	B
9.	Khariar → Bhawanipatna	70 km	SH-16	Kalahandi, Nuapada	B
10.	J.K.Pur → Muniguda → Bhawanipatna	50 km-	SH-5	Rayagada,	A
		68km	SH-6	Kalahandi	
11.	Jagatpur-Patamundeī-Chndbali	99Km	SH-9	Cuttack, Kendrapada	A

On Anandapur Karanjia-Jashipur route the road cuts across 17 Reserved Forests, Mayurbhanj Elephant reserve, Similpal Biosphere reserve (buffer, additional buffer zone and transition zone), 6 elephant passages in Mayurbhanj and Keonjhar Districts and within the 5kms impact zone of Hadgarh Sanctuary and 10Kms of Similpal sanctuary. Refer Annexure – XII.

On Daspalla-Banarpal route the road passes through 5 elephant movement passages and 5 reserved forests (running across or running adjacent to) in Cuttack, Dhenkanal and Nayagarh Districts and requires acquisition of land in R.F.s and in private land.

The Chandbali-Bhadrak route passes within the 10km. impact zone of the Bhitarkanika wildlife Sanctuary, habitat of estaurian crocodile, horseshoe crab, various wetland breeding areas of fish, shrimps, crabs, molluscs, amphibians, and reptiles.

The J.K.Pur → Muniguda → Bhawanipatna route passes through dense reserved forests of Rayagada and Kalahandi districts besides several Wildlife Crossing points.

Therefore the year-1 roads were chosen on the basis of least environmental impact zones as in Table – 2.3.

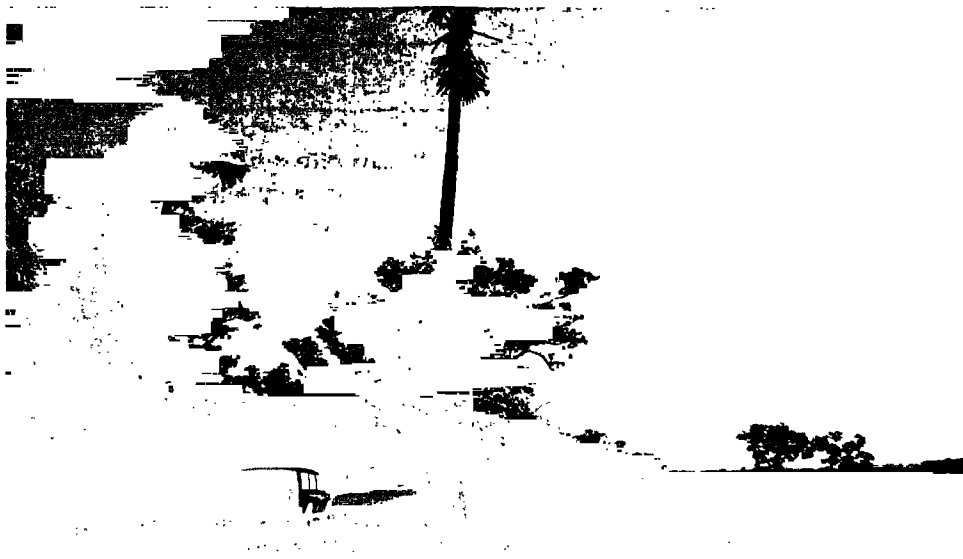
Table-2.3

Sl. No.	Project Corridor	Specific Reasons
1.	Khariar → Bhawanipatna-68Kms	No Reserved forest or protected area
2.	Chandbali → Bhadrak upto 45 th Km	No Reserved forest or protected area
3.	Bhadrak → Anandapur up to 48 th Km	No Reserved forest or protected area
4.	Bramhapur → Bangi JN → Rayagada -41Kms	Reserved forest, ghats, and wildlife crossing points.

Table - 2.4
The year - II roads

1.	Anandapur→Karanjia-Jashipur 48 th -86 th Km	Elephant passes or corridor, reserved forests, biosphere reserve, (additional buffer and transaction area), elephant reserve, wild life passage.
2.	JKPur→ Muniguda → Bhawanipatna	Wild life crossing points and diversion due to level crossings
3.	Daspalla→Gania→Narsinghpur→Hindol→Malidharpur→Nuahat. (Banarpal)	Reserved forests, wild life crossing points and elephant passages.
4.	Jagatpur→Kendrapada→Potamundai to Baitarini→Chandbali Bridge→SH-9A	Heavy built up area, wetland ecosystem, close proximity to Bhitarkanika wildlife Sanctuary.
5.	Bhadrak-Chandbali-45 th -51Km	Estuarian crocodile habitat.

The Joint biodiversity action plan for all the phase I roads (irrespective of the year 1 & year 2) was to be prepared along with environment impact and treatment action plan for appraisal of World Bank and for obtaining Environment and Forest Clearance from the statutory authorities under ministry of Environment and Forests (MOEF) Govt. of India and State Pollution Control Board, (SPCB, Orissa) State Board for Wildlife, National Board for Wild life and Chief Wild Life Warden-cum-Principal. C.C.F Wild life and Pr. C.C.F. (General) etc.



VIEW OF DASPALLA - BANARPAL ROAD CORRIDOR

2.2.1 JAGATPUR – CHANDBALI – ROUTE – 9A – 99 KMS.

This corridor originates from NH-5 at Jagatpur on the banks of river Mahanadi in Cuttack district and has not yet been connected properly by road up to Chandbali. The starting point is at Km 28 on 4-lane NH-5 at Jagatpur. This road passes through the densely populated fertile alluvial plains connecting NH-5A at Kendrapada which is a 4 lane track connecting NH-5 and Paradeep port. The industrial park at Jagatpur and the up coming port facility at Dhamara will make this route more prominent for freight as well as passenger traffic. It also touches the tourist destinations of Buddhist ruins in Lalitgiri, Udaigiri and Languli Pahad, the Baldevjew temple at Kendrapada, the Bhitarkanika wildlife sanctuary (WLS), (estuarine crocodile breeding, horse shoe crab breeding ground and wintering ground of migratory birds.

The portion of the road between Jagatpur to Pattamundai is quite old with sufficient ROW for a two-lane road. There are very old avenue trees and some new additions of multi row avenue plants. One or two rows of these young avenues may be required to be removed during road improvement. There has been two rows of old avenue plants of cocoanut 1.2 km long which is at chainage 95.8 km to 97 km dating back to the thirties of last century. This being a landmark of the area is needed to be retained and one row can serve as the road divider between the two lanes.

There is a large water-logged area or wetland on the western side of the road before Bramhani Bridge and few more at other places. Their connectivity with the river system anInter- tidal swamps is more important from the biodiversity point of view.

There are no reserved or protected forests within the impact zone of the project corridor. The area is however prone to flood damages by river Baitarani, Kharasrota and Bramhani. This has been aggravated by new roads (NH-5A) and railway line (now being developed). The level being very very low water logging and flood damage is a routine affair. **Annexure –XV & XVI.**

2.2.2. CHANDBALI – BHADRAK- SH-9 – 51 KMS:

This road passes through the congested market and residential areas of Chandbali after the recently constructed Baitarani Bridge. The road will require to be realigned near Chandbali to avoid the congested area along the river Baitarani. This is one of the oldest roads. There are good number of sound and healthy avenue trees and multiple rows of avenue trees raised within last 20-25 years or so. The road double-laning can be easily carried out with minimum sacrifice of tree growth if carefully planned. However the old hollowand rotten trees may need removal for road safety. There are several places on this road between Tihidi to motto, which are submerged during floods. The river Baitarani is a tidal river and inundates vast stretches of fields on either side of the road connected by several culverts, drainage cuts, creeks and nallas. Several long stretches of wetland system has developed over the years along this stretch. The flood water carries rich topsoil, humus and essential mineral which settle down on the flat agricultural lands, ponds and wetland enriching the soil. The tide brings fishes, crustaceans, mollusks to lay eggs and breed in this biomass rich shallow wetlands.

The crabs, fishes, shrimps, mollusks etc. breed here along with predators like water snakes, owls, kites, falcon, frogs, monitor lizards, water monitor lizard, etc.

The road construction and improvement is supposed to be on raised road base, which will further require cutting of the avenue trees which serve as food source, nesting, and perching grounds. Some portion of the project road corridor is within 10 km of impact zone of the sanctuary. There are no reserved or protected forests along the road. All most all the culverts, bridges, are to be reconstructed on account of raising of the road surface and widening for double laning meaning soil erosion, silting up the creeks and wetlands. This needs careful planning. **Annexure –XVI.**

2.2.3 BHADRAK – ANANDAPUR – SH-53(PART) –57.4 KM.(UP TO GODABHANGA)

This road crosses Chennai - Kolkata railway line after the NH-5 from where it originates. A railway over bridge is under construction. There are good and young avenue trees along this route and most of them have formed excellent green tunnels. Road improvement, parking bays at village junctions and market areas, diversion of road to reconstruct bridges and culverts will lead to air and water pollution, soil erosion and cutting down of green tunnels and young avenues as wel as giant trees between railway overbridge up to 12th Km on the

right side. There are very little wetland and ponds along this road and no reserved or protected forests along this road up to Anandapur bypass.

The Hadagarh wildlife sanctuary is within the impact zone of 10 kms but negligible wildlife movement on the road is noticed due to the openness of the agricultural fields without any cover for the wild animals. **Annexure –XVII.**

2.2.4 ANANDAPUR TO KARANJIA – JASHIPUR (TONGABILLA) 65KM TO 0KM SH-53 SH 49–15.4 KM =80.4 KM.

The road passes through several Reserved forests of Karanjia forest division, Mayurbhanj elephant reserve and additional buffer and transitional area of Similipal Biosphere Reserve. There are several causeways and vented causeways along the route. The road corridor intersects 6 elephant passages and passes within the 10 km impact zone of the Similpal wildlife sanctuary. There are ghat portions and plateaus, hills and flat lands, several avenue plantations between Anandapur to Godvanga (Keonjhar – Mayurbhanj border) and Karanjia to Jashipur. The right of way between Godabhanga to Karanjia and Karanjia to Jashipur is sufficient enough for the double laning except requiring some occasional felling of trees for providing free ROW and to facilitate road diversion for improving road geometry..

The wildlife corridors and habitats as well as the buffer zone of Biosphere reserve need further investigation and evaluation for proper planning.

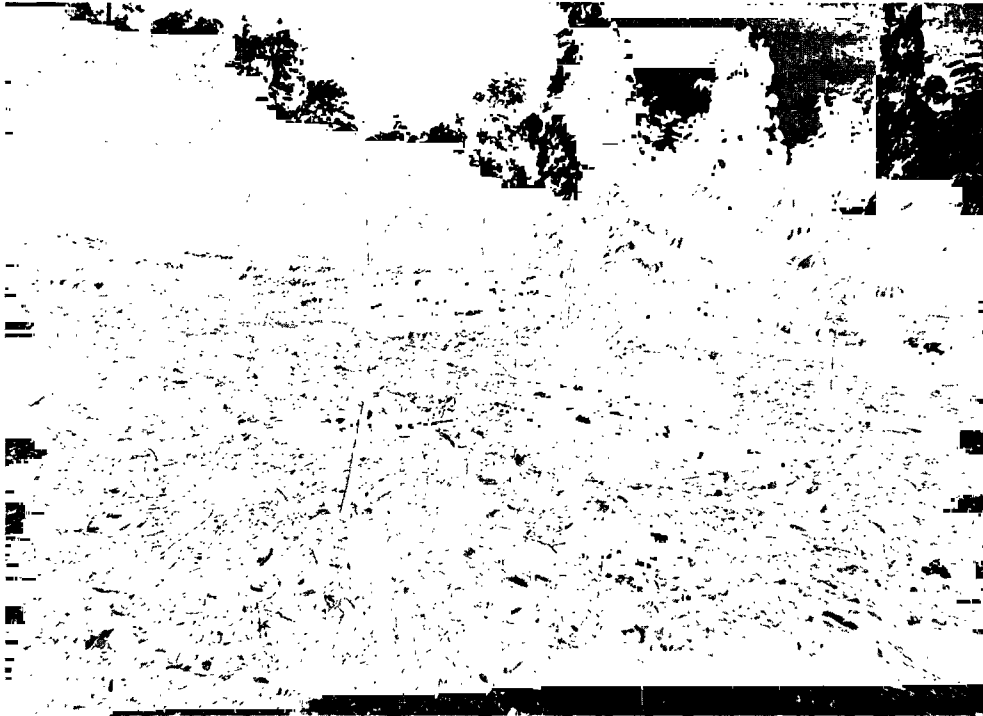
Man animal conflict exists in this area from Anandapur to Karanjia, which is another priority concern to be attended to during road improvement. **Annexure –XIV.**

2.2.5 KHARIAR – BHAWANIPATNA – SH-16 –68KM.(02-70)

This corridor originates from NH-217 at Khariar in Nuapada district and terminates in Bhawanipatna SH-6. There are no reserved forests or protected areas along this corridor. A portion of the road runs within Bolangir district. This corridor also connects NH-201 and NH-217 through Bhawanipatna – J.K.Pur – Raygada corridor. There are old avenues along the road and most of them are likely to be sacrificed for improvement of the road. The road does not cover any hilly tract, rather runs through plain rolling terrain, agricultural land and built up areas Khariar and Bhawanipatna towns. **Annexure –XVIII.**

2.2.6 BHAWANIPATNA – MUNIGUDA – J.K.PUR – SH-6 - 68 KMS, SH-5 – 49.5 KMS.

Major portion of the road passes through agricultural land or built up areas except chainage 21 km to 38 km where it passes through dense reserved forests. There are several stretches of protected forests occurring intermittently. Built up areas like J.K.Pur, Theruvalli, Bisam-katak, Ambadola and Bhawanipatna etc lie on this route. There are 5 railway level crossings, at 49.3, 46.2 of SH-5 and 25.6, 26.8 64.4 km of SH-6 respectively with a narrow road over bridge at 26.8 km. There are Reserved Forests between Muniguda to J.K.Pur. There are several wildlife crossings on this route. The road requires realignment to avoid the level crossings between Bisam-katak to Muniguda and Muniguda to Bhawanipatna. **Annexure – XXII & XXIII.**



ROAD SIDE MEDICINAL PLANT GARDEN ON J.K.PUR-BHAWANIPATNA ROAD

There are green tunnels and forest growth, some of which are to be sacrificed for the improvement of road. But this should be done judiciously to minimize felling.

2.2.7 BRAMHAPUR – MOHANA – BANGI JUNCTION-J.K.PUR – RAYGADA

This corridor is in two links:

- i) Bramhapur – Bangi Junction SH-17 – 150 km.
- ii) Bangi Junction --J.K.Pur-- – Raygada – SH-4 – 52 Km.

The road corridor starts from NH-217 at the first gate point of Berhampurjunction and runs on flat agricultural terrain up to Podamari after which it enters into forested and hilly area from 40 km.

There are reserved forests, proposed reserved forests, protected forests, jungle blocks, cashew plantations etc. There are thickly populated built up areas all along the route from Bramhapur to Podamari through which the road passes. There are town ships like Digaphandi, Dengausta, Mohana, Adava, Raipanka, Kenduguda, Gumuda, Antarjhula, Bangi and J.K.Pur. There is a deer park at Taptapani at 48 km and hot water spring at 49 km. The SH-17 passes through two medium irrigation dams named Harabhangi and Badanala in Gajapati and Raygada districts respectively. The road crosses Vansadhara River and again enters Makundpur ghat beyond Bangi on Bangi – J.K.Pur link where leopards and other wild animals cross the road till the ends of the ghat.

There are dense forests as well as podu cultivation on steep hills, which accelerates sheet erosion. The entire corridor from Podamari to J.K.Pur is now threatened with Nuxalite movement and there have been brutal killing of government officials and police informers in this zone between Luhagudi, R.Udaigiri to Adava police stations and there has been kidnapping of officials and workers enroute. The Ganupur-Gumda belt faces more brutal

killing of landowners and looting of property. Land mines have been used to kill armed police, CRPF jawans and civilians and state govt. officials in this belt. Therefore any activity relating to cutting of trees, acquiring Pvt. Land, demolishing commercial establishments and settlements for ROW will be problematic unless the public and stakeholders are taken into confidence and adequately compensated.

Provisions for wildlife crossing points, road under pass, habitat development in podu ravaged barren and bald hill tops will have to be carried out most carefully without depriving the tribals of their freedom of movement, settlement and commercial activity.

There is severe crop damage every year within this corridor on account of elephants, wild boar, deer and sambar as well as sloth bear. The stakeholders are to be organized and provided support for change over from paddy, sugar cane and maize cultivation to raising of mixed crop of non browsable species in the periphery and browsable species away from forest fringe to reduce chances of loss. There are several link roads from this corridor connecting Aska, Surada, Chikiti, Badagada Parlakhemundi, Daringbadi, Simanbadi, Phulbani, Gudari, Gunupur etc. The Taptapani ghat needs geometric correction from 46th to 53rd Km due to steep gradient. **Annexure –XX.**

Bangi Junction to Raygada – S.H.-4 – 51 Km.

The dense reserved forests are between km 154 to 128 with steep ghats and sharp curves, for which some new alignment is proposed over ^Kms abandoning the old road. requiring additional R.F. land. There are wildlife movements across this route but no permanent established wildlife crossing in this stretch. **Annexure –XXI.**

2.2.8 DASPALLA – GANIA – SIDHAMULA – BAGHDHARIA – NARSINGHPUR – BUDHABUDHI GHAT – NUAGADA – HINDOL – MAHIDHARPUR – NUAHATA (BANARPAL)

This road is a fragmented road as the approaches to the bridge across river Mohanadi at Sidhamula on Khandpada side and Baghdharia on Narsinghpur side are yet to be connected with proper approach roads. Several MDRs and ODRs have been regarded as SH as indicated below:

These links are:

- (a) Daspalla to Gania – 0 to 23 Km—SH-65A.
- (b) Gania to Kanasinghi or Sidhamula –15.2 Km -- SH—65B.
- (c) Sidhamula to Baghdhariya. The 1.6 Km river bridge and 1.2 km approach road on both sides.—SH--65 B
- (d) Baghdhariya to Narsinghpur Panchmundia Junction.— 6.3 Km---- SH-65—6.3 KM
- (e) Panchmundia (Narsinghpur Jn.) to Hindol –25 Km-- SH--64
- (f) Hindol to Mahidharpur— –11.7 km---SH—64 A
- (g) Mahidharpur to Nuahata (Banarpal)—18 Km---SH-64B-

The road originates from NH-224 at Daspalla and terminates at 92.5 km on NH-42 near Banarpal. The project corridor passes through to hitherto unconnected portion between Gania to Narsinghpur and Narsinghpur to Angul as a vital linkage across Mahanadi.

The corridor from Daspalla to Gania and Gania to Sidhamula runs along the boundary of Reserve forests and protected forests on left or right side for some distance and wildlife such as deer, sambar, sloth bear, hare, porcupine, wild boar mostly damage the crops. Except wild boar other animals are few as these were degraded areas recently developed into some moderately dense forests of Sal and miscellaneous species with the involvement of Vana Samrakhyana Samitis (V.S.S).

On the other side of the river Mahanadi the road runs along social forestry plantations in village forest and protected forest blocks with little presence of wildlife.

The real wildlife zone starts beyond the Deobhumi RF boundary from Budhabudhi ghat on Nuagarh hills upto Hindol town. There are elephants, gaur and leopards in this zone with other wildlife, like deer, sambar, nilgai, and python in this tract. The road is running on a steep ghat portion and fragments the elephant and other animal habitat. The easing of the ghat is problematic that may require a long detour involving additional RF land.

Beyond Hindol – Mahidharpur is the 2nd largest village in the whole country followed by Talamula another big village through which the road passes. There are some congested portions, which need realignment of the road from Mahidharpur to Banarpal for avoiding number of sharp curves.

There are palm avenues, scattered roadside tree growth in the forest portion and open areas between Daspalla to Gania, Patanda to Mahakana, Panchmundia to Ranasinghpur, etc. but most of these are likely to be felled for road improvement and double laning.

There may be fewer requirements for tree felling except in the zones where road section will be in high embankment for avoiding submergence or providing elephant under pass, diversions for erecting culverts and bridges and realignment needed in ghats for easing the gradient. **Annexure –XXIV.**

2.2.9 BHANJANAGAR – ASKA – SH-7 – 39.2 KM.

The link originates from Bhanjanagar and culminates near Aska on NH-217 within Ganjam district between Km 46.8 to 86.0 (SH-7). There are thickly populated villages & Towns like Gobara, Gangapur, Kendupada and Zilundi.

At Places the road corridor is narrowed by commercial structures and there are very old trees along this route. There are no reserved forests affected along this corridor, As most of the adjacent areas are agricultural land amphibians, reptiles, birds and small animals like jackals, hyenas, will be affected by the corridor development. Birds and rodents will be affected on account of cutting down of avenues for improvement of road width and ROW.

But the road passes along 3.5km stretch of Kaliamba R.F boundary on its south. Elephants, gaurs, cheetals, wild boars and barking deer, do cross the road during crop season to forage in the crop fields. **Annexure –XIX.**

CHAPTER – III **REGULATIONS AND POLICIES**

3.0 INTRODUCTION:

The increase in environmental concern also necessitated appropriate tools to protect the environment. After the Stockholm Conference exclusive Wildlife (Protection) Act, 1972 was enacted by Government of India and two years after this, the first exclusive environmental act, Water (Pollution Prevention and Control) Act was enacted in 1974. In accordance with this act Central and State Boards for Prevention and Control of Water Pollution were set up. Later these boards were renamed as Central Pollution Control Board and State Pollution Control Boards. Department of Environment was set up in 1980. Subsequently in 1985, it was upgraded to a full-fledged Ministry of Environment and Forests to serve as the focal point in the administrative structure for planning, promotion and coordination of environmental and forestry programmes. The Ministry of Environment and Forests (MoEF) has overall authority for the administration and implementation of government policies, laws and regulations.

For sustainable development and pollution control, MoEF identifies the need to enact new laws and amend existing environmental legislations when required, in order to continue to conserve and protect the environment. At the state level, the Department of the Environment and the Department of Forest implement the authority MoEF.

In 1976, the 42nd Constitutional Amendment created Article 48A and 51A, placing an obligation on every citizen of the country to attempt to conserve the environment. As a result, a number of laws related to environmental conservation were passed to strengthen existing legislation. Environment (Protection) Act, 1986 is the landmark legislation as it provides for the protection of environment and aims at plugging the loopholes in the other related acts. The recent replacement of 1996 notification with a comprehensive impact assessment format in SO No 1533/14.9.2006 by MOEF, GoI a mile stone in environmental protection has been reached.

The Indian forest Act 1927 was replaced by Orissa Forest Act 1972. Wildlife protection Act 1972 was adopted in Orissa from 14th August 1974. This act empowered the GoO to constitute the advisory board for wildlife with definite responsibilities and duties. It also provided separate provisions under chapter III on ban on hunting, collection of plants and specimens, trading, stock declaration, Plants being the property of Govt. besides protection of animal and plants through declaration of schedule animals and restricted plants. Settlement of sanctuaries and national parks regulations on entry in to them and activities inside sanctuaries and national parks was also provided for.

The state govt. has also issued wildlife (Protection) Rules in 1974 of course, this need amendment with amendment to the act. In order to prevent diversion of forest land for non-forest use Forest (conservation) Act, 1980 has been enacted and several guidelines provided for its implementation. This is being scrupulously followed by the Government of Orissa.

3.1 KEY ENVIRONMENTAL LAWS AND REGULATIONS:

Environmental regulations and legislations relevant to Orissa State Road Project, is the responsibility of a number of government agencies. **Table-3.1** presents summary of different legislations.

Table-3.1
Summary of Relevant Forest and Environmental Legislations

Name of the Act, Rule, Policy, Notification etc.	Year of enactment	Objective	Responsible Agency
Environmental (Protection) Act	1986	To protect and improve the overall environment.	MoEF, GoI; DoE, GoO; CPCB; OSPCB
Environment Impact Assessment Notification No SO 1533/14.9.2006	2006	To provide environmental clearance to new development activities following environmental impact assessment	MoEF, GoI, CEIAA; SEIAA, CPCB, OSPCB
The Forest (Conservation) Act The Forest (Conservation) Rules The Orissa Forest Act	1980 2003 1972	To check deforestation by restricting use of forested land for non-forest use.	Forest Department, GoO (for land conversion below 5 hectare & 40% density).and MoEF for area exceeding 5ha
Wild Life (Protection) Act Wildlife (Protection) Orissa, Rules	1972 1974	To protect wildlife and constitute National Parks and Sanctuaries.	Chief Wildlife Warden, Forest Department, GoO.
National Forest Policy National Forest Policy (Revised)	1952 1988	To maintain ecological stability through preservation and restoration of biological diversity.	Forest Department, GoI and GoO
Water (Prevention and Control of Pollution) Act	1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards.	OSPCB
Air (Prevention and Control of Pollution) Act	1981	To control air pollution by controlling emission of air pollutants as per the prescribed standards.	OSPCB & Transport Department.
Central Motor Vehicle Act Central Motor Vehicle Rules	1988 1989	To check vehicular air and noise pollution.	Motor Vehicle Department,
Ancient Monuments and Archaeological Sites and Remains Act	1958	Conservation of cultural and historical remains found in India.	Archaeological Dept. GOI, Indian Heritage Society and Indian National Trust for Art and Cultural Heritage (INTACH).
The Land Acquisition Act	1894 And 1989	Set out rule for acquisition of land by government.	Revenue Department. GoO.
Hazardous waste management and handling rules	1989	Controlled handling, storage, transportation and disposal of solid waste	MoEF, GoI; DoE, GoO; CPCB; OSPCB

Name of the Act, Rule, Policy, Notification etc.	Year of enactment	Objective	Responsible Agency
Minor Mineral Concession Rules	2004	Leases for mining of construction materials and STP for borrow pits	Department of Mines and Geology Govt. of Orissa.
Noise pollution (control and regulation) Act	2000	Control of noise pollution	CEIAA/SEIAA
Labour Act	1986	Payment of minimum wages and incentives to laborers	Department of Labour Government of Orissa
Rehabilitation and resettlement policy	2006	R&R Guideline	Revenue Department

Clearance from SPCB is needed for setting up of crusher units bitumen and concrete mixing units, stone and morrom quarries, road grading and paving equipment etc. Proposal for all the road corridors are to submitted to OSPCB for for issue of public notice on behalf of the Collector for public hearing on the design and impact on each project corridor and video record the proceedings. Separate applications are to be submitted in Form No-I for category-A & B projects separately to the State Environment Impact Assesment Authority. For category-A projects this application is to be submitted to the EIAA of MoEF, GoI to get it examined by SEAC and EAC for examination and acceptance of the terms of refrence and pre feasibility report and subsequent submission of the EIA report after screening and scoping.

Wild Life Protection Act: Under the Wildlife Protection Act, 1972 the government has established a number of National Parks and Sanctuaries over the past 25 years, to protect and conserve the flora and fauna of the state.

In the present case this act will be applicable for all the roads irrespective of the presence or absence of reserved or protected forest along the road corridors as per the prevailing legal positions. But some of the roads pass within 10Km impact zone of wildlife sanctuary, elephant reserve and **Biosphere Reserve** buffer and transition zone as well as across the **elephant corridors** / passages for which the Wildlife (Protection) Act, rules and executive orders becomes mandatory to the followed.

The Water (Prevention and Control of Pollution) Act, 1974 resulted in the establishment of the Central and State Pollution Control Boards whose responsibilities include managing water quality and effluent standards, as well as monitoring water quality, prosecuting offenders and issuing licenses for construction and operation of any facility. This will include generation of liquid effluent during construction of road from civil engineering activities or from domestic activities in workers' camps.

The Air (Prevention and Control of Pollution) Act, 1981 empowers Central and State Pollution Control Boards for maintaining air quality and emission standards, as well as monitoring air quality, prosecuting offenders and issuing licenses for construction and operation of any facility. Air quality includes noise level standards. There are specific penalties for violation, which include imprisonment for responsible officials. This act has notified National Ambient Air Quality Standard for different regions e.g. Industrial, Residential and Sensitive Zones. Air quality during construction and operation phases will be guided by this specific act.

3.2 THE LEGAL REQUIREMENT:

The Forest (conservation) Act 1980 was promulgated by GOI to regulate indiscriminate diversion, acquisition and destruction of forested land for various projects, which are non-forest uses by agencies of state and central govts as well as private or corporate agencies. The Silent valley irrigation dam project of Kerala was the basis of such promulgation where the pristine biodiversity rich area was about to be drowned by the reservoir, closing the eyes to the wonton destruction of genetic diversity and ecological wonder of this vast valley which was also the main source of sustenance for local tribals, was one of the modulators of monsoon flow and was the main habitat of endangered lion-tailed macaque.

The Act has undergone several changes the latest being in the year 1988. The Forest (Conservation) Rules 1981 was amended in 2003 and 2004. Few amendments out of which 2004 has been challenged in the Apex court and its operation has been stayed.

Various PILS and litigations before the Apex court has been responsible for several executive instructions and guidelines issued by the MOEF, GOI to interpret, regulate and stream line the operation of various provisions of the Act from time to time.

The Act prohibits diversion of any forest land for any non-forestry purpose and certain activities in the forestry operations by even forest department. As regards **forest land** occurring in section – 2 will not only include forest as understood in the dictionary sense, but any area recorded as forest in the Govt. record irrespective of its ownership. This is how it has to be understood for the purpose of section – 2 of the Act. The provisions enacted in the forest conservation Act 1980 for the conservation of forests and the matters connected there which shall apply clearly to all forests so understood irrespective of the ownership or classification there of.

Rule –6 deals with submission of proposals for seeking approval of central Govt. under section –2 of the Act.

Rule –7 and 8 elaborates the powers of the advisory committee and action to be taken by the GOI on the advice of the committee.

The Appendix under Rule –6 Form No. A provides the detail application format in part – I, II, III and general instructions.

Several executive instructions have been issued on this act, which need the studied.

3.3 LEGAL PROVISIONS (FOREST & WILDLIFE) FOR CLEARANCE OF PROJECT UNDER FOREST (CONSERVATION) ACT –1980:

The definition of Forest as furnished in Part-C chapter 1-Para I of the hand book of Forest conservation Act 1980 and Forest (Conservation) Rules 2003 issued by G.O.I. MoEF New Delhi.

- (i) The term “Forest land” mentioned in section 2 of the Act refers to Govt. Reserved Forest, Protected forest or any area recorded as forest in the Govt. records. Lands which are notified under section 4 of Indian Forest Act would also come within the preview of the Act (Supreme courts Judgment in NTPC’s case). It would also include ‘forest’ as understood in the dictionary sense (Supreme Courts order dt 12.12.1996 in WP No.202/1995). All proposals for diversion of such areas for any non-forestry purpose, irrespective of its ownership would require prior approval of the Central Govt.

- (ii) Boulders, bajri, stone etc. in the river beds located within forest areas would constitute a part of the forest land and their removal would require prior approval of Central Government.

**A) Chapter 2 Submission of proposal as described in the Handbook:
2-1-VII-1**

Diversion of Forestland within Reserved Forest

Any proposal for diversion of Reserved Forest should be very carefully examined and detailed justification after exhausting all alternatives for locating the project in this forest area should be given while forwarding the proposal.

Chapter-2 Para-1-VII-4

It is essential to have the opinion of the local people whenever the project is coming up in the area. Therefore any proposal for diversion of forest land should be accompanied by a resolution of the "Aam Sava" of the Gram Panchayat or local body of the area endorsing the proposal that the project is in the interest of the people.

Chapter2-Para-2.2

2.2-(I)

Map of the forest area required showing boundary of adjoining forests etc. is to be furnished along with the prescribed form No. 'A'

This should normally be on 1:50000 scale original Survey of India topo sheets.

2.2-(II)

Species wise, diameter class wise abstracts of trees to be felled should be furnished in the prescribed form. Total enumeration of such trees is necessary only up to 10 ha. For larger areas species wise and diameter class wise abstract of trees may be computed either from the Working plans or by standard sampling methods.

B) Chapter-3 Compensatory Afforestation:

The guidelines under chapter-3-Para-1- Sub para I specifies that compensatory afforestation is one of the most important conditions stipulated by the Central Govt. while approving proposal for diversion of forest land for non forest use. It is essential that a comprehensive scheme for compensatory afforestation is formulated and submitted to the Central Govt.

The scheme should include details of non forest land or degraded forest land identified for compensatory afforestation, map of the areas to be taken up for compensatory afforestation, year wise phased forestry operations, details of species to be planted and suitability certificate from afforestation / management point of view along with cost structure of various operations to be furnished.

The compensatory afforestation schemes must have technical and administrative approvals, from the competent authority and should be in conformity with cost norms based on species, type of forestland and site conditions.

Where non forest land for compensatory afforestation is not available compensatory, afforestation may be carried out over twice the area of degraded forests subject to production of certificate of non availability of non forest land within the entire state for compensatory afforestation from the Chief Secretary of the state.

3.4 ELEMENTS OF SCHEME FOR COMPENSATORY AFFORESTATION:

- a) Details of equivalent non-forest or degraded forestland identified for raising compensatory afforestation.
- b) Delimitation of Proposed area on a suitable map
- c) Agency responsible for afforestation.
- d) Details of work schedule proposed for compensatory afforestation.
- e) Cost structure of Plantations, provision of funds and mechanism to ensure that the funds will be utilized for raising afforestation.
- f) Details of proper monitoring mechanism.

3.5 LANDS (NON FOREST LAND):

Non-forestlands identified for compensatory afforestation are being transferred to the Forest department and declared as Reserved or Protected forests so that the plantation raised can be maintained permanently. The transfer and notification must take prior to the commencement of the project. (This has been modified later by MoEF) to ensure notification under Indian Forest Act under section 4 or 26 as Proposed Reserved Forest or Reserved Forest. The Nodal officer is to ensure final notification as RF within 6 months. The honorable Supreme Court of India in their orders on 30.10.2002 in 1A No.566 writ petition (Civil) No. 202 of 1995 have directed regarding the creation of a body for "Compensatory Afforestation Management and Planning Agency" to be constituted in each state. This body will look after the receipt of such compensatory afforestation fund from the user agency, the net present value of forest land (NPV) fund, the catchment area treatment fund, the wild life management plan fund etc. for the conditions stipulated by the Central Govt. Compensatory Afforestation fund Management and Planning Authority (CAMPA) has been notified in the official gazette on 23rd April-2004 by GOI.

A) Chapter-4-Para-4-1

The MOEF have delegated the powers as under for clearance of proposals under Forest Conservation Act. 1980 as amended up to date.

4-1-1

All proposals involving diversion of forest land upto 40 ha and proposals for clearance of naturally grown trees in forest area or portion there of shall be forwarded by the concerned State/ U.T. Govt. to the concerned Regional office of the MoEF.

4-1-II

The Chief Conservator of forest of the concerned Regional office shall be competent to finally dispose of all proposals (including decision regarding violations of the Act) involving diversion/ de-reservation of forest land upto 5 hectare except in respect of proposals for regularization of encroachments and mining (renewal of mining leases). Similarly proposals involving clearing of naturally grown trees in the forest area or portion there of for reforestation shall also be finally disposed off by the C.C.F. of the concerned Regional office subject to guidelines/ instructions issued from time to time.

4-1-(V)

In respect of proposal involving diversion of forest area above 5 hectares and up to 40 hectares and all proposals for regularization of encroachments and mining up to 40 hectares, the proposal shall be examined by the Regional C.C.F. in consultation with an advisory group consisting of representatives of the State Govt. from Revenue Department, Forest Department and user agency whose proposal is being examined. The views of the advisory group shall be recorded by the Regional C.C.F. With the same the proposal has to be sent to the Secretary

MoEF for consideration and final decision. The views of the advisory group are not binding while deciding the proposal. The proposal shall however not be deferred for want of quorum in the advisory group meetings.

4.2. Two stage clearance

Forestry clearance will be given in two stages:

Stage I clearance: If the proposal is agreed to in principle in which usually the conditions relating to transformation, and declaration as RF/PF (under the Indian Forest Act 1927 or relevant State Forest Act) of equivalent non forest land for compensatory afforestation and funds for raising compensatory, afforestation there of are stipulated and after receipt of compliance report from the State Govt. in respect of the stipulated conditions, formal approval under the Act shall be issued. The compliance can be sent by the nodal officer of the Forest Department in certain cases.

4.3. Anticipatory action by State Govt. is not legal and permissible and attracts penal action by State Govt. or Central Govt. The Regional C.C.F. of MoEF is the competent authority in this case on behalf of the Central Govt.

4.4. Project works can't be started on forest land until project clearance for forestland portion is issued by GOI. This does not empower any one to start work on Non-forest land in anticipation of clearance on forestland.

4.5. Labour Camps:

There shall be no labour camp in the forest area.

3.6 TIME LIMIT:

The MoEF G.O.I, vide their letter in F, No.2-1/2003-FC dated 20.10.2003 have specified vide para-IV that while formulating a project in tribal area like power, roads, railways etc. such cases should be given priority and forwarded by the State Govt. in the prescribed time frame to the concerned Regional Office or Central Government as the case may be for consideration.

During the execution the user agency/State Government shall ensure maximum employment for the local tribals.

Para (VI) stipulates that for all projects in a tribal area, the user agency shall earmark 5% of the total project cost for the development of indigenous skill of tribals, basic amenities, education, health, sports facilities for children, youths etc in the area. The detailed plan should be enclosed along with the project proposal. The funds for these components shall be deposited with CAMPA.

In Letter No. F, No.12-3/2004-PC-dated 24.11.2004 G.O.I. Ministry of Environment and Forest have requested the Regional C.C.Fs (Central) to consider the infrastructure development

projects to be executed in Naxal affected areas on priority basis and decisions on the project as prescribed in the Forest Conservation Rules 2003.

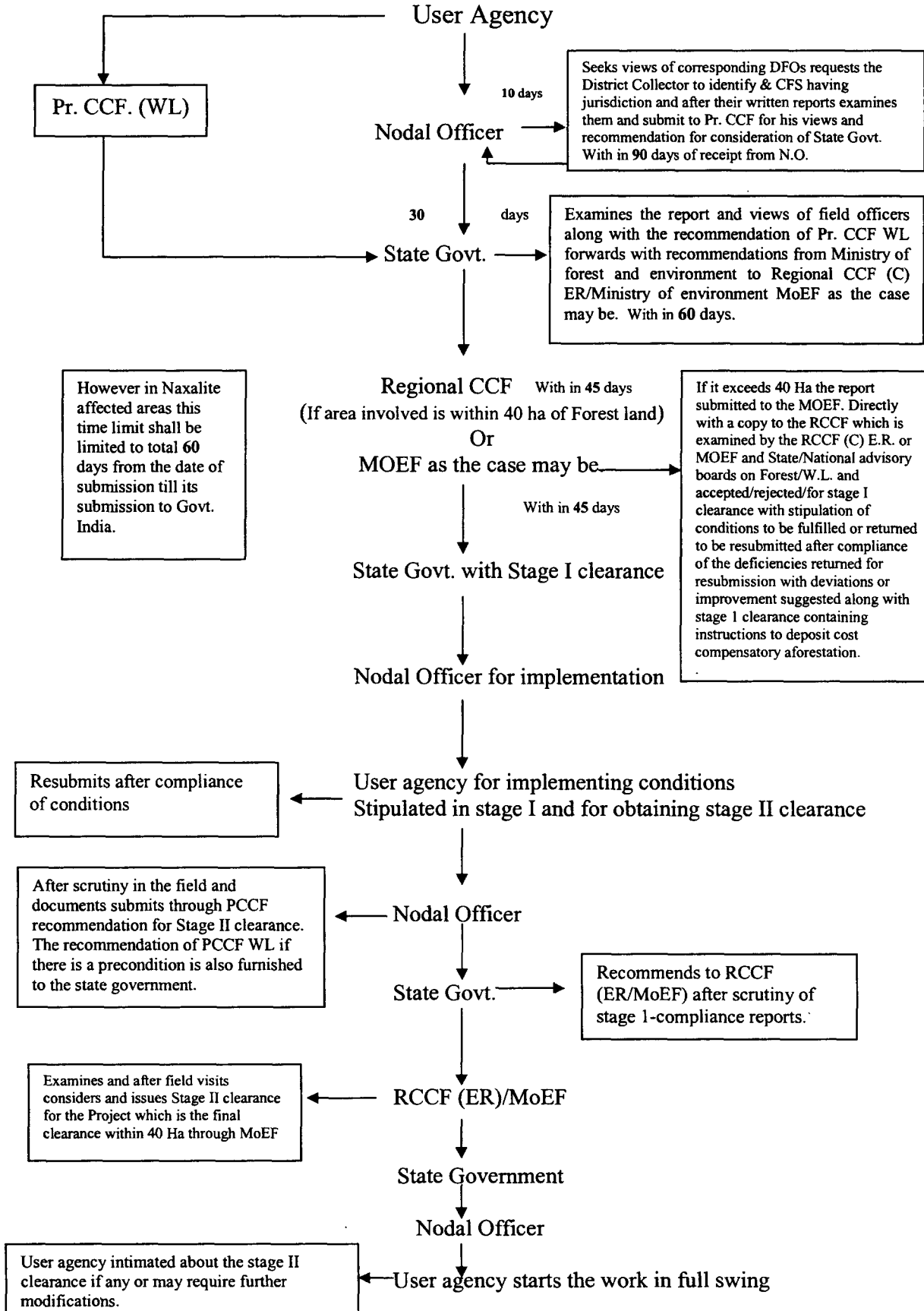
In F.No.5-1/98 FC (Pt-II) dated 17/18 sept.2003 the MoEF Govt. of India have Clarified the N.P.V. (Net Present Value) of forests to be assessed and realized @ Rs.5.80 Lakh/per hectare to Rs.9.30 lakhs / hectare depending on the quality and density of forest on the land in question which is converted for non forestry use and state and U/Ts have to charge NPV within the monetary limit depending up on the quality of the forest and density and type of species in the area. These funds will be transferred to the Compensatory Afforestation Management and Planning Agency (CAMPA) under chapter 2 for submission of proposals.

In para2-2(VI); it is declared by G.O.I. MoEF to be mandatory for all proposal on diversion of forest land for non forest purposes to submit.

- (a) Extent of forest cover in the concerned state /district
- (b) Extent of forestland diverted so far under forest conservation Act 1980 in the concerned district/state.
- (c) Extent of forestland diverted for same/similar project so far in the district / state.
- (d) Progress of compensatory afforestation in the concerned district/state under earlier forest clearances.

This data is to be furnished by the state Nodal Officer, in the office of the Pr.C.C.F. Orissa and the Orissa State Forest Department.

FLOW CHART – UNDER FC ACT - 1980



CHAPTER - IV

METHODOLOGY OF SURVEY TO ASSESS THE THREATS TO WILDLIFE

4.1 PREAMBLE:

Orissa is rich in biodiversity. It is dotted with National parks, sanctuaries, reserved and protected forests. Some of the project routes under consideration for improvement under OSRP project are located close to or running through the wildlife habitats and reserved/protected forests. There is a Biosphere reserve and one of the roads Anandapur – Karanjia - Tongabila (Jashipur) runs through the buffer and transition zone of this biosphere reserve. There are several elephant reserves and out of that the Mayurbhanj E.R, Lakhary valley ER, Raygada – Kalahandi ER, come under or in the project impact area (PIA) of the corridor development programme.

There are several ecologically sensitive zones along the corridors where the effect of corridor development will be prominent such as from Chandbali to Bhadrak and Bhadrak to Anandapur, Anandapur to Jashipur, Daspalla to Hindol, Bramhapur to Raygada, Bhawanipatna to Bangi Junction corridors. Effective mitigatory measures in the project design along with wildlife survey is planned by the consultants. This wildlife survey is intended to cover movement of wildlife around project corridors, species of prevailing wildlife and frequency of spotting wildlife on project corridors. The data related to floral species in PIA of project corridors was also planned to be collected through this survey.

The methodology of the wildlife survey is explained in the following sub sections:

4.2 IDENTIFICATION OF PROJECT CORRIDORS FOR WILDLIFE SURVEY:

The specific project corridors, out of all project routes under consideration in OSRP, identified for wildlife survey are as given below:

1. J.K.Pur – Muniguda – Bhawanipata	SH – 5 & SH – 6	118 Km
2. Berhampur – Bangi Jn. Via – Mohana	SH – 17	150 Km
3. Bangi Junction – J.K.Pur - Raygada	SH – 4	51 Km
4. Bhawanipatna – Khariar	SH – 16	68 Km
5. Chandbali – Bhadrak	SH – 9	51 Km
6. Bhadrak – Anandpur – Karanjia – Jashipur (Tongabila)	SH – 53, SH - 49	137 Km
7. Daspalla to Banarpal	SH-65A&B, 65, 64, 64A&B	102 Km
8. Aska – Bhanjanagar	SH – 7	39 Km

4.3 INSTITUTION LEVEL SURVEY:

The institutional level survey was be done by interviewing and contacting Divisional Forest Officer (DFO) / Range Officers / Forester & Forest Guards along the identified project routes. A structured questionnaire was used for collecting the informations. The collection of information included species wise faunal inventory, locations of water holes, road crossings, etc. The detailed questionnaire is enclosed in the computed data.

4.4 ROAD USER LEVEL SURVEY:

A structured questionnaire was formulated for road user level survey. This questionnaire was used to record the views and information given by road users at predetermined location when the survey teams of consultants were on the move. The road users were explained the significance of survey and requested for cooperation. The answers given on the questionnaire were collected by survey team and compiled to assess the biodiversity of the corridor.

In case of survey the survey terms held discussion with local people at vintage points on the corridor for collection of in depth reaction of the public, which are reflected in the corridor strip field maps.

4.5 LOCAL HABITAT LEVEL SURVEYS:

The above routes have been finalized based on reconnaissance survey, environmental screening output, local level consultations during screening, and discussion with State Forest /Wildlife department.

Constitution of Survey Teams:

The consultants have constituted three wildlife survey teams. The wildlife survey teams consist of following members:

- Retired Divisional Forest Officer (one)
- Two Graduates Male/Female surveyors with Graduation in Science.
- Each survey team consisted of three members.

All the survey team members could communicate in local language as they hail from Orissa to interact with the local people.

4.6 TRAINING TO SURVEY TEAM:

Necessary training to survey team for the proposed wildlife survey was imparted at Bhubaneswar project office by Mr.S.K.Pattanaik, Ex-Chief Wildlife warden, Govt., of Orissa. List of wildlife species with local name was given to survey team members for easy comprehension. The survey team members were explained procedure for interaction with people for extraction of relevant information during the survey. They were also supplied pictures of different wild animals to show them to the respondents, as many species had different local names in different regions of the State.

4.7 TYPE OF SURVEY PLANNED:

Following type of survey was planned:

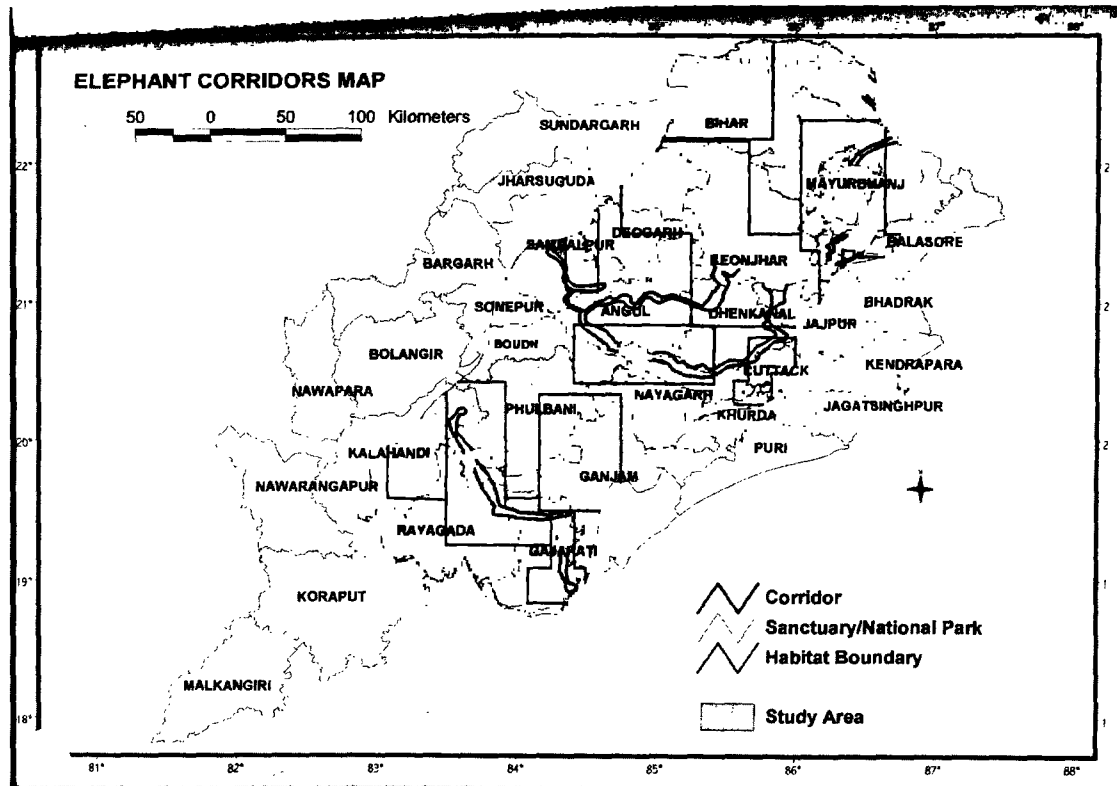
- Institutional Level survey
- Road users Level survey
- Local inhabitant level survey

CHAPTER - V

WILDLIFE MOVEMENT

5.1. As already discussed there is unbridled movement of wild life across the road at present due to the following factors where.

1. Density of the forest is high.
2. Density of population and vehicular traffic is relatively low.
3. Road corridor is not causing much hindrance for the wild life to cross over as there are no barricade, few high embankments, no crash barriers at turnings, approach to bridges and culverts, at road junctions or at wild life crossing points, at dams, reservoirs and canals etc.
4. The roadside trees, farm lands and grasslands are more or less intact and unobstructed.



ELEPHANT HABITATS OF ORISSA WITH MOVEMENT CORRIDORS (ORSAC)

In future years during the improvement of the road corridor, culvert and bridge construction, the road side trees will be removed along with camouflage cover of bushes and grasses due to soil working, raising of formation level, digging of foundation and dumping of debris away from the road surface.

The digging of nala beds, canals, streams and rivers for new culverts and bridges, realignment of road to improve the road geometry and speed regulations, to negotiate curves and flood zones, to avoid H.T. line over head low clearing etc. will disturb the natural landscape and create hindrance.

The formation of culvert and bridge casting, road compacting and laying of grades, W.B.M layers and asphalt layers, with noisy heavy machinery and work force, road diversions, all

will affect the tranquility of the wild habitat more than enough to prompt the animals, birds, amphibians and reptiles scurry for cover away into the interiors of the forest, or get killed or injured while in distress to cross the road.

During maximum stress period for the wild life in search of food and water i.e. the winter and summer the road will become a formidable barrier agog with construction activity or movement during day and night. The animals will suffer most at least for over 3 to 4 years because of such activity. The present scenario may not return even after the road expansion and improvement is over due to the crash barriers, other abstract modulation and transformation of the landscape, which will puzzle the wildlife for venturing on to the road. The increased traffic and speed shall also create problem for wild animals.

Each road corridor shall have a different story all together depending on the location of the road with reference to the forest, water source and human settlement.

The topography, road formation materials, haulage of quarry materials and operation of quarry and crusher units shall have the negative impact on movement of wild fauna in several other sectors within a span of 30 kms or more away from the road corridor too.

Thus there will be unforeseen problem for the wild life (all living organisms in the zone) if the entire roadwork is taken up in each corridor simultaneously. Among the wild animals in Orissa, elephants do move over long distances for foraging, as their food need is very high and with the reduction, depletion and fragmentation of their habitat they have to cover long distance to meet their food requirement. Hence they migrate crossing roads, rivers, hill locks and cultivated land. They tend to create havoc if their corridor is obstructed. The conflict with people escalates. This corridor development also may isolate small herds, thereby causing inbreeding with ultimate result of decimation of the population. Hence even after the improvement of road corridors the movement of these large mammals should not be obstructed across the road even though there are uder pass for elephants.

The corridors most affected will be the reserved forest and protected forest stretches where the corridors pass along or within. Such roads are in order of their presence or absence of P.A's grouped below where maximum/minimum impact will be visualized on wildlife.

1. Anandapur – Karanjia – Jashipur - SH -53 & 49
2. Bramhapur – Mohana - Bangi Jn. – J.K.Pur– Rayagada - SH-17 & 4
3. J.K.Pur – Muniguda - Bhawanipatna- SH- 5 & 6
4. Duspalla-Gania–Sidhamula–Baghdhariya–Narasingpur Jn. – Nuagarh – Hindol - Mahidharpur - Nuahata (Banarpall) - SH – 65A&B, 65, 64, 64A&B
5. Chandbali – Bhadrak - SH-9
6. Bhadrak – Anandapur - SH-53
7. Aska – Bhanjanagar
8. Bhawanipatna - Khariar

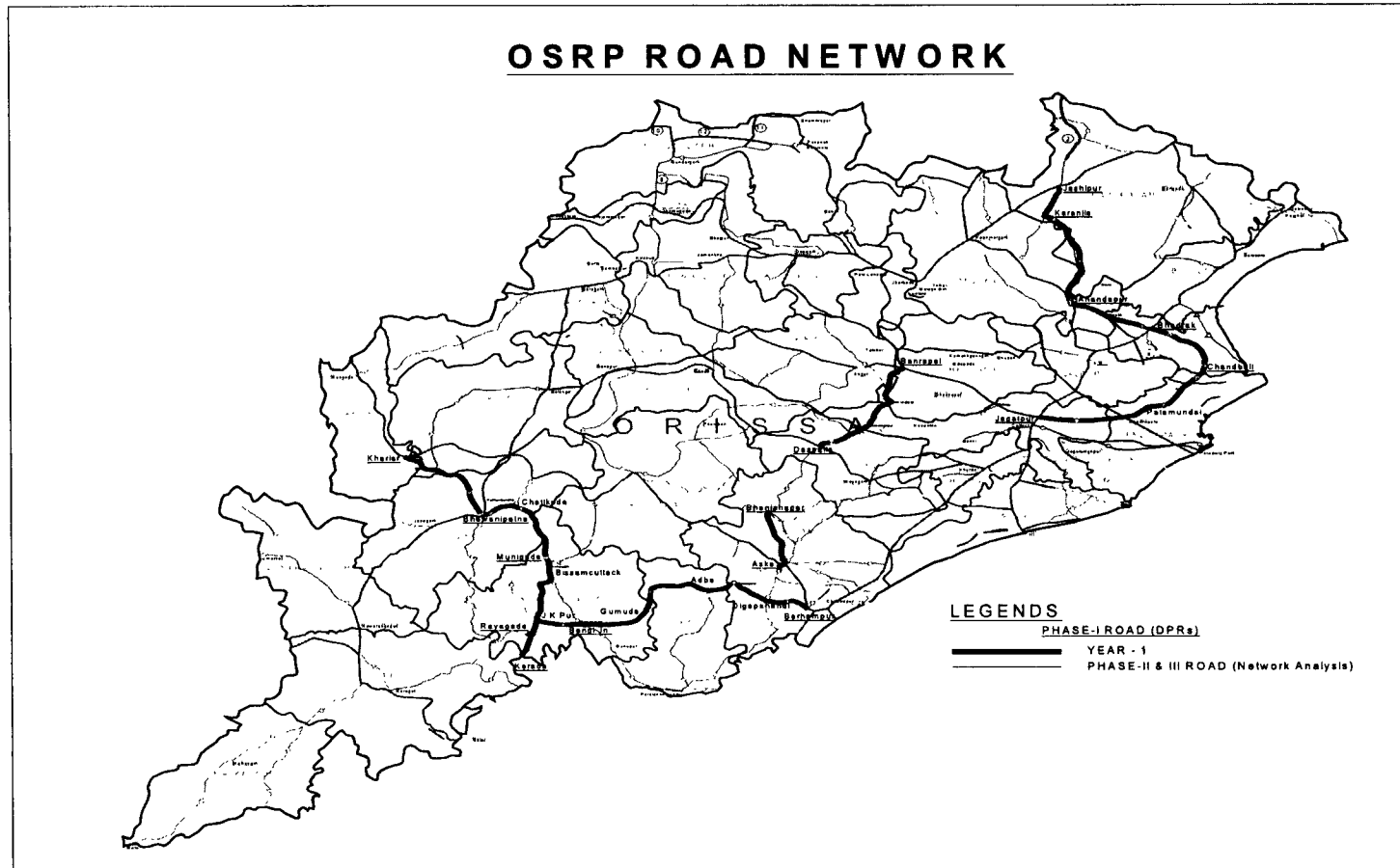
The movement of Wildlife in respet of each road is indicated in the table below with chainage and species commonly found crossing the road as ascertained from Biodiversity survey.

Table No. 5.1: Wildlife Movement – Compilation of Biodiversity Survey

Sl. No.	Project Corridor	Status of the Road	Length in Km.	Chainage of wildlife movement in Km.	Species crossing the road	Important stretches which species mainly cross
1	2	3	4	5	6	7
1	Anandapur - Karanjia – Jashipur Taking Anandpur bi-pass as 0-km upto Tongabilla as 92-km.	SH-53 SH-49	77.4 km <u>15.0 km</u> 92.4 km	09.3 km 20.7 km 25.5 km 26.3 km 55.9 km 56.5 km 17 to 22 km 35 to 37 km 41 to 42 km 45 to 46 km 50 to 53 km 62.5 to 63 km 72 to 74 km	Elephant pass Elephant corridor Elephant pass Elephant corridor Elephant pass Elephant corridor Movement of bears, sambar, deer, rattel, barking deer, snakes, jackals, hyena, fox and wild dogs; hares, monitor lizards, civets, tiger, leopard, pangolins etc.	The most prominent corridors are that of the elephants in herds of 15 to 20 regularly cross at chainage 20.7-km and 56.5-km. The most prominent movement areas are at chainage 18-km, 21-km, 36-km, 41.5-km.
2	Bramhapur – Mohana – Bangi Jn – J.K.Pur - Rayagada	SH-17 SH-4	150km 51 km	26.1 km 118 km 121 to 123 km 41.0 km 53.0 km 56.0 to 56.5 km 66.5 to 67.0 km, 73.0 km 78.0 to 79.0 km 91.0 km, 93.0 km, 96.0 km, 102km 107 km, 174 km, 176 km	Slouth bear – 26.1 Elephant pass Elephant pass	The prominent movement is Bear corridor at 26.1 (Moulabhanja), 118.0 & 121.0 Goibandha elephant corridor which is regular crossing. For other wild life out of the total length spots located under column 6 the frequented spots are at chainage 53, 56, 66.5, 91, 96, 107, 118, 171 and 176 kms.

Sl. No.	Project Corridor	Status of the Road	Length in Km.	Chainage of wildlife movement in Km.	Species crossing the road	Important stretches which species mainly cross
1	2	3	4	5	6	7
3	J.K.Pur - Muniguda - - Bhawanipatna	SH-5 SH-6	49.5 Km <u>68.0 Km</u> 117.5 Km	12, 18, 19.5, 23.3, 29.0, 30.0, 36.2 km	No specific elephant pass information available. There are several wild life movement zones for tiger, leopard, sloth bear, sambar, deer, wild boar etc.	The Railway road in between the road and forest creates a formidable barrier in restricting the movement of large animals across the corridor upto Sikerkupa
4	Bhawanipatna - Khariar	SH-6	<u>0.2-68 km</u> 70.0 Km	4.1, 18.85, 22.15, 23.35, 54.35, 65.1, 67.85 km	Hayenas, wolves fox, python, snakes rats, mongoose, civets, amphibians, monitor lizards and gekos.	There is no important stretch
5	Duspalla – Gania - Sidhamula - Baghdhriya – Narsinghpur - Nuagarh – Hindol Mahidharpur - Nuahat. - (Banarpal)	SH-65-A SH-65-B (Mhanadi Bridge & Approach) SH-65 SH-64 SH-64-A SH-64-B	23 Km 18 km 6.3 km 25 km 12 km 18 km	68.4 75.1 75.6 77.6 79.8 55 to 56 57.5 to 59 63 to 65 68 to 69 km	Elephant corridor Elephant pass Elephant corridor Elephant pass Elephant pass deer sambar, sloth bear, rattle, barking deer, python, king cobra, gaur, cross the road. Leopards and Hyena, Jackals, civet pangolins, land monitors Lizards, rhesus monkeys and langurs.	Two recognized elephant corridors are there. Wild life crossing points are many during winter and summer. The most prominent crossovers are located near the Budha Budhi ghat temple where elephants drink water from one well. 53.0 km (Budha Budhi Teple) & Forest check gate 55.2, 56, 58, 63.6, 68 km
6	Chandbali - Bhadrak	SH-9	51 km	26.1m 28.8, 30.05, 31.6, 36.005 km	These are the wetlands and creeks, drainage channels etc. which serve as a food source for aviary, amphibian and reptilian fauna as well as the vital breeding ground of sweet and brakish water fish, shrimp, molluscs, amphibians, reptiles, rodents and millions of micro organism, common crabs, Crustacean and dragon fly etc.	There are canals and rivulets which serve as the conduit in the biodiversity chain to generate, disperse and regroup the different species for reproduction in intertidal areas and flood plains of river Baitarani.

Sl. No.	Project Corridor	Status of the Road	Length in Km.	Chainage of wildlife movement in Km.	Species crossing the road	Important stretches which species mainly cross
1	2	3	4	5	6	7
7	Bhanjanagar - Aska	SH-7	39km	40.95, 45.2 km	There are no perceptible wild animal movement corridors due to absence of forest. But the road passes along a R.F. Kaliamba from Ch. 4.5 to 7.5 and elephant, gaur, wild boar, crags the road for foraging in the crop fields. Now mostly Barking deer, mouse deer, wild bear, Hayena, Jackals, Panthor, Bear, Porcupine, Snacks cross over during Nov-Dec for foraging and hunting	No underpass is provided to prevent public resentment for allowing wildlife to damage crops
8	Bhadrak - Anandapur	SH-53	46km	12.2, 13.8, 17.2, 21.75, 23.5, 34.0, 41.1 km	Hyena, Rabbit, Frog, Lizard, Snakes, Jackal move across the road Check gate Check gate	



The list of protected areas with their maps and other basic location details are in the table below at para-1.4.4.

Sl. No.	Name of the protected area	Established in the year	Location
1.	Lakhary valley Elephant sanctuary	08.02.1985	84°-16' to 84°-25'(E) Longitude 19°-15' to 19°-25' North Latitude
2.	Hadagarh WL Sanctuary	06.12.1978	86°-11' to 86°-25'(E) Longitude 21°-11' to 21°-25' North Latitude
3.	Bhitarkanika WL Sanctuary	22.01.1975	86°-30' to 87°-06'(E) Longitude 20°-30' to 20°-50' North Latitude
4.	Similpal WL Sanctuary	03.12.1977	86°-04' to 86°-37'(E) Longitude 21°-28' to 22°-8' North Latitude
5.	Baisipally WL Sanctuary	07.11.1981	84°-35' to 85°-50'(E) Longitude 20°-23' to 20°-33' North Latitude
6.	Satkoshia George WL Sanctuary	19.05.1976	85°-35' to 86°-05'(E) Longitude 20°-30' to 20°-45' North Latitude
7.	Karlapata WL Sanctuary	15.10.1992	82°-45' to 83°-15'(E) Longitude 19°-30' to 19°-50' North Latitude
8.	Similpal Biosphere Reserve (Declared by Govt. of India)	22.06.1994	86°-05' to 86°-37'(E) Longitude 21°-30' to 22°-08' North Latitude

What is a corridor? (1) It is interpreted that the facilitated movement function of a linear landscape element is the most commonly assumed distinguishing characteristic of a corridor. (2) The corridors as a matter of fact allow the inter mixing of the genetic pool of one area with the other to permit the continuance of the race without which the growth in isolation will lead to in breeding and self destruction of the species within the confines due to lack of genetic variation and recessive genes becoming stronger to weaken the progenies.

The wild life habitats, its fragmentation and obstruction of corridors has to be viewed from the above angle to appreciate and recognise the vital role played by inter connectivity and isolation that may happen on account of fragmentation of corridors and habitats, in developing the roads passing through any wildlife habitat and across any wildlife corridor.

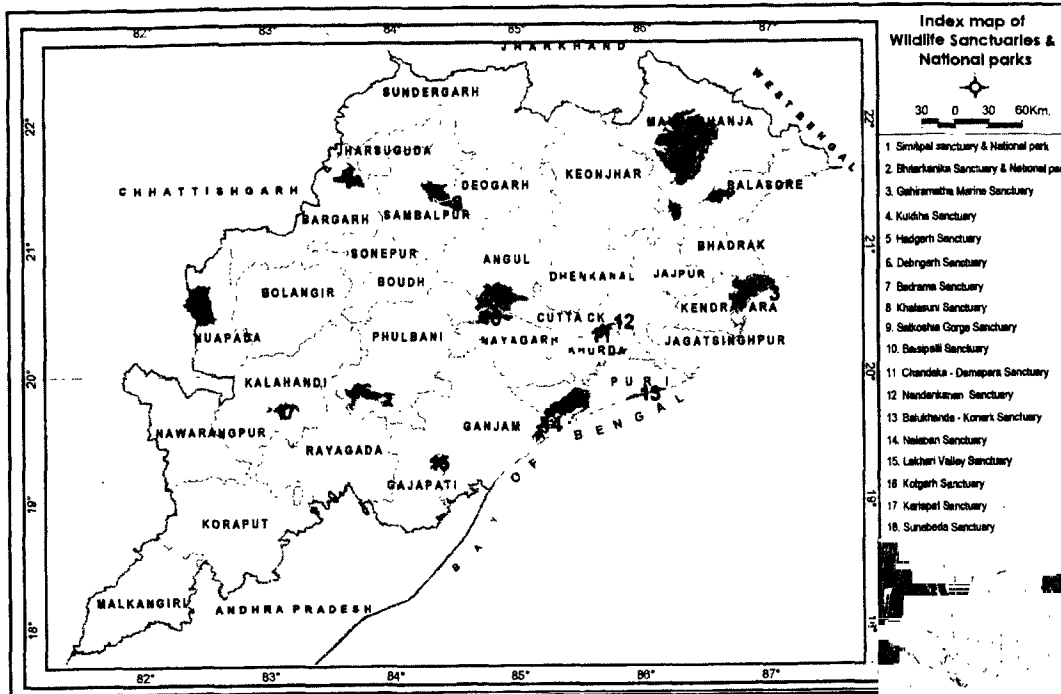
One such isolated habitat of elephants exists in Rayagada District and Gajpati district ie Mahendragiri hill & Lakhary valley. Lakhary has no inter connectivity but Mahendragiri which has an escape corridor at Goibandha to cross over and mix with the other herds of elephants in forests across Vansadhara and along Vansadhara will be fragmented on account of the development of Bramhapur – Bangi Junction – Raygada road i.e. SH-17 and SH-4. This elephant movement is on SH-17 at 117 km. to 123 kms and maximum movement at this place near 118 km stone adjacent to the culvert. 8 to 15 elephants cross the road every day at 4.30 to 6 pm.

Similar is the importance of Elephant Corridor at Satkoshia R.F. in Mayurbhanj district which links Similpal with Jharkhand on one side and Hadagarh- Kuldiha WLS on the other side of the habitat. The importance of this corridor is ecologically prioritised as high and

conservation feasibility as medium. The width of this corridor is 3 to 4 kms and on chainage 21 km to 25 km and length is around 15 to 16 km.

5.2 THE PROTECTED AREAS:

The protected areas in the State of Orissa are indicated in the accompanying map given below showing the sanctuaries, national park, elephant reserves, biosphere reserve, etc. Movement corridors of elephants in Orissa and part of Bihar (undivided) as published by GoO in the book "Project Elephant" is furnished at protected areas in **Annexure – IV**.



PROTECED AREAS OF ORISSA

Out of the above-protected areas the Phase-1 road corridors pass through none of the sanctuaries or National Parks or core area of Biosphere Reserve. But the SH-53 & 49 pass through the buffer and transition zone of Similpal Biosphere Reserve and Mayurbhanj Elephant Reserve. The roads also run across various Reserved and Proposed Reserved Forests, Elephant corridors, sloth bear track and other wildlife movement path. The project influence area (PIA) has been extended up to a radial distance of 10 km from the periphery of the road corridor on either side of the centerline. This is also similarly extended across 10 km from the center of the haulage road and quarry area for impact study on biodiversity and action plan.

The elephant habitat and its distribution in India is delt in detail in the book "Right of Passage Elephant Corridors of India" publshd by Wildlife Trust of India 2005. The definition of Corridor and the high priority assigned to one such elephant corridor from Similpal to Satkoshia connecting the Hadagarh W.L.S, Kuldiha W.L.S. and the adjacent forests of Satkoshia is mentioned to emphasize on the importance of corridor for elephants and other wildlife.

An Elephant corridor is defined as line of patches of natural vegetation providing habitat for species that are not adapted to surrounding habitat as temporary use areas or as a permanent part of their home ranges.

5.3 THE CENTRAL INDIAN POPULATION OF ELEPHANTS:

The elephant habitats in central India extend over 17000 km² in the states of Orissa, Jharkhand and southern West Bengal and hold a population of about 2400-2700 elephants (Chowdhury, unpublished draft action plan). Biogeographically, this region falls in the Chhota Nagpur plateau in the north of the Eastern Ghats (Rodgers and Panwar, 1988). A major portion of the forests of Jharkhand, southern West Bengal and north-western portions of Orissa is deciduous. To the north of the Mahanadi River, elephants are distributed in Baripada, Karanjia, Keonjhar, Bamra, Rairakhol, Angul, Dhenkanal, Athamalik and Athgarh Forest Divisions in Orissa. Eastern Ghats extending from the south of the Mohanadi River upto Mahendragiri, Boudh, Nayagarh, Phulbani, Baliguda, Kalahandi, Rayagada, Parlakhemundi and Ghumsur North Forest Divisions in Orissa form the elephant habitat in the area. Singh (1989), Datya (1995), Tiwari (2000), Nigam (2002), Swain and Patnaik (2002), Sar and Lahiri Choudhury (2002) and Singh et al. (2002) have dealt with elephants of the area.

Orissa has about 57% of the elephant habitat in central India with 1800-2000 elephants spread over about 11,000 km² (Swain and Patnaik, 2002). Nearly 44% of the elephant habitat falls within eleven Protected Area, viz. Similpal National Park, Similpal Wildlife Sanctuary, Hadgarh, Kuldiha, Satkosia gorge, Baisipali, Chandaka-Dampara, Kotgarh, Lakhari, Khalasuni and Badarma. Three Elephant Reserves, viz. Mayurbhanj, Mahanadi and Sambalpur have also been declared. Maps enclosed in **Annexure -VI & VIII**.

The first, including Similpal Tiger Reserve and Kuldiha and Hadgarh Wildlife Sanctuaries, has an area of 3200 km² with an estimated population of about 491 (Prusty and Singh, 1994). This zone along with the adjacent forests of Noto and Garsahi could be an ideal habitat for the long-term conservation of elephants. The Satkosia-Baisipalli zone, situated in the central Orissa, has the Satkosia gorge and Baisipalli Wildlife Sanctuaries. This with the adjacent 800 km² Reserve Forests could form a larger landscape of about 1760 km² (Chowdhury, unpublished draft Action Plan). This area has been cleared by GOI, MOEF recently as the 2nd Tiger Reserve of Orissa.

The south Keonjhar Plateau, with about 2600 km² is spread over Deogan, Ghatgan and Telkoi Ranges of Keonjhar Forest Divisions and Kamkhya nagar east and west Ranges of Dhenkanal Division is believed to have about 200-250 elephants. Madanpur-Rampur-Kotgarh-Chandrapur zone in the Eastern Ghats have about 800km², of which about 80% is fragmented due to shifting cultivation. About 300-400 elephants are estimated to be present in this area. These constitute the South Orissa elephant reserve as at **Annexure -V**.

5.4 WHY BIODIVERSITY ACTION PLAN:

The MOEF, Govt. of India has formed and adopted fresh National wild life action plan (NWAP) in 1983, which is still in vogue. To mitigate the constraints noticed at the time of implementing the action plan for wild life conservation on account of demographic presence, development activities, consumption pattern on account of population increase in human and livestock, increased commercial use of natural resources etc which are to be addressed properly.

Habitat loss is always associated with developmental projects like dams, mines, Industries, roads, road expansion, Rly expansion and new railway line.

Effective ecosystem conservation is the foundation of Long term ecological and economic stability. The term wild life encompasses all uncultivated flora and underestimated fauna. Every species has the right to live and every threatened species must be protected to prevent its extinction.

Water wilderness and wild life are irrevocably interlinked. The natural processes in forest and wild habitats, the impact of floods, cyclones, draughts, ensuring food security on account of shrinkage and degradation of wilderness has witnessed the erosion of our heritage i.e. rivers, aquifers, forests, grass lands, mountains, reducing territory of wild life and geomorphologic features.

For all these factors i.e. Ecological security, priority to conservation, National land use policy, Primacy for water as sustenance, wildlife conservation with peoples support, man, animal, conflict etc. the new National wildlife policy of the MOEF was inaugurated on January 21st, 2002 by the Prime minister of India in the XXI meeting of the Indian Board for wild life. A few of the Expert committees' observation and recommendations are cited for better appreciation.

- (A) The National Planning has not adequately taken into account the Ecological and economic consequences of extracting short-term commercial gains from wild life habitats. It is therefore necessary to engage national decision making bodies in direct discussion on the Board to protect our Natural Treasury which is comprised of rivers, aquifers, forests, grass lands, mountains, wetlands, coast lines, marine habitats, deserts and various species that inhabit them.
- (B) Decision makers need to recognize that natural ecosystems reduce the frequency and intensity of "Natural" disasters including floods, drought, cyclones, land slides and are the life line for hundreds of millions of rural people. Protecting the environment is rather in the nation's economic health and human interests, apart from being a moral imperative.
- (C) **Ministry of Surface Transport and ministry of Railway to plan roads in such a manner that all National parks and sanctuaries are by passed and integrity of P.A. is maintained. Wild life corridors also need to be avoided or mitigative measures (such as restricting night traffic) need to be employed.**

Keeping these factors in view and aiming at development of existing infrastructure it is most necessary and appropriate to go for the assessment of Biodiversity components, threat, corridors and breeding habitats of wild flora and fauna, balancing and protecting the aquifers, springs, wet lands, wet land ecosystems, riverine and marine habitats of threatened and threat perceptions on account of the project activity, prevention and mitigation measures to minimize the risks involved and suggest corrective habitat development plans, the biodiversity study and action plan for the project corridors of OSRP was under taken.

The table of contents below shows the road corridors and wild life areas directly or indirectly going to be affected by such improvements:

Table-5.2: Evaluation of threat perception along road corridors for biodiversity

Sl. No.	Name of the corridor	Status	Length in km	Wild flora likely to be affected	Wild fauna likely to be affected	Threat perceptions	Weightage assigned
1	Berhampur – Bangi Jn. Link Bangi Jn. to Raygada	SH-17 SH-4	150 52	Avenue plants, Green tunnels of many established trees, micro habitats developed over years containing conglomeration of several plants of medicinal value and ecological importance. Loss of landmark trees and vegetation.	The aviary, rodents and amphibian fauna, reptiles dwelling on the avenues and along the avenues. The micro habitats developed over years, corridors of wildlife movement in search of food and water getting fragmented and disrupted putting old, young, pregnant and infant wildlife at risk of pursuers and predators, blockade of elephant, bear, ungulates path as camouflage disappears along the road wildlife is precariously prevented from moving and grazing in the vicinity.	Loss of forests in RF & PF, within impact zone of 10 km. loss of breeding, nesting, perching and scavenging habitat loss of biodiversity in mini and micro climax zones along the corridor leading to destruction of several organisms and plants beneficial for agriculture and environment as they were the hosts to beneficial insects, rodents, birds, amphibians, reptiles. Fragmentation of habitat leading to starvation or falling an easy pray to carnivore or human beings, serious pollution, soil erosion, alteration in the physical features of the habitat puzzling the wildlife. Plants at the risk of adaptation rise in weed growth of toxic types and rise in temperature affecting procreation. Bears, elephants, snakes, frogs and birds are to be worst hit. Soil erosion, land slides, silting up of the water bodies, pollution of aquifers.	8.5
2	Daspalla – Gania - Gania - Sidhamula - Sidhamula - Kamaladeipur - Kamaladeipur – Narsinghpur -Narsinghpur – Hindol - Hindol – Nuahat	SH -65-A SH-65-B SH-65 SH-64 SH-64-A SH-64-A	25 km 18 km 6.3 km 25 km 12 km 18 km	Avenues trees, Green tunnels, established land mark trees, micro habitats of many plants medicinal and aesthetic value plants, wild fruit bearing (edible) species, loss of forest growth.	The wetland aviary species, amphibians, reptiles, monkeys, apes, aquatic fauna, breeding habitats, foraging wildlife and their corridors of movement. The micro habitats along the road corridor, removal of camouflage cover for large and small animals, rodents, birds. Amphibian fish and crustacean will be killed or eliminated.	Several reserved and protected forests and forest growth affected, loss of avenue trees, green tunnels, soil erosion, release of toxic chemicals, vapors, loss of biodiversity and micro climatic climax of the area. Loss of food source for aviary, scavengers, (owls, vultures and crow) water birds on account of corridor development. Fragmentation of wildlife habitat, due to erection of embankments and crash guard, quarry and borrow areas further stressing the animals and plant life. Weed invasion will cause insurmountable difficulties during road improvement activity due to air water, noise pollution and soil erosion for old, infant and pregnant wildlife. Aquifers will be badly affected in ghat cutting.	8.5
3.	Chandbali – Bhadrak	SH-9	51 km	Avenue trees, aquatic plants and medicinal herbs, micro habitat of several conglomerate of interdependant plants, fruit bearing and land mark trees, green tunnels will be lost. Heritage trees more than 100 year old shall	Intertidal wetland and breeding area of aquatic life and associate fauna will be seriously at risk. The aviary and aquatic fish and amphibian will be deprived of their source of sustenance and destroyed.	Total loss of marine/ estuarine fish and shrimp production as aquatic life forms breeding and nesting habitat will be lost. The aquatic plants and insects breeding on these will be threatened to extinction; the estuarine habitat of Bhitarkanika WLS Annexure –VII, will be upset due to decrease in population of various fish, crab, shrimp mollusks on account of effluents and soil erosion. There will be silting up and flooding, loss of agricultural production and fish catch. Traditional occupation of local inhabitants will be seriously	9

Sl. No.	Name of the corridor	Status	Length in km	Wild flora likely to be affected	Wild fauna likely to be affected	Threat perceptions	Weightage assigned
				be lost.		affected. Many endangered turtles, fish, Shrimp, crabs, mollusks, beetles, and birds, will perish never to be seen again in the area. Rise in summer temperature. Loss of cyclone preventing shelter belt	
4	Bhadrak – Anandapur (Upto Bypass)	SH-53	45 km	Avenue trees, green tunnels, landmark trees, fruit bearing trees micro climax conglomeration of medicinal, aromatic and geoclimetic plants colony will be lost.	The aviary, the amphibian and reptilian flora, the aquatic fish, crustacean, beetles will perish or affected locally and down stream. The food chain will be seriously threatened.	Increase in summer temperature, loss of food source for aviary. Nesting, resting and perches will be lost. The wetland life down below the chain will be at risk of depletion. Comes within the impact zone of Hadagarh WL 3 to 7 kms, soil erosion plugging of drainage channels during and after road improvement causing drainage problem, loss of cyclone shelter belt.	6
5.	Anandapur – Karanjia Karanjia – Jashipur (Tongabilla)	SH-53 SH-49	77.4 15	Avenue trees forest growth, medicinal plants, microhabitat of plant colonies, rare aquatic plants and fish within the impact zone of the corridor; landmark vegetation will be lost. Orchids and ferns will be affected by the corridor development.	Elephants, tigers, cheetah, panther, gaur, king cobra, flying squirrels, giant squirrels, mahaseer, shrimps of Similpal springs and river systems down below, breeding zone of various fish up stream and down stream, food source of aviary and rodents will be seriously affected during and after the project work. Wildlife will be seriously stressed. Hunting, shooting and snaring will increase. Toxic effluents will damage several life forms.	Loss of aviary food along the corridor, loss of green tunnel, fragmentation of corridor putting old, young, infant and pregnant animals at high risk in search of food, water and shelter, more exposure to predators and hunters, stress on procreation and territorial conflicts, limited scope of cross under or cross over points along the corridor will be leading to loss of agriculture and man animal conflict. Tigers and panthers will be at greater risk of being killed, so also elephants. Smuggling of forest and wildlife will increase. Biodiversity buffer and transition zone will be adversely impacted to rapid commercialization of road corridor on account of land development and encroachment, illicit felling and poaching will be more as more people settle down in these villages after communication improves. Soil erosion, release of effluents, litters of polyethylene, polyurethane foam, discarded auto disposables and lubricants will flow into the river and drainage systems, upsetting the equilibrium. Elephant Reserve corridors will be greatly affected restricting flow of the wildlife at specific points making them vulnerable to hunters, sharp shooters and antisocials. Corridors will be more hot and exposed to weeds	9
6.	J.K.Pur – Muniguda Muniguda – Bhawanipatna	SH-5 SH-6	50km 68km	Loss of avenue trees, green tunnels, forest growth, land mark, micro climax association of plant colonies, medicinal	There are several wildlife movement across the road near Chatikona and else, where. The tiger, panther, cheetah, gour and deer, sambar will be affected by corridor improvement due to	There are no protected area nearby within project impact zone. The loss of avenues will adversely affect the aviary fauna in the corridor; the fragmentation of habitat will put the wild fauna under stress and risk of life and food resources. The increase in traffic during road development and after will lead to flood and	8

Sl. No.	Name of the corridor	Status	Length in km	Wild flora likely to be affected	Wild fauna likely to be affected	Threat perceptions	Weightage assigned
				plants along the corridor, grazing grounds, food supply chain of avenues will vanish, realignment of the road to avoid Railway level crossings will cause further loss of forest and tree growth.	increased night traffic. The aviary and rodent population along the avenues will be hard hit due to tree felling and loss of food source, the soil erosion, ghat cutting will be detrimental for aquatic fauna down stream.	submergence owing to embankment and diversions, soil erosion. Hunting, poaching, disforestation and encroachment will increase with rise in settlement and population during and after the corridor development. The wildlife genetic diversity will be at risk of further localization on account of multiple fragmentations already made by the Railway line and industrial ventures coming up in Kalahandi and Raygada districts besides Podu and olicit felling in highhills. The Aquifers and nala beds will be further raised due to erosion upsetting the river flow causing flash flood damage to bridge and culverts.	
7.	Bhawanipatna – Khariar	SH-16 02 to 70 km	68 km	The loss of avenue and green tunnels for the ROW will lead to loss of trees and damage to the micro climax vegetation along the corridor. Many medicinal, aromatic and beneficial plants will be destroyed; land mark giant trees will be sacrificed. Food chain will be lost.	There are no forests worth the name along the corridor. The loss of avenue trees will disadvantage the aviary and rodents due to loss of nesting perching and foraging facility. The micro fauna residing along the road within the micro climax vegetation will be lost. Wildlife will be devoid of camouflage cover to some extent as land is mostly avoid of natural forests either side like hayena, jackal, mongoose, birds, rodents, amphibians, reptiles will be more stressed.	There are no RF/PF or P.A. Aviary, rodent and amphibian species will be at risk of starvation stress and devoid of nesting and breeding area. The ground moving species will be killed and exposed by road expansion and destructions of habitat. The complex ecological balance of the area will be lost as all most all bridges and culverts except the Tel and sunder river bridge all others will be either demolished or rehabilitated afresh along with digging out the road base at many places for new formation heritage and giant trees will be removed from the corridor.	6
8.	Bhanjanagar – Aska	SH-7	39	The avenues and green tunnels of many established trees, micro habitats of several plants developed over years along the route, medicinal plants, along the corridor will be lost.	The common wildlife in the countryside like fox, jackal, hyena, mongoose, rodents, owls, birds nesting, perching and feeding on the fruits of avenue plants, the monkeys and apes, amphibians, reptiles etc. will be at stress. The wildlife crossings from Kaliamba reserve forest block to agricultural fields and back yards will be disrupted.	Loss of biodiversity, loss of food source to aviary and rodents, loss of habitat for aviary, rodents, and fragmentation of movement corridors, loss of mini climax areas, invasion of weeds, rise in summer temperature.	6

CHAPTER – VI

THREATS TO WILDLIFE

- 6.0.1.** 'Wildlife' refers to uncultivated or undomesticated life forms, while biodiversity of any area refers to all life forms and their diversity within the species and between the species and their habitats. This is dynamic and undergoes changes with time due to natural causes or human induced pressure. Of course, we are basically concerned here about wild biodiversity rather than agro-diversity.
- 6.0.2.** Every one of more than 1.7 million organisms in the world, so far known to science, has some role to play in the ecosystem, some of which are known and many are yet to be known. But we have no right to destroy any of them before we clearly know as to what role it plays in the entire ecosystem. This is specific reason as to why there is concern about protecting all life forms occurring in the wild. Protected areas, Tiger Projects, Elephant Projects, Biosphere Reserves, Ramsar sites, World Heritage sites, etc. have all been set up with that objective in view.
- 6.0.2.** Hence, while taking up the corridor development under the Orissa State Road Project, it has been decided to assess the threats that the road project is likely to the local bio-diversity, due to various actions needed for such development.

6.1. GENERAL THREATS:

The Wildlife, wild animals and biodiversity of the region may suffer due to any road development. Some perceived threats are enumerated below.

- 6.1.1.** Removal of road side trees either avenue or naturally occurring ones for widening shall deprive the birds, animals, reptiles, orchids, mosses, lizards and insects of their habitat and totally wipe away their population.
- 6.1.2.** Cutting of hill slopes for road making without proper protection may lead to soil erosion and affect moisture retention, thus creating arid condition and loss of food.
- 6.1.3.** The construction work involving, blasting of rocks, crushers, mixers, light, road making machines shall destroy wildlife habitat along the road corridors.
- 6.1.4.** Fast moving traffic and increase in movement of vehicles during the day and night shall obstruct natural passages and corridors of long ranging animals, either by affecting their foraging or cause genetic isolation of small herds.
- 6.1.5.** Due to fragmentation and reduction of natural habitat, animals will enter crop fields and habitation, thereby increasing man-elephant conflict to detriment of both the human population and wild animals.
- 6.1.6.** Many species of plants, which are common to road sides, may vanish if adequate step is not taken to save them. These plants which often host many other plant and animal species may suffer irreparable loss, including those which find 'niches' on them.

- 6.1.7. Opening and improvement of roads also facilitate poaching of wild animals and collection of parts or whole of endangered vulnerable plants, thereby endangering them further or even resulting in their extinction.
- 6.1.8. Labour camps in side the forest areas, may not only disturb their habitat, but may also increase forest fire hazard, particularly in summer months, thereby killing the ground vegetation and small animals, birds and others.
- 6.1.9. Unchecked dumping of solid wastes both by road workers and road users may create problem not only for regeneration, but also for wild animals, who may injest them.

6.2 SPECIFIC THREATS TO WILDLIFE:

These threats are either site specific or species specific. The site specific threats to Biodiversity are:

1. Avenue plants along the road: - These will be cut away never to be replaced by the same species again. For example one pepal tree (Aswath) or one Neem tree or Arjun tree generates more oxygen at night and releases more moisture to the ambient air around it compared to all other plants of similar size and shape. Rather it is 4 times stronger than other in longivity, carbon synthesis and carbon cycle, oxygen generation and cooling of the atmosphere. It also provides fruits for wild fauna. Because of excess oxygen generation at night it is prohibited to sleep under pippal trees at night and this tree was selected to be a place of worship and meditation. Thus the ambient air along the road corridor will be missing after removal of these trees.
2. The coastal areas of the state are prone to cyclone and hurricanes causing wide spread damage to human life, property and agriculture. These avenues located like a green and thick wall across the path of wind flow and deflect the cyclone direction upwards 10 times the height of trees. Thus the effective zone of movement and destruction gets diverted and the hinter land is protected from catastrophic damage. Once the avenue trees and green tunnels are cut down for the ROW the lee ward side of the corridor & cyclonic flow will be directly affecting the agriculture and habitation with full force killing and destroying infrastructure, human beings and wildlife as well as domesticated animals. To recreate another shelter belt or wind break will take many years and the magnitude of such threat over a period of 25 to 30 years and the loss accruing out of it can be well imagined and appreciated.
3. The road corridors pass through reserved and protected forest and the wildlife residing in these areas are moving across the road in their day to day movement for territorial marking, procreation, foraging, breeding, rearing the young etc. Once the road corridor development starts the wildlife will be disturbed and separated from the groups and habitat.

The flora of the area will be depleted as pollinating birds, bats, squirrels, will disappear, as trees, shrubs, bushes and herbs are cut away and many under ground and terrestrial life forms crushed to death. This will be a direct loss of flora and fauna which may not come up there again because conditions after road corridor improvement will be more hostile for them. There the Biodiversity loss can't be quantified in monetary terms or

number of species lost evaluated because no one has minutely evaluated the complex biodiversity scenario nor it is possible within a short span of 30 to 60 days or so to get a comprehensive data when nil data base on these tracts of roads concerned with biodiversity is confronted.

The barricading and embankment formation, the fast moving vehicles, day and night, movement of heavy machineries and human beings will scare away the animals. The water course, movement track will be disturbed along with loss of landmark vegetation, water bodies, culverts etc. This will confuse the human beings what to speak of wildlife on locating their source of food, water and shelter on account of afore mentioned factors.

The distressed flora of orchids, ferns, herbs, shrubs and trees will be suppressed by exotic weeds and will fail to overcome them. The wild elephants will be at a loss to negotiate its way out of the habitat due to barricading and over crowding etc. The territorial male tiger, leopard, panther, civets, otters, will not find space for marking territory and frequent infighting of adult and sub adults will be there, for limited space and food source. There will be inbreeding on account of this and wildlife will become a sitting duck for the predator and sharpshooter along the road under pas or barricades. The pregnant, infant and old will be more disadvantaged in finding their way and escape route.

4. The wetland ecosystems along Chandbali to Bhadrak, within buffer and transition zone of Similpal Biosphere reserve, the elephant corridors of Mayurbhanj elephant reserve, Kalahandi elephant corridors, Berhampur – Raygada bear and elephant corridors are zones of vulnerability and careful handling as the threats of adverse impact are far reaching above and below the corridor and that may lead to serious law and order or economic issues in latter years.

The irrecoverable loss that may accrue has to be visualized well ahead and treatment of mitigation befitting to the local conditions has to be found out.

5. The rat race for earning quick bucks and acquiring land along up coming road corridors every where has brought all the planning to hay wire in subsequent years after completion of the project. Some of the prescriptions may therefore appear quite irrelevant, costly and inappropriate when looked at generally but the same are to be assessed and evaluated from our day to day experience in the field.
6. The threats of **man animal conflict is to be** given more importance as specific threats, where the crop pattern, the exposure to wildlife needs and habitat protection is paramount and that warrants retention of green tunnels and avenues partially if not wholly as specific threat perceptions have been evaluated for the same above.
7. The introduction of hybreeds, genetically engineered crops, exotic fish, bees, birds, goats, cattle, sheep and biotic control measures within the buffer and transition zone of biosphere reserve has to be seen with devastating threats to the biodiversity as else where in our country and other countries, catastrophic damage to indigenous fish population, indigenous bee population, increase in foreign crop pastes have happened

on account of introduction of imported crop seeds, food stuffs, cattle, poultry, pigs, rabbits, koil, bees, tilapia, catfish etc. in the name of improving the lot of tribals and farmers in the impact zone. The lantana, eupatorium shrub and climbers, the parthenium, and ipomea, the wattles and eucalyptus, the teak all have ruined the wetland and dry land habitat of indigenous flora and fauna and such follies should be our eye opener when we are assessing the impact and mitigation on specific areas.

The cutting of trees inside forest, widening of ghat sections to correct the road geometry, the quarry sites and borrow areas are specific threat zones for the biodiversity as geo climatic variations allows specific plants and wildlife to proliferate in an area.

The occurrence of plants like *Xylocarpus xylocarpa* is one such species found in Daspalla to Nuahat (Banarpal) and Taptapani to Kenduguda. The occurrence of *Embelia ribes*, *Embelia tsjeriam* along Ganjam to Raygada corridor, *Strobilium taxoides* (Jhumpudi), *Vitex peduncularis* along Daspalla to Nuahat (Banarpal), and Anandapur to Karanjia *Solanum khasianum* and *Solanum trilobatum* along the Bramhapur - Raygada corridor, indicates the unique influence of climate on plant and animals.

The orchids are also unique in Gajapati and Mayurbhanj districts in particular. These species will gradually become extinct if not properly protected during corridor development.

The detail treatment plan of the road corridors is dealt with separately and accordingly the mitigation measures will be worked out.

CHAPTER – VII **MANAGEMENT PLAN FOR** **MITIGATING MEASURES**

- 7.0 Though survey was conducted on all road corridors, it was not possible in great detail as planned particularly in the months of July to September due to incessant rain, flood and disruption of roads in many parts of the state. Despite that surveys were conducted, in the approachable stretches in 3 visits.

The road users, shopkeepers local people, senior citizens and OFD staff were interviewed according to prepared questionnaire, to elicit information on movement of wild animals, death or injury due to accidents, cause of crossing, waterholes, feature responsible for species found in the locality and time of the year they use the road most, presence of any endangered fauna and other relevant information.

7.1 IDENTIFICATION OF VALUED BIODIVERSITY COMPONENTS:

The parameters that evaluate the Biodiversity component of an area are:

- a. Natural environment sustaining various life forms.
- b. Ecological diversity due to geological and edaphic factors.
- c. Protected area involved containing endangered flora and fauna.
- d. Breeding ground of endangered species in PIA zone and the impact assessment.
- e. The mitigation measures needed to be taken by stake holders.
- f. Natural water sources along the corridor and present habitat conditions and future development strategy.
- g. Infrastructure development, monitoring devices.

7.1.1 THE NATURAL ENVIRONMENT:

This is a short of equilibrium or edaphic climax that has been established in the region for more than 50 years or so with gradual changes of the scenario to which the present proposal will make inroads and may upset the equilibrium attained over the corridor even after the effect of biotic interference along with air and water pollution, soil erosion in the area. Rainfall, humidity & run off with temperature determines the land to support a particular type of vegetation and self sustaining life forms of plants, animals, reptiles, amphibians and birds with bacteria's and fungus etc. The food habits, food varieties and quantity of food and cover under natural environment determine the continuation of a particular species depending on the topography and drainage. The terrain required for the elephants is more or less stable and flat ground or moderately rolling ground with plenty of grass, bamboo, palatable fruit bearing trees, and Ficus trees, deep moist valleys to move about without interference and plenty of water. The tiger prefers such a space but more hilly than plain forest for its shelter and cover or camouflage while stalking, plenty of prey animals for hunting and for rearing its young ones. The aquatic and land based flora contains specific vegetation which once disturbed fails to come up again due to modifications naturally or forcibly brought about by such action. The inroads made into such natural habitat affects the movement, foraging, grazing, hunting, breeding and resting pattern of the wildlife and upsets the pristine character of the area. Pollutants in shape of noise, toxic fumes and effluents, diseases and pastes transmitted through transported

cattle moving on the corridor. They spread rinderpest, foot and mouth disease (FMD), tuberculosis and septicemia etc. The roads those are planned to be developed now were there since long and therefore the weight age has to be on the basis of disturbance proposed for cutting of ghats, new realignments, quarries and borrow pits, removal of tree growth through micro climatic climax vegetation and wildlife area, springs, drainage channels, rivulets, rivers, reservoirs, wetland, wildlife movement corridors and migration routes, valuable and rare plants and wildlife located within the project impact area (PIA).

7.1.2 ECOLOGICAL DIVERSITY DUE TO GEOGRAPHIC FACTORS:

There are certain pockets of forests, which provide well-distributed rainfall through out the year with specific range of temperature, humidity and food production. Once the forests are cut, vehicles move about, nalas and rivulets dug up for new structures, borrow areas and GSB quarries operate with ghat cutting for the road fill, the situation drastically changes decimating the vegetation and life forms due to imbalance in the habitat and pollution on account of excavation, dumping of debris, inflow of pollutants. The toxic substances released to the streams and nalas adds to the problem during and after the project operation is over and the ecological balance between the plants and wild animals and a biotic factor becomes incompatible. The forest types identified in the zone of the corridor will mismatch along with wildlife because of the conglomeration of adverse factors like tree cutting, poaching, encroachment, increase in settlers, squatters, commercial activity, illicit felling, release of toxic wastes and diseases to the hither to unspoilt area.

7.1.3 PROTECTED AREAS:

The purpose of declaring protected areas were to conserve nature and its inhabitants within their location with little change or non-interference. Such areas were declared legally as wildlife sanctuaries, and national parks. Elephant reserves, biosphere reserves, eco-sensitive and parts or entire eco-fragile zones, reserved forests, breeding habitats etc are often included in P.A's. and no entry zones. Stoppage of commercial non forest working and removal of trees from such areas (not even the dead, dying and diseased or dry ones), and prevention of planting of exotics in these areas were legally adopted on principle. Stringent and ingenious steps were prescribed for development of alternate livelihood for the dependent tribals through eco-development within and outside the perimeters (core and buffer) of such P.A's.

7.1.4 BREEDING GROUND AND FRAGILE RESIDENTS IN PIA:

Breeding of natural life forms is not like the breeding we see in domesticated insects, dogs, domesticated cattle and human beings. The natural law has a major role to play in the breeding of plants and wildlife through sexual conditions. The other two factors are very very strong.

The conditions required for this natural selection is unbridled movement of the animals, and tranquility of the forests to fight, win and enter into courtship before procreation. All these will be a daydream for wildlife as forests are under threat of shifting cultivation, Maoist movement and illegal settlements along all corridors. The road improvement activity which will continue for more than 3 years if not more will lead to noise, pollution, hectic activity, soil erosion, movement of heavy machinery adding more constraints as a result of which ritual fight and ritual display of plumage, colour, statures and prowess against the

adversary and female species in the wild along the corridors will not be there during this period. The stressed wildlife will go without the natural selection in some cases and inbreeding will takeover to weaken the next generations. The valuable plants of timber, ornamental, food and medicinal value or commercial importance may be smuggled along with its seeds and flowers before they mature to earn a few bucks. There is possibility of the leaves, barks, twigs, roots of commercial importance being smuggled and exported outside reducing most of them as we have lost the Bija, Rose wood, Sandal wood, Haldu, Faldu, Teak, Asan, Fanfana, Lodha, Medha, Kasi, Red sanders, Bandhana, Kangada, Dhaura, Fasi, Patuli, Katrong, Giringa timber species of exploitable girth and bamboos all over the state by unscrupulous traders and smugglers. The corridors are therefore to be more strictly watched during and after the proposed improvement along with monitoring device to follow up the effects and provide further safeguards.

With the improvement of road condition and plying of speedy vehicles, it will be difficult to check poaching and smuggling of wild animals and their body parts without proper staff, check gates and modern equipments.

There are several movement corridors across the road by elephants, bears, bisons (gaur), tiger, leopard, ungulates, fishes, amphibians, birds etc. The corridor of roads during development and after will be a formidable barrier for the wildlife and wild flora. It may be tragic if birds suffer due to scarcity of food and wetland, infants, pregnant mothers and old animals may suffer without food and water or get killed by poachers, or predators, or may not be able to swim across the barriers and barricades to safer area during flash floods. The forest fire may kill many as they will be unable to cross the roads in frenzy and while trying hard to escape and may get either killed or move into habitations to get killed. Hence such disaster may occur along PIA in the days to come if remedial measures are not taken. So far general consciousness is lacking regarding these factors. However, this document tries to address these issues in a holistic manner.

7.1.5 THE MITIGATION MEASURES:

Conflict does arise when we have to address the problems of flora and fauna, while taking up development of road corridors for fast moving traffic in order to achieve economic growth.

All these are to be addressed in a holistic manner. It may appear unrealistic to allow free movement of wild fauna across the roads. But the barricades will not provide them free access to other parts of the habitat. When we forget to find our path in a small town or in a changed landscape we were familiar with, can we expect the wildlife to find out the few under passes we are proposing to provide for them at locations of maximum concentration of wild animals. Therefore we may have to provide safe passage at more than one place and prevent wild animals to cross over at other places, besides making these passages as closely resemble wilderness areas as possible. Where it is either not possible to provide safe passages or crossings at frequent intervals, awareness should be created among drivers or other road users to drive slow, and watch for wild animal movements to prevent any accident involving them.

The damage to the aquifers, springs, nalas, river basins and river beds, wetlands can be minimized by left or right centric improvement in which case only one side of the trees, shrubs, herbs, common property resources (CPR) of project affected persons (PAPS), rehabilitation and resettlement activities (R&RA), habitat loss and habitat improvement will be limited. Where the carriageway and

ROW is narrow (below 20 mtrs) this may also be economically sound proposition as only one side shall be affected.

The corridor camouflaging for wildlife under pass in such cases can be taken up simultaneously on the undisturbed side and by the time the other side is complete there will be some cover on the undisturbed side with mitigation measures like development of habitat, water holes, salt licks, gully plugging, check damming, improvement of food sources etc. The wild animal niches established over several years will not be totally disturbed as one side is still there to sustain them.

The erosion on account of diversion, dumping of construction materials, road fills will be much less and the progress of construction work will be faster.

7.1.6 NATURAL WATER SOURCES:

Many wild animals, love to have a bath or swim across large water bodies like river, rivulet and nala during summer or wallow in mud. This is more pronounced in case of elephants, sambers large cats and amphibians.

Therefore while developing the under pass care has to be taken to locate the same on the approaches to water sources. But at times failure of rains makes things more difficult for wildlife. Hence alternate artificial water harvesting structures or waterholes may be created on the nala beds to aid in percolation of water under ground and recharge the aquifers in the upper catchments by gully plugging, vegetative and random rubble stone check dams and low masonry check dams on the lower slopes across the road so that the fear of washout and flash floods is minimised. Within two to three years these nalas will become perennial sources of water at depressions and many of the distressed wildlife can be saved as the improvement in water regime will give a boost to vegetation and improve water availability even during the pinch period.

Few salt licks and gully plugging measures can be taken up in the difficult podu affected areas from day one of starting the project work to ensure this. The local staffs and the DFO of the area has to take up the initiative for planning and execution, while the nala beds outside the forest area will be treated by OWD contractors.

7.1.7 MOVEMENT CORRIDOR OF WILDLIFE:

As many wild animals move through same wildlife track unchanged even after generations, this factor has to be borne in mind while providing passage for them across road corridors. Therefore while developing the roads the exact spots where the wild animals were moving across may be retained so that the wild animals will not be disoriented.

When on account of limiting the estimated cost on each stretch, it may not be possible to provide separate under passes, it will be prudent to add an extra span in the existing culverts for the purpose. The approach to that span which shall be of proper specification is to be developed by planting indigenous shrubs and bushes properly during rains. They should be planted in large pits with sufficient manuring for fast growth, so that the wild animals accept them and easily pass under the culvert. In this case 50m to 150m wide camouflage corridor on either side of the opening may be provided with the same species prescribed for the under pass corridors. **Annexure – XXVI (A to G)**

7.1.8 HABITAT DEVELOPMENT:

While developing proper habitat for wild animals, besides water availability, availability of food should be looked in to. The most viable and effective alternative is to go for planting of edible plant species which will provide fruits, leaves, branches, flowers for the wildlife to consume and provide cover for their movement. The trees should be indigenous, utility oriented such as Kusum, Mahula, Kendu, Jamun, Bahada, Katrang, Mango, Bel, Kaitha, Ficus etc. on the route, Edible grasses should be planted up in sheltered blanks, free from grazing by domestic live stock. **Annexure – XXVIII, XXIX & XXX.**

7.1.9 GENERAL ACTIVITY ON WILD LIFE CORRIDORS IN BIODIVERSITY ACTION PLAN:

Apart from providing road under pass for elephants and other wild animals, via duct and side trenches for reptiles and amphibian fauna, grills and side guards for preventing vehicles triple down the road will prevent domestic cattle as well as wild life to come over to the road. Provision of chain link mesh barricade may be detrimental to free movement of wild animals, as it will prevent their intermixing resulting in isolation and inbreeding depression. **Annexure – XXVI D&F.**

- i) On all ghat roads while cutting of ghat is taken up the nalas and springs are to be saved by diverting the runoff away from the nala so as to avoid the aquifers being poisoned polluted and blocked by soil erosion and the flow getting blocked rendering the lower reaches of these water sources dry. This will distress the dependent wildlife of the area.
- ii) On all roads passing through the Reserved forests & thick forest cover other than R.Fs, the earth work in excavation and disposal of excavated material from the road surface and foundation of culverts and bridges should not be dumped on either side of the road and should be dumped at specific sites for development of parking Islands enroute where the vehicles and commuters park and rest. These should be on non-forest Govt. or Pvt. Land acquired for the road and not within the Reserved Forest or protected forest. This will prevent silting up of drainage channels, nalas, rivulets, rivers and river mouths down below including reservoirs, water harvesting structures and save avoidable investment that otherwise would have been made in mitigating measures like flood control, relief and other calamities. This will also improve the aesthetic appeal of the road corridor once the development is complete.
- iii) The avenues on all road corridors are to be retained where green tunnels exist by right or left centric expansion so as to retain at least one row of the tree, which will provide food, shelter, breeding ground and commanding perch for hunting mating and retention of biodiversity. Retension of the eastern side avenue need be ensured in the Jagatpur-Bhadrak portion of the road which is prone to cyclone. This will serve as windbreak to save life and property in the area.
- iv) Fly ash should not be used in the formation areas of the road which drains directly into an ecologically sensitive and fragile biotic habitat as it will pollute the ground water & surface water; poison, destroy and silt up the nala, river, estuaries and confluence of river thereby affecting many endangered flora and fauna if there is any negligence breach or mishap besides surface cuts, unloading escapes etc.

- v) Green tunnels along the roads which run for more than 0.25 km should be retained by right or left centric widening so as to retain a multiple or single line of trees, unless unavoidable to serve as perch, nesting zone, living habitat and breeding site for birds, lesser mammals, Rohdents, (Bandicoots, Shrews), Owls, Snakes, Bats, fruit bats, chemenias etc.
- vi) All fruit bearing trees to be preserved in advance by preparing advance nurseries through Forest department and self help groups by rooting offsets of such avenue plants which can be planted in habitat development programmes and avenue planting as soon as the road improvement work starts, so that supervisions and maintenance becomes less costly.
- vii) The notified forest check gates existing on the roads are to be retained with either side parking bay checking Island for checking and detention of any wild life or forest offence and provision for the storage of seized materials, vehicles, and living accommodation for the checking staff and culprits etc. like the tool gates now operating. This may be combined /unified gates in the beginning and later used by the department exclusively. A standard plan and C.S. is to be developed by Forest Department for such structures. **Annexure – XXVI (E).**
- viii) Where the road passes through P.As. (Protected Areas) like sanctuaries National Parks, Biosphere Reserves, Elephant Reserves, eco-sensitive and eco-fragile corridors parking of vehicles at night near the check posts after journey through the forest area for a through check up to retrieve/detect plants, specimens, animals, animal parts/trophies collected, if any, without proper authority. In blanks along the avenue, species of trees which yield non timber forest products such as Sal seed, flower and seed, Harida, Mahua, Bahada and Amla (Myroabolans), Kamila dye, Lodha, Medha, Fenfena, Gamhar, Indrajaba, Jamun, Mango, Ritha Bel, Bidanga etc. can be planted in multiple rows and maintained by VSS/SHG/GPs of the locality to earn a living and pay users fee to the OWD.
- ix) Leaflets/ brochures and signages mentioning dos and don'ts for road users passing through P.As, wild life corridors and eco-fragile zones shall help to prevent disturbance to wildlife.
- x) The local people and contractor's employees should be educated about the dos and don'ts on specified project corridors and all reserved /proposed reserved forest boundaries to be clearly indicated departmentally.
- xi) Light reflector boards with fluorescent reflectors should be posted in such a way that when ever any vehicle passes on the road the reflected light will fall on either side of the road towards the forests at 1' to 5' eye level so that all animals can sense the approaching vehicles from the reflected light and stay back from crossing over till such vehicular traffic passes by. This should be on prestressed cement posts of 2mtrs height with pedestal at the base 30cm long 10cmx10cm thick embedded 60cm deep into ground. **Annexure – XXVI (G).**

7.1.10 DISPOSAL OF EXCAVATED EARTH BETWEEN ANANDAPUR TO CHANDBALI:

There should be cyclone and flood calamity shelters on this route and the excavated earth can be dumped in shape of small mounds 100' wide at the base and 40' wide at top raised to a height of around 30' above G.L. where sacred groves can be created with planting of different medicinal, aromatic, sacred plants of all faiths in mixed /pure patches at close spacing. On top of the mound one

shelter of 30' x 30' can be built for community use as cyclone shelter, flood shelter and the like. This can be managed by the local self-help groups of the village, Panchayat or committee formed for such management and this should be located adjacent to the road. One tube wells be provided for each of these sacred groves. There shall be 6 such sacred grove cum cyclone/flood shelters 3 each in flood zones of these roads between Mirzapur to Chandbali and Randia to Ambagadia Fakirpur by placing signage on road side trees and R.F. boundary pillars showing name of R.F. P.R.F., pillar number direction of the R.F. boundary. Similar boards for forest blocks or jungle blocks, protected forests to be fixed by Forest Department for avoiding unnecessary confrontation trespass and unauthorized tree felling, camping quarry etc.

The plants selected for such groves may include Champa, Kadamba, Mango, Neem, Pulango, Karaja, Arjun, Asan, Sal, Harida, Bahada, Amla, Jack fruit, Bel, Barun, Bija, Chandan, Rakta chandan, Dhataki, Sugandhi, Tulsi, Durlava, Apamarga, Pippali, Long pepper, Talamuli, Bacha, Mahaghora bacha, Kalihaldi, Ramkedar, Kurubelli, Poodina, Mint, Golmaricha, Katha champa, Narguni, Hingu, Nageswar, Nagmallika, Ashok, Muchukanda, Udumbar, Palasa, Gandhana, Babul, Gohira, Gangasiuli (Har singar), Bidanga, Paluo (Arrow root) Gandhasunthi, Gunja, Kaniar, Gheekuar, Dalchini, Tajpatta, Guggul, Jatropha, Rudrakshya, Indrajaba, Lodha, Medha, Fan fana, Kamalagundi Anona reticulata, Anona squamosa, Zizyphus, Mahula, Tala, Tamala, Casuarina, Tagar, Tarat, Mallika, Jasmine, Kunda, Hatia creper, Ritha, Khus grass, Sabai grass, Lemon grass, Periwinkle, Sarpagandha, Hadjoda, Bamboo, Cassia fistula, Narkoli, Muturi, Salaparni, Krushna purni, Tihudi, Vasak, Chiller, Inga dulcis, Sirisa, Eucalyptus, Akashmalli, Hinjala, Achhu, Pome granet, Arka, Bakul, Paladhua, Semul, Kanchan, Rakta kanchan etc. spider lily and Tube rose mayalso be introduced in this zone. At least malati, madhu malati, Henna may be planted for fragrance. The location of such groves may be nearer market places, important road junctions, Block offices, Colleges and such other institutions as they will provide recreation and shelter from calamity. They shall also provide venue for socio religious community activity without spoiling the nature. The sacred grooves will later on become hot spots for conservation and education of local people and students to know about each plant and its use. The top will be for the vehicles and a small shed for religious activity. A formal plan is enclosed showing the detail layout at **Annexure-XXXVII**.

7.2 BIOSPHERE RESERVE AND TREATMENT:

7.2.0 Biosphere Reserve is an international designation assigned by UNESCO for representative parts of natural and cultural landscapes extending over large areas of terrestrial or coastal marine eco-systems or combination thereof. These are intended to promote conservation of biodiversity and also to promote alternate livelihood for man and preserve cultural values. The Biosphere Reserves are different from wildlife sanctuary and National Parks in the following aspects:

- (i) Its emphasis is on overall biodiversity and landscape rather than some specific flagship species.
- (ii) It lays importance on research activities.
- (iii) It takes into account the overall developmental activities and resolves conflict between development and conservation.
- (iv) It ensures increased and broad based participation of the local people by special attention given on different components of Biosphere Reserves like landscape, habits, species and land races.

7.2.1 The Biosphere Reserves are not substitute or alternative to, but re-enforcement of the existing protected areas. The Ministry of Environment and Forests launched the Biosphere reserves Programme in 1986 with these aspects in mind. The specific objectives of this programme are:

- (i) To conserve the diversity and integrity of plants animals within the natural eco-systems.
- (ii) To safeguard the genetic diversity of species on which their continuing evolution depends.
- (iii) To provide areas for multi-faceted research and training and
- (iv) To ensure sustainable use of natural resources through most appropriate technology for improvement of economy and living standard of local people.

In order to undertake activities relating to biodiversity conservation and development of sustainable management aspects, BRs are demarcated into three zones. The core area of the BR is absolutely undisturbed and secured under legal protection, management and research activities. In this zone, management and research activities that do not affect natural process and wildlife are allowed. The core zone is to be kept free from all human pressures external to the system. The buffer zone adjoins the core zone. In this zone, only those activities, which protect the core zone, are allowed. The activities allowed include limited recreation, tourism, and fishing, grazing which are permitted to reduce its effect on core zone. Research and educational activities are to be encouraged. The transition zone is the outer most part of BR. This is a zone of collaboration where conservation knowledge and management skills are applied primarily to foster alternate livelihood and reduce dependence on consumptive use of the forest.

7.2.2 SIMILPAL BIOSPHERE RESERVE:

The Similpal Biosphere Reserve has been notified by Government of India on the 22nd June, 1994. It comprises of the entire Similpal sanctuary (core and buffer together), the adjoining Nato and Satkoshia Reserve Forests forming additional buffer and a belt of approximately 10 KM width all around the entire buffer designated as the 'transition zone' The total area of this BR is 5569 Sq KMs. A part of Similpal hill ranges (845 sq kms), a densely forested area constitute the core which is also proposed National Park and rest of Similpal and other contiguous fonts constitute buffer zone of the BR. There are also 65 villages within these two zones including four in the core zone. Similpal is in the eastern end of the Eastern Ghats also called as Garjat Hills and classified in the Chhotanagpur biotic province of the Mahanadian bio-geographical region. The transition zone of the Reserve has 1200 villages whose total population is about 4.5 lakhs. The tribals constitute about 73% of this population. The forests and the biodiversity resources to a great extent sustain the livelihood of these people. The forest and wild life in the sanctuary, and the human population and cattle living in close proximity impact on each other. The Management Action Plan for the BR seeks to put emphasis on suitable programmes of eco-development in the transition zone and also to a limited extent in buffer zone, to promote various alternative livelihood options, and thereby to reduce people's pressure on the forests. The significant features of Similpal include:

- Relatively higher annual precipitation of over 200 cm spread over about 135 days. Attitude ranging from 40mts to 1168 mts (Khairiburu and Meghasini hills)

- Numerous water courses and two permanent waterfalls namely Barehipani (400 mts) and Joranda (150 mts)
- Occurrence of frost valleys in central and south Similpal. A degree of resemblance of floral and faunal composition with those of the Western Ghats and north-east India, while being a representative eco-system within the Mahanadian bio-geographic region.
- Marked variation of temperature range between the central and southern regions.
- Similpal is the abode of 94 species of orchids and about 3000 species of other plants. These include 2 species of orchids which are endemic, 8 plants which are endangered, 8 species whose status is vulnerable and 34 other rare species of plants. Similpal is also the abode of the black and melanistic tiger, which is very rare. The identified species of fauna include 12 species of amphibians, 29 species of reptiles, 264 species of birds and 42 species of mammals, all of which collectively highlight the biodiversity richness of Similpal, Endemism in Similpal is not fully explored, yet it is expected to be very high particularly in sectors like tree ferns, orchids, medicinal plants and insect fauna. The checklist of flora and fauna has been updated at intervals with new additions. *Paradoxurus jorndensis*, an endemic civet was located by the Zoological Survey of India in Similpal during 1980 and subsequently recorded from all zones of Similpal. *Philiautus Similpalensis*, a frog located near Chahala in 1975 has been identified from other locations from Similpal. *Eria -meghasaniensis* and *Tyna hookeriensis* are two endemic orchids of Similpal. The former is found near Megahsini in South Similpal and the latter is seen near Pakaladihanna of Jenabil. Another rare orchid, *Bulbophyllum panigrahanum*, is also seen in Similpal. A species of paddy known from Kerala was first collected in Orissa from Similpal near Khejuri hills in the late 1980. Up to 2003-2004 Govt. of India assistance of Rs.207.3194 Lakh has been received and spent in Similpal B.R. 343 ECO DEVELOPMENT Committees have been formed. One committee is chaired by the Director Similpal Biosphere Reserve. Two NGOS of Mayurbhanj district are involved to formulate suitable action programme. So far till 2004-36 nos. of water harvesting structures and improvement of irrigation systems renovation of ponds, pisciculture has been carried out. Leaf plate and sabairope making units supplied to villagers. Training in sericulture, sabairope making improved agricultural technique, bee keeping has been imparted to more than 100 persons.
- There are several roads joining the SH-53 and SH-49 from both sides and the movements on the roads are to be checked by barriers at the point of intersection to prevent smuggling and poaching which is to be decided by the forest department.
- Treatment for Biosphere Reserve – water holes and salt licks are to be developed along the route where wild life movement is restricted due to road embankment. This site has to be selected by forest department for the above spots. **Annexure – XIV & XXV (B)**

7.3 MEDICINAL PLANTS:

- 7.3.0 The state boasts of number of wild medicinal plants. Some of them are found close to proposed road corridors. A list of such plants have been given in

Annexure-II. Efforts should be made to conserve them in the process of road development. Stress may also be given for planting of these plants in the avenues, mounds, and as compensatory afforestation.

7.4 SPECIAL MEASURE FOR WILDLIFE MOVEMENT IN DIFFERENT ROAD CORRIDORS:

7.4.1 ANANDAPUR – KARANJIA – JASHIPUR (SH-53, SH-49):

There are confirmed and established elephant crossing on this road at 9.3 km, 20.7 km, 25.5, 26.3, 55.9 and 56.5 km of this route. Other wild animals like sloth bear, wild boar and cheetals do cross the road at the 1st pass at 9.3 km chainage. Similarly between 17th and 29th km chainage many species of wildlife keep on moving from one side of the road to the other and there is regular wildlife activity on either side of the road. Assuming bypass point as '0' km at Anandpur towards Karanjia the chainage is indicated above.

i) Strategy:

In the first animal crossing close to 9 km chainage the movement takes place from forest side Mayurbhanj district hills to flood plains of Baitarani at Bankhidi on the right to left of the flood plains of river Baitarani where added to the perennial river flow there is cultivation of early paddy, sugar cane, maize, millets, jawar and summer vegetables like pumpkin, watermelon, cucumber. This not only attracts the elephants but also other herbivore and bears.

Hence there is heavy crop depredation by different wild animals and even human casualties. This can be handled by improving the fodder and water availability on the forest side and cultivation of non-edible or repelling species on the riverside till the movement is completely stopped.

An under pass be provided with barrier on either side of the road up to certain length on. This will be supplemented with planting of fodder trees on the route taken by the animals up to the river and planting of non edible species on either side of the passage and along the river bank.

ii) Details of Measures:

A 4.5 mtr high under pass with an opening of 8 mtrs be provided at the point of crossing to the forest. At least 1.5 mtr thick earth cushion and road surfacing material be put above the passage slab to minimize vibration due to vehicular traffic. The approach on either side should be planted with edible species of trees, shrubs and grasses including bamboo to make the passage natural and inviting for the wild animals. B.G. rail barrier on BG rail posts of 1mtr height can be provided on either side of the road to prevent straying of wild animals, particularly elephants to cross over the road surface. **Annexure – XXVI (A).**

A 100 mtr wide passage may be acquired if it is not govt. land and planted up with trees shrubs, and grasses to provide a camouflaged passage for wild animals. On either side of the passage the land owners be persuaded with the support of V.S.S (Vana Samrakshyana Samiti) to plant species like Bel, Amla, Bahada, Gilo, Agave, Vasak, Begunia Bidanga, baibidanga, Teak, Tamarind, along with cash crops like owned paddy, sunflower, colocacia, ginger, turmeric, mango zinger, arrowroot, amarphophalus, Onion, garlic, chilli, ridge guard, bitter gourd, potol, snake gourd, aswagandha, sunamukhi, kalamegh, arhar, marigold, yam,

chrysanthemum, rajanigandha (Tube rose), roses, tabaco and tapioca etc which are not liked by herbivores depending on preference of people and marketability.

Annexure – XXX.

Some of the above species will have ready market owing to the road connectivity with Kolkata and other cities. This may be raised in a strip of 100 mtrs on all sides of the agricultural fields so as to douse the smell and the view of paddy and other edible crops. They should cooperate as they have already started switching over to many such other cash crops. Like jute and brinjal which are labour intensive but less paying compared to the crops suggested above.

Proper signages be provided along the road corridor alerting drivers /pedestrians about movement of wild animals and need for caution. At least 100 mtrs before the underpass on either side. The base of the under pass will have a soil cushion of 1 mtr i.e. (6x8mtr with 1 mtr) cushion on the base and 1.5 mtr cushion on top of the box culvert. **Annexure – XXVI-G & XXVII.**

A similar passage way should also link the under pass to the forest where the crop need be supplemented by edible species, water holes and check dams be erected on the forest based nala beds and valleys. Artificial salt licks and prevention of forest fire are also required to make conditions congenial for wild animals. These are to be developed by the forest and wildlife wing inside the forest land.

Similar measures are to be taken up near other two elephant road under pass bridges at 20.7 and 56.5 km chainage where both side there are govt. forest and nala near by. At chainage 20.7 there is a culvert existing and another under pass has to be erected along the same where either side there is Satkoshia RF between 17 km to 20.69 km and Pvt. land beyond 20.7 km. The elephants cross over on either side of the culvert and because the Pvt. land side is lower than the RF acquisition of the land for culvert at 20.7 km to 20.8 km and beyond will be required as the existing culvert is in good condition. In such a case minimum 20-mtr wide passages for over 100 mtrs length on either side has to be acquired and developed into forested corridor or passage. The species raised on either side of the under pass shall be grasses, bamboos, edible shrubs, and some tree species which will provide camouflage to wild animals and the elephant to move across the passage. The cushioning of minimum 1 mtr GSB and road surfacing material over the passage slab has to be provided for absorbing vibration and moise of passing vehicular traffic above wild and grass turfing of the ground to be done for giving it a natural look. Spacing of trees should be wide enough to allow unhinded passage of large animals like elephant. The blanks and open forest canopy has to be treated with habitat development with under storey planting of bamboo and shrubs like Karada, Dhatuki etc. besides edible fruit and flower bearing species like Mahula, Bel, Zizyphus, Kaitha, Mango, Ficus etc. The peripheral agricultural lands will be treated as was prescribed for the 9.3 km underpass.

The next elephant road under pass at chainage 56.5 km will be similarly treated for camouflage cover on both side as there is Charatangar RF on either side and there is a depression where the under pass is proposed. Most likely the movement path for the underpass will be on the R.F. boundary line. Here there is enough tree growth for the elephants on either side only 20 mtrs away from the road centre line and the same will be supplemented with relocating some of the shrubs and bushes to be removed for ROW through mechanical means for better utilization and quick coverage of the camouflage. **Annexure –XXV-B.**

The barricading will be provided on either side of the road up to 100 mtrs and the passage to be planted on one side connected to private agricultural lands with density plantation of species which are non browsable with strong odour so as to mask the smell of paddy and other cereals. The land owners be taken to confidence and persuaded to take up peripheral cultivation of tubers, vegetables, rabi crops and kharif crops as was suggested for land near 9.3 km chainage.

The other three elephant movement across the road will be prevented except at 26.3 km with B.G.rail barriers mounted on B.G rail posts while the salt lick and water holes are to be artificially developed near Mahuldiha MIP on the left side of the road and another created in the nala basin on the right side of the road to Karanjia from Anandapur behind Mahuldiha which will prevent the elephants trying to cross the road at these points near the habitation bordering Satkoshia RF and Chheratangar RF etc. The chainage point at 55.9 and 56.5 being very near like 25.5 km and 26.3 km no separate provision for salt lick and waterhole is considered necessary at 25.5 and 55.9 kms. At 26.3 km the elephants will be allowed to cross the road as a precautionary measure to avoid man-animal conflict. Annexure XIV & XXV-B, XXVI-A.

The other wildlife road under pass points on this corridor will be in shape of box culverts along the nalas where culverts are being built afresh, by adding one span extra to the culvert which shall be on higher ground. To negotiate the nala on either side, the approach has to be eased by bulldozing and paving the sites so as to allow the wildlife to negotiate the nala and come under the under pass to cross the road under it. The height of the culvert shall not be less than 2.0 mtrs and may be more to maintain level with the main nala bridge height design based on hydrological data. The easing out of the nala bank on either side to allow wildlife movement has to be made keeping in mind the HFL of the nala so that the banks are not cut away to cause flooding of the sides and damage to the road surface.

The second span of the culvert for wildlife will be provided with 1 mtr GSB cushioning above to absorb the noise of moving traffic and therefore care has to be taken to keep minimum clearance of required 5.5 mtr gap between top of the loaded vehicles and power transmission lines prescribed while executing the project work at such underpass locations. The box culverts shall be either double cell or triple cell 2 x 2 or 3 x 2 size.

As has been prescribed earlier all wildlife passage points and passages are to be treated by planting the local edible grasses, shrubs, trees etc which are relished by herbivore so that the wildlife will be at ease to use the corridor. The species planned to be planted on elephant pass will be the same for other animal pass with more dense planting of bushes, shrubs, trees etc. where private agricultural land borders such culverts the land owners to be persuaded to avoid the regular are cropping pattern and raise species as prescribed for the 100 mtr wide peripheral cultivation of non browsable species like sunflower, jute, castor, colocacia, ginger, turmeric, arrow root, chili, garlic, onion etc. As discussed earlier the planting shall be made by uprooting and relocating shrubs and bushes from ROW to these camouflage corridors mechanically for early effective coverage.

The details of chainage and engineering structures are available road corridor wise (Annexure XXV & XXVI), which may be seen to appreciate the location and design of the structures.

iii) Signage:

As the entire road from Godabhanga to Karanjia SH-53, Karanjia to Tongabilla SH-4 comes under the transition and buffer zone of Similpal Biosphere reserve it has to be very very specific for the, visitors, transport operators/ drivers and tourists. They are to be cautioned about unauthorized entry into forests, unauthorized collection of species, unauthorized collection of stones, boulders, sand, metal, pollution of water bodies, destruction of habitat and any act detrimental to ecology, environment and forest to be an offense and advise them not to venture and collect materials. No wild animals, animal trophy and plants or parts of plants be collected without prior permission. Signage to bring down speed at animal crossing points to be displayed. **Annexure – XXVI G & XXVII.**

7.4.2 BRAMHAPUR – MOHANA – BANGI JN.- J.K.PUR – SH – 17 J.K.PUR – RAYGADA – SH – 04:

The road passes through flood plains and coastal plains of Ganjam, Gajapati and Raygada districts. There are certain plateau and valley conditions too on the Eastern Ghats. The reserved forests or proposed RFs start from 42.3 kms approximate chainage on right side of the road center line beyond Pudemari. The ghat road starts from 40th km and there are several ghat sections on this route i.e. 40th km to 60th km 63 to 75, 79 to 83, 117 to 125, 154 to 160 km 162 to 167 km etc. The two major ghat portions are near Taptapani and Mukundpur.

There is one bear pass, four elephant passes and several wildlife pass other than elephants. A few of the wildlife crossing points have been left as such and nearby passage point has been designed for development of masonry under pass having contiguity with the forest either side if there are no culverts near by within the zone of movement.

The bear pass at chainage 26.1 from left to right and return trip from right to left before Moulabhanja has one side a public road on left that is used by the bear. The other side a road to Sundipally (right side) runs at 26.05 km. The issue of providing an under pass culvert is a tricky one here as the road to Dherendi via. Changudidei hills are used by the bear and human beings. The bear usually uses it at night or early morning.

The culvert will be provided at 26.1 km with a vent of 2.5 mtrs X 2.0 mtrs. with a cushioning thickness of 1 mtr of GSB materials over the culvert slab to reduce the noise of passing vehicles. On the left side separate approach excluding the road has to be developed at least 500 mtrs into the hill side on Govt. land or acquiring private land (minimum 20 mtr wide). This 50 mtrs approach corridor may be barricaded and planted with bear friendly vegetation like Zizyphus, mahul, Ficus, Bengal almond, Capparis horida, Carissa, jack fruit with grasses in density planting near the culvert on road side. The other side of the (Culvert) bear under pass opens to Pvt. land and the owner may be persuaded to develop this land with bear friendly species of trees and some bamboos, so that camouflage will be easy and the land owner gets revenue from sale of bamboo. The under pass approach may be developed up to 50 mtrs with afforestation /rehabilitation measures undertaken on the bouldery out crop of Changudidei. The plants should be liked by bears and other herbivores. They may be of species like *Madhuca indica*, *Terminalia chebulla*, *T.belarica*, jamun, Karounda, Cashew, Palms, Mango, Bengal almond, *Zizyphus oenoplea*, *Z.mauritiana* etc. with an inter mixing of grasses.

The road side approach should be provided with 1.5m high, 200m long RCC vertical wall to prevent bears climbing up and crossing the road. There are hills on both sides of the road one on left very close and the other on the right is far off, 8 km to 10 km away. Both of them need to be rehabilitated with planting of herbivore friendly species and fruit, flower bearing species, to provide cover and food for the bear etc.

There shall be habitat development to contain the bear on Changudidei hill by water hole and vegetative cover. Signage are to be fixed to warn the private land owners and road users. These are to be fixed at prominent locations cautioning the motorist, the passers by pedestrians about bear at least 50 mtrs & 20 mtrs away from the bear pass.

The chainage 42.6 km and 118, 121.1, 123 km are passages of elephants on this corridor. At 42.6 km no road under pass is required to be constructed but the approach to the nala at this point is to be eased out on the side from which the elephants come to cross the road for water available in the Guharikhol MIP. The approach from right side to left side and right embankment of the nala has to be eased out, paved with concrete/laterite blocks so as to develop the nala over bridge as an elephant under pass. There shall be planting of grasses, fruit bearing trees and bushes as camouflage cover for wildlife in Govindpur PRF. On right side a stretch of 500 mtrs from the road side out words and up to 500 mtrs on left side including the minor irrigation project Gohirakhol. The species chosen are as specified for elephant passes of Anandapur – Karanjia stretch.

The habitat development including improvement of food availability in this zone shall have to be taken up for other wildlife that uses the MIP as the source of water. There shall be check dams and gully plugging measures on the nala up stream to make it perennial and provide succer to the wildlife up and down stream by providing 1 to 1.5 met high wire mesh covered boulder gabion barriers across the nala bed. With same methodology for planting bushes, shrubs, small trees uprooted from one location planted in this zone.

The elephant pass at 118, 121.1, 123 km chainage after Goibandha and before Milkapanga is on the boundary of Saradhapur RF of Raygada forest division. This is the only elephant group having a limited corridor of movement to Kalahandi and Phulbani side across the Badanala and Vamsadhara River, after Badanal irrigation project was constructed. This corridor continuity has to be maintained for genetic improvement and prevention of inbreeding.

The location of 121.1 km and 123 km are not suitable for elephant pass as one is right on the road to Panderigudu village and the other is milk a Panga village. The H.T. line overhead is another negative feature. The only frequented passage left being 118 km, where a culvert exists and required to be replaced with a box culvert of 4.5mtr x 8 mtrs with 1.5mtr top cushion and bottom cushioning to facilitate absorption of noise and vibration and to make it elephant friendly. The detail design is at **Annexure-XXVI (A)** for cushioned box culvert elephant under pass.

There shall be an opening of 5.0 mtrs height x 8 mtrs wide on the embedding the concrete base of the channel with 1.5 mtr GSB and cushioning the top slab with minimum 1.5 mtr GSB and carriage away hard surface in such a way that the role is not unusually high at the stretch.

On either side of the there should be habitat development by planting of fodder grass and fruit bearing trees, with shrubs and bushes to serve as camouflage. In both the under pass impact zone and round about the agricultural activity has to be changed by persuading the land owners to change the cropping pattern from paddy and millets or maize to non elephant friendly non browsable crops of Onion, Garlic, Ginger, Colocacia, Amorphophalus, Yam, Sunflower, Tobacco, Tapioca, Arhar, Green and Black gram, Turmeric, Amla, Bahada, Harida, Chiller, Chilies, bitter gourds, Patol, lemon, lemon grass, palmarosa, Bhuin neem etc, which will douse the smell of the paddy and maize etc. planted inside with the 100 mtr wide peripheral planting of above species.

The produce from these species have good food value and market value in kharif and rabi seasons along with Brinjal, cows itch, Aswagantha, Pudina, Pepper mint. As transport will improve, better price will be available to the growers for their produce in markets around Gunapur, Gadari, Parlakhemundi, Berhampur, Gumuda, Parvatipur, J.K.Pur, Raygada and other areas.

There are several places along the road where wild animals other then the elephants cross the road. At present most of these places are near a water source, nala or reservoir or grazing zone. Due to rampant podu cultivation also the wildlife is compelled to abandon the areas on the south western to move across to the north east. For this reasons where ever any culvert is existing and to be replaced by a new one, one wildlife under pass provision may be made by extending the span of the culvert to double span or widening the span from 2.5 mtr to 5 mtr or so. As a result some part of the culvert may run on the dry ground through which the wildlife can pass during all seasons. In all such cases detail location of the provision made is indicated in annexure in a tabular form for each corridor combinedly. Showing detail chainage and type of structure provided. These will be cushioned culverts.

The provision of ushioning to reduce noise and vibration and habitat /camouflage development of the approach on either side is the same as is provided for other elephant passes. The agricultural land has to be protected by change of cropping pattern and shifting for value added crops as indicated above and any other crop that the tribals have experimented and found to be effective. It is sure to enhance their income than the low outturn out of maize or paddy they are getting now after the same is saved from the wild boar, deer, porcupines and elephants etc.

Treatment of avenue trees and land mark trees / Giant trees.

As far as possible all large sound trees along the road from Bramhapur to Raygada where birds are nesting and which signify the identity of the place are to be retained by right or left centric improvement to provide safeguard to such rare habitat which can't be replenished once destroyed along with the micro climax vegetation under neath such locations harboring scores of different plants and wild fauna. Some of them, even though they are exotics to the locality, but some how been carried by birds, transport vehicles, rodents to these places to germinate and establish. Preservation of these will preserve the genetic diversity and host plants of many beneficial life forms and medicinal plants.

7.4.3 CHANDBALI – BHADRAK (SH – 9):

The road passes through the flood plains of river Batarani along the coastal tract where drainage is very very stow and difficult on account of the river mouth being influenced by tide kilometers upstream.

This character has developed into several ponds, wetlands, and drainage channels, canals on either side of the road and across. The flood plains get inundated and recharged by sediments of floodwater rich in humus and other organic and inorganic salts good for agriculture and aquatic fauna. The saline surge during high tide enhances its value by bringing in fish, shrimp, crab, rare horse shoe crab and common crab, several endangered fish, crustacean, salt and brackish water and sweet water fish, turtles, amphibians and reptilian species to breed and rear their young ones in these nurseries, which do not appear so important to the common man. The avenues and green tunnels harbor the birds of pray and provide free service in keeping down the rats, insects and pastes. Here the recommendations are to retain one side of the road side avenue at any cost to prevent the cyclone damage and retain the shelter belt character of the avenue which is another free service provided by this road corridor.

The wetlands and drainage basins are to be retained as such in order to preserve the breeding nurseries of fish, crustacean, mollusks, birds, amphibians reptiles so that the Bhitarkanika WL sanctuary, a salt water crocodile breeding habitat, the "Baga gahan", a vast heronay is also protected far away down stream.

The area is prone to flooding, which infact is a blessing in disguise. Without flooding the entire land mass shall become sterile salt pan devoid of the nurseries or rich agriculture return. The number of culverts, height and width of the culverts, bridges are to be raised for avoding submergence of the road on the entire road.

Here fly ash is one proposition to be used to shore up the road surface. This should not be used as it is highly toxic for the wetlands, under ground subsoil water, the estuarine ecology and sanctuary downstream. The high fluoride alkali and ash content with several toxic chemicals in the ash shall be detrimental for use as a road fill.

The borrow areas along the road in an alluvial flood plain can't meet the standard of road fill. The best option is to dredge sand from the beds of Baitarani and use it in the road fill upstream of Baitarani Bridge so that neither the wetlands nor the ecosystem down below will be affected.

The box culverts here will have a ledge chuija projection 30 to 40 cm below the roof slab of the road way and 60 cm wide with a raised edge on both support abutment walls. These chuija will be connected to the side drains on either side of the road so that the snakes, monitor lizards, frogs, bandicoots, mangoes, shrews, can cross over to the other side of the road without crossing over to the road surface. The drains so erected on either side of the road will be higher up to prevent its submergence and silting up with debris brought by the flood and will be used as utility structures too. The road side drain wall shall be vertical and 1 mtr in RCC and the lower side wall will be sloping at 30° so as to make the entry and escape of the land amphibian fauna and reptilian fauna cross over under the bridge without getting crushed on the road. We have to think 10/20 years ahead when the concentration of vehicles will increase to wipeout the entire snake and frog population along the corridor.

The detail locations of the drains and via duct are enclosed in **Annexure –XXVA** Engineering Interventions.

The giant Arjun, Kadamba, Aswath and Bara trees due to be removed on either side will be limited to one side and hollow, cankered dry trees may have to be cut down for road safety.

7.4.4 BHANJANAGAR – ASKA (SH-16):

This is one of the oldest roads and there will be little requirement for expansion or cutting of green tunnels and avenues except at turnings and habitations where geometric correction is required to attain the recommended curvature and speed.

There is only one reserved forest along this corridor nearer to Bhanjanagar, named Kaliamba Reserved Forest. The wildlife like Cheetal (occasionally), Jackals, Hayena, Panther, Wild boar, Hare, Civets, Pangolins, Otters, Cats (wild) barking deer etc cross over the road during kharif season to feed & haunt on agricultural fields. Here only roadside barricading with B.G. rail and chain link mesh fencing will be provided on the forest side of the road to prevent the cross over. No wildlife pass is required in this zone. This is aimed at minimizing the man animal conflict.

7.4.5 DASPALLA – GANIA – SIDHAMULA – BAGHDHARIA– NARSINGHPUR – HINDOL – MAHIDHARPUR – NUAHAT (BANARPAL)

The corridor is a newly developed corridor of several MDRs now developed into SH in fragments. The corridor passes over river Mahanadi at Sidhmula in Nayagarh district and enters Cuttack district at Ekdal. There are few village forests, protected forests and reserved forests along this road from Daspalla to Sidhamula and Sidhamula to Ranasinghpur via Baghdraria – Panchmundia crossing etc. These forests were decimated to open forests 10 to 15 years back. Now with the village protection committees these rooted wastes have been developing into young even aged forest of Sal, Bija, Sisoo, Arjun, Asan etc. supplemented in some case with plantation by social forestry and RDF activity.

Tree growth has attracted and activated the wild fauna to bred and inhabit the forests and come to cross over the roads for consuming paddy and other cash crops beyond Ranasinghpur up to Hindol and from Hindol up to Baunsa pokhari village & pokhari or “Kia” RF. The presence of wildlife can be felt on the hills which connect the Satkoshia WL Sanctuary now nominated as 2nd Tiger reserve of Orissa with Baisipally sanctuary of Nayagarh and Baudh districts.

There are 5 elephant crossing points on this road and several wild life-crossing points other than elephants. The area between Budhabudhi ghat to Hindol also harbours the gaur, leopard, panther and migrating tigers from the Satkoshia.

The crossing points are between 19 to 20, 21 to 22, 58 to 56, 57 to 58, 63 to 64, 68.4, 75.1, 75.6, 77.6, 79.8, 86, kms chainage. Out of these 68.4, 75.6, 77.6, 79.8, 86 km chainage points are elephant and other animal crossing on the road.

Except the last two locations at 79.8 & 86 km the corridor is intact inside the reserved forests of Athagada and Dhenkanal forest divisions. There are provision of the road under pass at 75.1 & 77.6 km in Athagarh division and 79.8 km in Dhankanal division. The size of the under pass will be 6 x 8 mtr with box culverts with cushioning at the top and bottom. Since the entire location is within RF and thick-forested track, only few habitat development works may be taken up on the approaches besides creation of two water holes on Athgarh division side and one on Hindol side of Dhenkanal Forest Divn for the elephants and other

wildlife. The other wildlife will be moving through the same under pass except at the culverts to be erected at 22.2 km (Daspalla Range), 55 km in Narsinghpur range and the general culverts on the forested tract. **Annexure – XXIV.**

The site development, culvert size and the species shall be the same for all these structures except that the agricultural lands around forests have to adopt a change in cropping pattern on the periphery of the forest area or under pass approach zone. This will be carried out jointly by the PIU, local DFO (Wildlife)/(Territorial) and the VSS units in a joint activity to mobilize the cultivators for change in cropping pattern.

7.4.6 BHAWANIPATNA – KHARIAR (SH –16):

The forest lands are mostly dry and open. The area gets less rainfall. Most of the vegetation in scrub forest and hence camouflage cover is missing. Wildlife such as Hayena, Jackals, Bear, Rattel, Civets, Otters, Mongoose, Frogs, Snakes, Rats cross the road and the culverts at chainage 4.150, 23.350, 54.350, 65.100, 67.850 earmarked as cross over concentration points. **Annexure – XVIII.**

7.4.7 MAKING UP FOR LOST AVENUE TREES:

Despite all efforts likely to be made to protect existing avenue trees, some felling shall be unavoidable. Replacement in the form of new planting shall certainly not be able to compensate for the loss as old trees had established and had created niches for biodiversity during their long life and had adapted to local factors. Hence, it is suggested that at least 10 times the number of trees to be felled should be planted both in new avenues and outside on OWD land and in the degraded forest land. The planting beyond the ROW should be handled by the Forest Department at project cost. Cost norm applicable for 'compensatory plantations' shall be applicable for these plantations which appended to this report at **Annexure-XXXVI.**

A table indicating number of avenue trees likely to be felled in the process of road improvement and widening is given below with the green tunnels to be cut on one side / both side.

Sl. No.	Project Route	No. of Trees likely to be removed	Length of Green Tunnel likely to be affected	Giant Trees above 2400 mm girth
1	Jagatpur-Kendrapara-Chandbali	5000 Nos.	2.2 km out of 12 kms	160 Nos.
2	Chandbali- Bhadrak	2975 Nos.	3 km out of 10 kms	99 Nos.
3	Bhadrak-Anandpur-Karanja	7563 Nos.	12 km out of 20 kms	265 Nos.
4	Karanja-Jasipur	1523 Nos.	2 km out of 4 km	63 Nos.
5	Berhampur-Bangi Jn.	3895 Nos.	5 km out of 12 kms	233 Nos.
6	Bangi Jn – Rayagada	1120 Nos.	0.8 Kms.	25 Nos.
7	J.K.Pur-Muniguda-Bhawanipatna	3600 Nos.	8 km out of 13 kms.	193 Nos.
8	Aska-Bhanja Nagar	1120 Nos.	1 km out of 10 kms.	110 Nos.
9	Daspalla – Banarpal	3853 Nos.	1.2 km out of 8 kms.	128 Nos.
10	Bhawanipatna – Khariar	4095	3.5 km out of 4 km	104

The road between Jagatpur and Bhadrak lies in the coastal belt. Hence the avenue trees, particularly those where multi row planting has been done serves as a wind break against cyclonic storms which is frequent in the region. While taking up widening it should be borne in mind that the avenue row in the eastern side plays this role quite well and can save life and property in case of such disasters. Hence, all effort should be made to protect this avenue row while taking up road improvement.

7.5 FUTURE DEVELOPMENT STRATEGY:

7.5.0 As the wildlife issues are complex in nature the effect of the habitat improvement, water harvesting, wildlife under pass and movement across the corridors are required to be monitored and evaluated. For this purpose 'pug impression pads' may be created for taking plaster casts on the under pass route. Recording pug mark impressions at the water holes, nesting and perching of animals and birds on the avenues and closing in or opening of the canopy has to be recorded periodically so that the beneficial effects of the previously discussed programme of action is examined thoroughly and further improvement and mitigation measures are adopted or corrective measures are initiated before it is too late.

The wildlife wing of Forest department, the local NGOs, VSS units, the tribals and researchers on wildlife may provide unbiased feedback. The universities may be invited to take up such project works so that the effects are documented, remedial & further improvement measures are suggested and inbuilt into the FDA (Forest Development agency action plan of the area). The tribals and other target groups may be roped in to share their part of the story. The SHG, stake holders and financing institutions to local entrepreneur and farmers may be invited to monitor and evaluate the results of change in crop pattern and yield therefrom so that the success story of one corridor can be replicated in other places where man animal conflict was ruining the inhabitants along forest boundaries along the road or where the habitat fragmentation is causing man-animal conflict.

7.5.1 The monitoring cell has to be with the Forest Department, Wildlife and Territorial wing under the main banner of the administrative officer or D.F.O who should gather data and furnish reports on each of the indicators:

1. Movement of wildlife.
2. Movement of aviary along the corridor.
3. Situation of procreation and movement across the corridor of specific road.
4. Water regime and water holes.
5. Any threat from encroachers, squatters and land owners.

A quarterly or half yearly report will suffice to gather information for replacement if any and such reports to be compiled by the forest department jointly with OWD and research groups.

Funding for future strategy may not be from the budget allocation but from the F.D.A activity only by preparation of the micro plan. There should be liberal plantation of species and land owners given free access to sale their timber, fire wood etc. direct from the field with removal of restrictions in the name of timber and other forest produce transit rules 1980.

Legislation for preventing development of habitation along the road corridors encroaching Govt. land and building housing enclaves in such areas may be considered so as to retain the biodiversity that is still there to be protected.

The sighting of birds along the corridor, increase or decrease in agricultural output, pest, and incidence of diseases has to be evaluated for 5 years during and after the corridor improvement which will show the effects of corridor development and resultant anthropogenic pressures.

Number of accidents with wild fauna on the corridor due to non-provision of barricade at places need be recorded and brought to the notice of the W/L wing of F/D for remedial measures jointly with O.W.D by inbuilt mechanism in the conditions for stage 1 and stage II clearance.

7.6 INFRASTRUCTURE DEVELOPMENT FOR MONITORING:

1. Monitoring of wildlife movement by periodic installation of infrared cameras in association with research scholars and W.W.F., W.I.I. local forest administration---FD / [Pr. CCF (WL) / P.CCF (Gen)] / OWD / OSRP.
2. Monitoring of forest growth and loss or gain of density of forests or forest cover by FSI, GOI and,
3. Evaluation of periodic wildlife survey made by forest department before and after the corridor development to use it in growth index parameters.
4. Results of habitat development, barricades at yearly interval.

The existing information of field staffs will suffice the job demand and only the research scholars may be introduced from academic institutions to evaluate the activities along with contractual surveyors.

All giant trees, landmark trees are listed and to be maintained in the form of a registrar for future monitoring and recording there removal if any.

7.7 FUTURE MONITORING STRATEGY:

Any human induced action in any wildlife habitat is likely to bring in many unforeseen changes, which can be either beneficial or detrimental to wild life. All the recommended measures need be monitored keeping this in view. If required suitable course correction be done, when certain action does not achieve the desired result or is counter productive. Hence suitable mechanism should be inbuilt in the programme to monitor different changes in habitat conditions, animal movement, nesting and breeding, water availability, encroachment, forest fire, increase or decrease in human-animal conflict, accidents involving wild animals crossing or moving on the road, awareness among local community, use of new passages by different wild animals. The Divisional Forest Officers concerned through whose jurisdiction the corridor passes on half yearly basis can take up this monitoring.

The OWD has to appoint one Environmental Specialist cum Forest Official/Wildlife Expert to supervise and monitor as well as co-ordinate the implementation and research on temporary basis utilizing Freelancers/Consultants/Retired Personal /Researchers as it may deem suitable for its activity.

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Compliance to para 35 of draft aide memoir of World Bank mission 29th January to 9th February 2007.

Additional empirical data

Wildlife movement is not predictable to specific points in general unless these are constrained with limited openings and induced environment for movement. Such inductions are for migration to breed, feed, hibernate, escape or find new territory.

In case of inter tidal swamps, wet land habitats, flood plains this movement is wide spread during rainy season and high flood and limited to few inter tidal plains drainage channels, canals and ponds & wet land habitat. Therefore the direction of movement in coastal plains is multifaceted and scattered compared to the hills and upland forested habitat.

In forested habitat the movement is due to water, salt lick, pasture, hunting ground, agricultural crops, forest fire, illicit felling, haunting, encroachment, mining and movement of heavy machinery. Here also movement can't be predicted for certain through a particular opening round the year as rapid changes are taking place on account of population explosion, PMGSY, rural roads development, destruction of vital food source of birds, rodents, amphibians, reptiles, and herbivorous animals thoughtlessly in the name of development of Industry, road connectivity, SEZ, ports, Railways, settlements within forest areas & non provision of relocating the displaced PAPS in and around project sites (which were the cause of their losing foot hold and encroaching into govt. forests) for habitat destruction.

Keeping these factors in mind it appears totally futile to predict the movement direction and purpose as the wildlife is threatened at all corners from above activities.

The movement is therefore a hypothesized assessment and not empirical to remain confined to specific locations predicted in this report. Off late Orissa has been experiencing this again and again. We have seen panthers entering into Cuttack, Berhampur, and other populated area. Elephants moving into Bhubaneswar, Delanga, Badabil, Dhenkanal, NH-5, Joshipur, Barunei, etc. during the last 5 years. Even king cobra and pangolins, civets have now entered households in Bhubaneswar. This is an ominous sign of distress to wildlife and it appears to be more pronounced in the days to come.

The writings are clear on the walls. As more and more roads are built, SEZs, Factories, Thermals, open cast mines, Irrigation canals and ports develop, more people from outside come and settle in the areas ignorant about the typical balance between the nature & the wildlife habitat, there will be wide spread loss of forest, vegetation, food source leading to this catastrophe. Orissa has to pay very heavily for this where the sufferer most unfortunately will be the poor tribal or settlers on the fringe of forests or animal territory. Therefore action plan to help wild life habitats remain intact and highly developed in a holistic manner has become more essential.

Orissa was a rich maritime country having river navigation the main mode of transport, trade and commerce with hinterland. These silted up drainage channels criss crossing the flood plains of Orissa's East coast especially the confluence of

rivers and the sea are open to wide spread flood during rains and tidal inundation during rest of the year. These drainage basins developed for navigating country boats have latter on transformed into wet land habitat supporting the migration, breeding, spawning, nesting and hunting of aquatic, amphibian and reptilian species. These are the streams through which the tidal surge of the sea influences the river mouth ecosystem by creating lagoons and inter tidal swamps, mangroves, mud flats etc.

We are only concerned with the inter tidal flood plains far away from the river mouth where water becomes murky and salty during high tide and flood in rainy season and after ebb. Thus the movement of aquatic life forms with amphibians, reptiles, birds, rodents, occurs with clock like precision. In rainy season the movement is from right to left of the road on SH-9 (Bhadrak to Chandbali) and vise versa, synchronized with the flow of flood water from right to left and reverse flow during ebb.

The tendency of mating, spawning upstream in a rapidly flowing water current attracts the fish, crustacean and mollusks to move across from left to right and right to left spread out in the inundated flat terrain of this zone in search of new colonies, new food source and mates continues throughout the year .The predatory birds, snakes, other reptiles, mongoose, monitor lizards, bandicoots, rats, fishing cats, jackals all congregate to haunt and survive in this zone during rains and their nesting, resting perching feeding habitat is thus on both sides of the road can be seen especially in rainy season.

This is reversed in areas affected by inter tidal inundation through out the year and continues as such through out the year, more so during full moon and new moon days or 2 to 3 days before and after when tidal surge inundates the ditches, drainage channels, navigation paths, through the culverts and bridges bringing in fish, shrimp, crustaceans, mollusks, and their predators on land and sky for proliferation and growth. When the ebb comes these channels become shallow and the men living around have contrived ditches & ponds to harbor the aquatic life and earn a living out of these bounties of nature besides agriculture.

The flood water moves from left to right in Bhadrak - Anandpur (SH-53part) in case of Bramhapur – Taptapani (SH-17) and Bhawanipatna – Khariar (SH-16) prompting aquatic life moving with flood waters to flood plains and vice versa, their predatory life forms moving to and fro on either side of the corridor in search of food. Only in extreme summer there is movement towards water sources on either side of these corridors at places. The details of each wildlife underpass has been indicated in the corridor strip maps (**Annexure-XXV—A to D.**)

Table showing location specific movement of wildlife along SH-9, SH-53 (Part), SH-16 and SH-17 (Part), of OSRP Phase-I Year-I roads with reason of movement. With reference to strip map.

Corridor	Name of the Road	Length in km	Study area in km.	1 st package in km	Concentration of WL movement recorded along survey	Location of underpass /via duct in km	Species found most commonly	Movement details with reasons	
								Left	Right
SH-9	Chandbali – Bhadrak	52.6	0 to 53 beyond Chandbali bridge	0 to 45	25 to 29	26.4 and 28.8 box culvert with additional hume pipe vents and trap drains connected to via duct.	Fish, Shrimp, Mollusk, Land monitor lizard yellow monitor lizard, Civets, Water snakes, Rat snake, Fishing cats, Bull frog, Water skippers.	Baitarani on the right. Flood inundates both side and the road facilitating movement of fresh water species of fish, crustacean, mollusk, amphibians and reptiles to spawn migrate feed and develop on the fertile humus rich ditches, ponds, creeks and canals. In winter and summer movement of jackles, hayena, snakes, civets, otters, fishing cats from left to right and right to left takes place in search of food and water.	Flood discharge from NH-5 up land flows to left. Small animals amphibians, reptiles rodents washed ashore due to flood during rainy season.
					30 to 32 km	30.05 and 31.6 box culvert with additional hume pipe vents and trap drains connected to via duct.	Fish, Shrimp, Mollusk, Land monitor lizard yellow monitor lizard, Civets, Water snakes, Rat snake, Fishing cats, Bull frog, Water skippers, Turtles, Terrapins.	Baitarani on the right. Flood and tide inundates both side of the road facilitating movement of fresh water and brackish water species of fish, crustacean, mollusk, amphibians and reptiles to spawn migrate feed and develop on the fertile humus rich ditches, ponds, creeks and canals. In winter and summer movement of jackals, hyena, snakes, civets, otters, fishing cats from left to right and right to left takes place in search of food and water in the inter tidal zone through out the year.	Flood discharge from NH-5 up land flows to left. Small animals amphibians, reptiles rodents washed ashore during flood in rainy season. Rest of the year the inter tidal inundation occurs from right to left every fort night bringing aquatic creatures to spawn, breed and grow, hatchlings which restocks the river basin with fish, shrimp and mollusks for 10 thousand fisherman along the corridor and beyond up to the sea and Bhitarkanika sanctuary and national park.
					35 to 46 km	36.05, 40.95, 45.20	Fish, Shrimp, Mollusk, L. monitor lizard yellow monitor lizard, Civets, Water snakes, Rat snake, jackals, Hyena, Reticulate python, Kraits, Fishing cats, Banded kraits, Vipers, Mongoose, Water monitor lizard, Terrapin, Turtles, Rats,	Baitarani on the right. Flood and tide inundates both side of the road facilitating movement of fresh water and brackish water species of fish, crustacean, mollusk, amphibians and reptiles to spawn, migrate feed and develop on the fertile humus rich ditches, ponds, creeks and canals. In winter and	Flood discharge from NH-5 up land flows to left to right and vice versa. Small animals amphibians, reptiles rodents washed ashore due to flood during rainy season. Rest of the year the inter tidal inundation occurs from right to left every fort night bringing aquatic creatures to spawn, breed and grow,

							Otters and Palm civets etc.	summer movement of jackals, hyena, snakes, civets, otters, fishing cats from left to right and right to left takes place in search of food and water in the inter tidal zone through out the year.	hatchlings which restocks the river basin with fish, shrimp and mollusks for thousands of fishermen along the corridor and beyond up to the sea and Bhitara Kanika sanctuary.
SH-53	Bhadrak – Anandapur – Karanjia	57.6 +65	57.6+65	0 to 50	12 to 14	12.2	Jackals, Languor, Apes, Civets, Water snake, Reticulate python, Viper, Rana, Rat snake, Cobra, Kauthia, Fresh water turtle, Bull frogs, Rats, Mongoose.	From left to right during monsoon months along the flood plains of Baitarani and canals of Salandi irrigation system. There are the lower catchments of Salandi connecting the out flow of Baitarani.	Right to left during winter for food, fodder, and nesting, hunting along the area. Summer movement is negligible except for hunting and predating.
					13 to 15	17.2 21.75	Small animals like Jackals, Hyena, Mongoose, Gray monitor, Civets, Palm civets, Rat snakes, Water snakes, Reticulate, Python, Naga, Cobra, Viper, Russels viper, Krait & banded krat, Rats, Bandicots, Bull frogs, Fish & crustacean.	From left to right during rains only in search of new pasture and by the seer force of water with one small drainage cut nala. Regular movement of Snakes, Lizards, Rats and frogs rest of the year for food only.	From right to left for spawning and new colonization though no permanent wetland exists here except only roadside wetland drainage area with ponds in between.
					23 to 34	23.5 34.0	The check gate at 34 th km is shifted to the road from Hadagarh sanctuary to SH-53.	Unified check gate of Bhadrak, Keonjhar Forest (WL) Divisions and Toll gate of OWD combined together at the Toll Plaza.	To cut down cost and repetition of delay on account of several check gates within a short span of 8 kms. with lot of infrastructure that would have been required to be built up including additional land acquisition.
					38 to 41	41.1	Wild cats, Rattles, Boars & Porcupines, Civets, Palm civets, Jackal, Hyena, Mongoose, Hares, Rat snakes, Cobra, Python, Krait, Banded krait, Keoutia, Bull frog.	The flood waters of Baitarani crosses the road at Ambagadia and inundates vast stretches both side. Movement of aquatic creatures, rodents, amphibians, reptiles from left to right with flood water during rainy season flow into the paddy fields and villages during rains and entering the lower catchments of Salandi on the right side of the road.	The flood water from left enters the nalas and river in spate bringing in fish, snake, rodents, amphibians and they take shelter in the shrubs, bashes and field bunds around. Resident rodents, Snakes, borrow animals come out and move to wards the

								Left to right movement only during flood. Seasonal movement during the summer towards river from right side in search of water and garbage along habitations by scavenging animals and birds.	river Baitarani during Summer nights when other sources are dry.
SH-16	Bhawanipatna – Khariar	70	02 to 70 = 68km		4 to 5	4.1	Civets, Jackals, Hyena, Pangolin, Mongoose, Reticulate Python and Python, Cobra, Viper, Russell's viper, Rat snakes, Water snake Hares, Field mouse.	From Brahmani RF seasonal and winter movement for food, water and procreation mostly left to right during pre monsoon, winter & summer, crossing the nala running parallel between the RF and road.	Movement to and from Dumla PF during monsoon, winter and summer months by rodents, hyena, jackals, mongoose occurs some of which are the resident animals of the R.F Brahmani other side.
					18 to 20	18.85	The existing culvert was the conduit between Brahmani RF & Adhamunda Hill lock on left & right. Hares, Jackals, sloth bears, Rattle, Mouse, Bandi koot, Python, Cobra, Mongoose, Water snakes, Monitor lizards Pangolin.	Move out of the Brahmani RF for food, water and hunting along the periphery of habitation. Concentration of wildlife is low on hills on left with scrub forests and water harvesting structure for irrigation across the road on the right.	Seasonal cross over during winter and summer by mainly Hyena, Bear and Python in search of water and food. Concentration is low on hills both side on right and left with exposed boulders.
					21.5 to 23	22.15	The existing culvert was the conduit between Brahmani RF & Adhamunda Hill lock on left & right. Hares, Jackals, sloth bears, Rattle, Mouse, Bandi koot, Python, Cobra, Mongoose, Water snakes, Monitor lizards Pangolin.	Kumkot RF with Kandalijhar seasonal spring, Siyaljhudingi PF on left and river Tel parallel to the road crossed for food during summer months on the right.	Chhagaon PF on right side of the road and low hills on the left. Both side movement is a daily affair for Hyena, Jackals, Bears in winter and summer.
					4 to 5 17.5 to 20 21.5 to 23 53.5 to 55 64.5 to 66	4.1 18.85 22.15 54.35	Hyena, Jackals, Bear, Pangolin, Mongoose, Snakes, Python, Porcupine, Hares, Rats, Jungle cats	Choura RF on left. The animals move during late rains, winter and summer months in search of food and water from left to right.	Open Scrub forest on hill locks on right with semi Perennial nala and Sunder river. The Scavengers have no limits of movement. They cover long distance in search of food and occasional mahula tree, mango & ficus, attracts bears, porcupine, rodents, alike. Snakes like reticulate Python and Python are common which cross over, cobra and Keoutia are rare to confront other then at

					66 to 68				waterfronts, water harvesting structure.
						65.1	Jackals, Hyena, Mongoose, Snakes.	RF on left near Lachhipur. Animals cross over to the ponds, on either side of the road between Risigam to Dohelpada during summer for water and scavenging for food.	Only agricultural fields and rodents, frogs, land monitor lizard, rat snakes, cobra abound which move towards water spots on both side of the road left and right. Reticulate python and Russell's vipers on exposed boulder out crops on the right and agricultural fields on the left.
						67.85	Jackals, Hyena, Mongoose, Snakes.	RF on left near Lachhipur. Animals cross over to the ponds, on either side of the road between Risigam to Dohelpada during summer for water and scavenging for food.	Only agricultural fields and rodents, frogs, land monitor lizard, rat snakes, cobra abound which move towards water spots on both side of the road left and right. Reticulate python and Russell's vipers on exposed boulder out crops on the right and agricultural fields on the left.
SH-17 & SH-4	Berhampur to Bangi Jn. Bangi Jn. to Rayagada	201.6	0 to 41	150	1.5 to 2.5	2.140	Rodents, Rattle, Snakes (Python, Viper, Cobra, Russell's, Krait, Branded krait, Rat snakes) Wild cats, Jackal (occasional) reticulate python, civets, Bull frog, Otter Hyena, Hare.	Ramaguda RF and hill from which animals cross over to the MIP across the road in winter and summer for food and water.	Water harvesting miner irrigation tank adjacent to road and agricultural land, Rusikulya canal system. The animals from left come over for food and water.
					9 to 11	9.810	Wild boar, Porcupine, Bandicoot, Bears, Rattle, Pangolin, Cobra, Viper, Kraits, Banded kraits, Rats, occasional sloth bear, python, all types of snakes, other than water snakes.	Mahughara hills on the right and open fields on the left with scrub forest and small hillock.	Animals come over from Mahughara hills on this side and cross over to the left during crop season for foraging and hunting and in summer for water in several ponds. Mostly at night time.
					25.0	25.0	Forest check gate at Punji kayan.	Road junction at Digapahandi with Chikiti connecting NH-5 and with Aska on the other side.	A bus Truck lay bye with check gate barrier prior to the road crossing pre existing here, which has to be developed for checking removal of forest products along with the Toll plaza at this junction.
					26 to 28	26.1	Sloth bear track.	Bears move from Changudidei hills 500mtrs to 1.5km away from road on left side and cross over the road towards Jagannathpur PF on the right km 6 to 8 away across Ghodahada river, traversing paddy and sugar cane, pea nut cultivation	Adult and sub adult males only cross over the long distance from Changudidei hill on the left and return from Jagannathpur hills (PF) during early rains or late summer after pre monsoon

								area during winter mating season. Female bears are seen moving around at right in paddy and peanut fields, scrub forests, around water spots, ponds, small springs in search of food and water on left and right side of the road after crop cutting in winter till harvest of pea nuts.	sowers.
						30.72 41.35	Hyena, Jackal, Civets, Wild boar, Porcupine, Python, Cobra, Keutia, Rat snake, Mongoose, occasional deers bears and sloth bear are encountered in this zone with mouse deer and barking deer.	Chandragiri RF block 1.5kms to 2kms away with shrubby under growth and agricultural land in between over a thin strip, a semi perennial nala runs at this location. Elephants rarely come to this area during summer for water in the nearby Guharikhol MIP.	Wildlife move from Gobindpur PRF side to Taptapani PRF side and return back across the road. Both side to be barricaded at this turning after the nala bridge to facilitate road crossing under the bridge by easing out the left embankment of the nala either side of the bridge.

Relocation of the young avenue trees, shrubs and bushes' all along the corridor and cost of such activity.

Trees below 30 cm dia, all shrubs yielding NTFP or evergreen and flowering type requiring removal from ROW are to be uprooted with roots and ball of earth intact through Shovel operators, pruning the lower branches up to 2mtrs and relocated in identified locations nearby for animal under pass, site enhancement and such other activity on all corridors .The Tree species which can be successfully relocated are Acacia, Eucalyptus, Sisoo, *Strebulus asper*, *Crateva nurula*, *Terminalia arjuna*, *T.tomentosa*, *T.belerica*, *T.chebula*, *Phyllanthus emblica*, *Azadirachta indica*, *Ficus* species, *Albizia lebeck*, *Shorea robusta*, *Mimosops elengi*, *Feronea liminea*, *Tamarindus indica*, *Cizygium cumini*, *Bombax ceiba*, *Ceiba patendra*, *Peltoferum feruginum*, *Acacia nilotica*, *A.leocophlea*, *Aegle marmelus*, *Butea frondosa*, *Holoptilia integrifolia*, *Annogessus acuminata*, *Alstonea scholaris*, *Mytragyna parviflora*, *Adina cardifolia*, *Spathodia companulata*, *Putranjiva roxburghi*, *Mangifera indica*, *Ingadulsis*, *Buchnanian lanjan*, *Madhuca latifolia* etc.

The medium trees, shrubs, bushes are *Nictanthes arbortistis*, *Soyimida fabrifoga*, *Cassiaria tomentosa*, *Delonix regia*, *Pongamea pinnata*, *Samania saman*, *Cleistanthes colinus* *Schleichera oleosa*, *Wood fordia fruiticosa*, *Embelia tsjeriam*, *E.ribes*, *Tabernamantana coronaria*, *Hibiscus rosasinensi*, *Hollarhaena antidysenterica*, *Combretum decandrum*, *Ixora*, *Gardenia gummifera*, *Lanea grandis*, *Murayya coingii*, *Muraya exotica*, *Messua farrea*, *Zizyphus*, *Cypedesa fruiticosa*.

Bushes and Grass

Eulaliopsis binata, *Vetiver zizanoides*, *Sacchrum munj*, Broom grass, *Flaucortia catafracta*, *F.romantai*, *Randia dumetorum*, *R.tetrasperma*, *Adhatoda vasica* or *Justacea adhatoda*, *Jatropha curcas*, *Glycosmis pentaphylla* etc.

Method of planting.

Pits of 1m³ at 1mtr interval from edge to edge or 2 mtr interval from centre to centre in the area to be vegetated on the nala & river banks, water harvesting structures, base of embankments in a single or multiple row are dug up by shovel operator and the Top soil on one side and bottom soil on another side.

The trees shrubs, bushes and clumps of grass to be relocated by removal from RoWare to be selected close to the planting site by peg marks with red flags on the trees at BH.. The shovel operator has to dig up the marked tree/shrub/clump only after marking its surrounding ground with shovel while keeping a ball of earth (minimum 0.3³ mtr wide) at the base so that when the tree /shrub is lifted the ball of earth remains intact. The ball of earth with the plant are then lifted and covered with a thin Hessian cloth (onion bags) or similar material and tied to the stem of the plant at collar and lifted to haulages vehicle. For easy carriage except the top ends many of the larger side branches at times have to be pruned to reduce the volume of biomass and reduce loss of moisture and stored food.

These plants with ball of earth are then unloaded at the planting site and transferred to the pit manually or through crane or shovel and the topsoil is then pushed into the pit. The pit is thus half filled and then watering done. The bottom soil heap together with compost

/cowdung manure one basket, Carbendazim and Mancozeb 5gms /pit, Chloropyrophos 50 gms per pit mixed together and filled into the pit and spread around the plant. The soil around the plant is then pressed by toe so as to make a depression and firm the base around the plant and balance spread out like the shape of a saucer to promote water accumulation in hilly and draught prone area..The relocated plants are then watered adequately .The exposed roots out side the ball of earth are pruned with sharp seckature or bill hook and smeared with anti fungal paint or coal tar.

Regular planting of one clump of grass alternating with shrub and bushes has to be done and then the 2nd and 3rd row in succession. The work should be taken up in early rainy season 1st of July to end and once the tree starts showing secondary growth (after 20 to 30 days of planting) well digested slurry containing 20 kg cow dung, 20 kg. Bhuin neem fermented in an open vat mixed with 2000 liters of water is applied at the base of each plant @ 2 litre per plant twice a month up to end of October, followed by summer watering from mid February onwards at fort nightly interval (to encourage rapid growth) up to end of 15th June next year during the 1st year of planting.

Un -wide, bent, deformed, damaged, diseased plants should not be selected for relocation.

In areas affected by high velocity wind the relocated trees /shrubs/bushes are to be provided with forked bamboo” stay” to prevent up rooting in the first year.

No up rooted plant for relocation be kept under direct sunlight or dry condition for days together. It has to be planted the same day in the field or in case of delay kept under shade with sprinkling of water and covering of wet Jute gunny bags/wet paddy straw at least for a day only. The ball of earth with covered gunny bag is to be sprinkled with water so as to keep it moist.

Though it is best to uproot plants when these are leafless to have minimum food and transpiration loss and stress to the plant, on account of summer heat ahead, this is not recommended.

Per plant cost will come down to Rs.500/- (Rs.150/-per clump for shrubs and bushes) minimum including the cost of shovel operation, carriage and after care for 3 years only. Other incidental charges can be worked out depending on the site condition and distance to be covered from the site of removal up to site of planting if it is more than 10 Kms.

Compared to a 10 year waiting period and uncertainty over actual growth the relocation of lower girth trees, shrubs and bushes, grass clumps along the side of the existing road using the existing corridor wise vegetation makes it more impressive and eco-friendly without the ugly sign of destruction and denudation besides saving time and environmental requirements.

While the work is in progress at least the site enhancement near Temples, Market places, Hospitals, River &, nala banks, approaches of feeder roads, schools, colleges, hostels can be under taken in the first phase. Improvement of barren, eroded patches can also be achieved in such manner to get an extra facelift of the area.

There should be some gaps left intermittently on each line of planting (re location) to introduce bamboo rhizomes / rooted bamboo off sets put inside earth filled gunny bags (Dwarf thorny bamboos of *Bambusa arundinacea*, *Cephalostachium*, *Salia*,) *Narium oleander*, *Bignonea*, *Adanthera pavonina*, *Bauhinia variegata*, *B.racemosa*, *B.purpuria*, *B.retusa*, *Lagerstromea indica*, *L.parviflora*, *Michelia champaka*, *Mangifera indica*, *Mallotus phillipinensis*, *Madhuca indica*, *Nyctanthus*, *Schleichera*, *Alstonea* pot plants as site enhancers. These plants flower at different time of the year to add beauty to the corridor.

These works are to be taken up simultaneously through independent agency except on forestland where MoU for speedy implementation of habitat development in consultation with the Environment supervision consultant and local DFOs may be arranged.

Relocation of *Streospermum acerifolium*, *Sterculia urens*, *Cyzigium cumini*, *Putranjiva* can be planted in the 2nd row and long bamboo, *Semul*, *Mango*, *Palmyra palm*, *Caryota urens*, *Terminalia arjuna*, *T.alata*, *T.catappa*, *T.belerica*, *T.chebula*, can be raised on the 3rd row of avenue planting where land is available beyond the 16mtr width for planting.

No planting or relocation activity to be undertaken below any power transmission line or over the Fiber optic cable routes.

No relocation should be carried out in shallow soil and rocky out crops or dry land areas other than near water sources and water bodies. In all such cases the surplus soil can be spread in layers and plantation can be taken up with shrubs and grasses.

Guide Lines for Tree Felling and Removal

1. All trees above 30 cm girth at Breast height (measured 1.35 mtr) above ground level on the down hill side.
2. Trees which are finally selected to be felled as per offset from centre line shall be given a blaze mark at BH (1.015 mtr.) and at the base of the tree (blaze size 15X15 cm) cutting away and removing the bark portion. The blaze marked trees are then branded with a property hammer duly registered with the local Divisional Forest Office for such purpose as per Orissa Timber and other Forest Produce Transit Rules 1982 to identify such trees as the trees to be felled.
3. Any tree, which is forked below the BH (1.35 mtr.) shall be having blazes on as many numbers of trunks for branding each trunk separately as a separate tree.
4. All such blaze marks shall be painted with coal tar or black paint on the border of the blaze.
5. All trees marked for felling and removal shall be enumerated jointly by representatives of the PIU, Local Range Staff of Forest Deptt, local divisional field staffs of Orissa Forest Development Corporation Ltd. and entered in a register of trees in Triplicate as per the Performa given below duly countersigned by the enumerators and their superior supervising officer who are to counter check

some of the measurements and other details at random not below 1% of the total trees so marked.

6. The serial number as per the enumeration list shall be continuous and separately maintained for left and right side of the road from starting point of each (Territorial /wild life) divisional jurisdiction (Forest Division wise) as the case may be. The blazes at BH and base of the tree shall be branded with digit hammer to impress the serial number of the tree trunk (Digit hammers from 0 to 9) and sound /unsound nature of the tree trunk (S/D).
7. The species of tree to be felled shall be mentioned.

The enumeration list shall contain the following information. Chainage details km to km, Tree Sl. No., species, Girth class 30-60, 60-90, 90-120, 120-150, 150-180, 180-210, 210-240 >240 in Cm., approximate length of clear bole, Hollow, sound /unsound (H/S/D) condition of tree trunk. To determine the sound and unsound nature of trees to be felled the following procedure to be followed.

- (a) If there is any cavity or hollow visible at the base, middle or cutaway portion of the clear bole or forked branches. -----H
- (b) If the tree trunk when struck with axe or hammer gives a hollow sound or muffled sound. -----H
- (c) If the sound is like a drum ----- H
- (d) If the timber is rotten and visible to naked eye. -----D
- (e) If it is buttressed, ridged and furrowed with irregular protuberances and epicormic branches or cancerous out growths like warts on the tree at several places. -----D
- (f) If mushroom fruit bodies or out growths are visible at several places on the tree trunk locally known as a "Chhatu" or Sambar eye in shape of Black or brown /dark brown colour.-----D
- (g) If the trunk is split, half burnt or half cut and removed. --D

At the end of the enumeration list there shall be an abstract of total trees to be felled in each girth class.

The enumeration of trees to be removed from forestland has to be made separately irrespective of its location indicating the name of the forest (as per Govt. records submitted for forest clearance maintaining separate serial for each separate forest block of village forest, protected forest, Reserved Forest, proposed reserved forest). In all such cases forest department marking hammer shall be used to brand the identified trees to be felled and the work has to be carried out meticulously taking only those trees coming within the Ro W including diversion for traffic at identified places. Other than these trees, other natural growth to be felled within hilly and forested track beyond the existing ROW recorded in the same format as was previously explained in clause 1 to 7 stating the chainage detail.

All the copies of the enumeration list shall be compiled together on the Register of trees to be felled and jointly signed in each page of original, duplicate and triplicate by the respective field staffs of Forest Dept., OFDC Ltd & PIU and supervising officer who has checked the same. After enumeration the trees are to be handed over to the OFDC and proper receipt obtained to that effect from the designated officer receiving the trees for removal in such cases the Sub Divisional manager and section supervisor of OFDC Ltd.

Felling and Removal

Felling of trees shall commence in forest and non forest land in phased manner so as not to obstruct the entire traffic flow. After the overhead transmission and entertainment cables are removed the trees shall be felled. The forest corporation shall engage dozer /poclain or such other machines for the removal of heavy tree trunks from the work area and ROW including diversion to facilitate easy flow of traffic and use devices so as to control the direction of felling to avoid damaging other trees, buildings and other infrastructure along the road those are to be retained.

In case of trees to be felled which are adjacent to Temples, schools, residential or community /Govt. structures the felling has to be controlled and executed after due compensation has been paid by PIU for the damages/acquisition and the site vacated by the occupiers. Till that time such trees shall not be felled. In all such Pvt. Property, the values of the trees are to be evaluated and compensation paid prior to felling. No private sale of any tree allowed in favor of any individual/institution/community/group/club etc. to avoid pilferage, duplication and misappropriation.

In all the cases after felling the trees are to be converted into log sections and fire wood stacks of 1mX4mX1mtr. size on level ground and all logs are to be serially numbered with branding of tree No, log No., one end of each log. The log serial number of the total lot worked out by OFDC has to be written on the cut end of each log in black /blue paint which should tally with the entries in the conversion register. The tree number log serial numbers and log section numbers are to be written in English on the cut surface of the stump and the log ends. The same has to be copied into 4 spare copies and one original for passing by designated forest officer as decided by the concerned Divisional Forest Officer having jurisdiction when an application to that effect is made to him as per Orissa Timber and other Forest Produce Transit Rules etc by OFDC. The fire wood stacks should be serially numbered and stacks size 1mX1mXmtr made near stamp sites. All logs and fire wood billets which are more than 1mtr girth to be branded with the property hammer mark of OFDC registered for the purpose and the conversion list submitted to the officer for passing. The conversion register should also contain the list of firewood stacks obtain from a group of trees adjacent to each other on either side.

The passing has to be carried out by the designated officer of Forest Dept. on Top priority so as to facilitate road construction activity, by branding all the firewood above one mtr girth and up to 1 mtr. length by passing hammer and all the logs and billets branded with the property hammer of OFDC Ltd.

After passing is made permits shall have to be issued by the concerned OFDC official or an officer of forest department specially engaged for this purpose for passing and

issue of perennial for immediate removal of the converted and passed material. Only after removal of the passed materials from the stump site the contractor for going ahead with the roadwork can uproot the stumps. Such stumps can be sold in public auction by the PIU /OFDC as the case may be, or some such stumps may be preserved on cemented platforms as showpiece for the road users and posterity to appreciate the colossal nature of the trees those were existing on the avenue.

Heavy cranes may be required for lifting and loading the huge logs to trucks for transport and OFDC shall be responsible for arranging the same and removing the logs within a fort night to one month from the site after the materials are passed. Felling operation has to be started in order of preference near bridges, culverts, open country with sufficient scope for diversion of traffic and one side of the road where the site Engineer, Contractor and Supervision Consultant decide to start the work first. However instead of continuous stretch of many kms 1km stretches with 2 km gap has to be considered while phasing out cutting operation and after completing one reach the other reach is taken up. All young below 30cm girth plants, which can be relocated at approach to bridge, culvert and animal under, passes are to be shifted first of all during early rains when there are frequent showers by using shovel operators and removals from the proposed ROW for unloading at relocation sites. In all such cases the heavy side and lower branches of such trees are to be cut /pruned for easy removal. Such trees which could not be felled due to constraints of damaging life and property has to be removed in dismembering, the top branches if it is so required and then main tree trunk felled and removed.

The OFDC shall be responsible for timely felling, logging and removal of logs firewood from the work place where as the Forest Deptt shall be solely responsible for passing of timber and the fine wood and issue of permits to that effect. Any undue delay or stoppage of passing and issue of permits for transport is likely to escalate the project cost and the forest department should be held responsible for such additional expenditure to state exchequer.

The expenses may differ from place to place and depending on number of higher girth class trees. Estimate of working cost shall have to be submitted by the OFDC to the PIU after taking delivery of stock of trees to be felled and the same may be examined by the PIU for sanction of approval and release of funds to remove the trees. Where such funds are not released by PIU the royalty value of the trees calculated on unit basis has to be assessed and deducted from the total working cost of the estimate and balance released in phased manner on the basis of progress of work. Only royalty for the trees to be removed from forestland has to be assessed along with natural tree growth beyond the old ROW in forested areas. All other trees which are growing within the existing ROW and which are compensated, for being the property of OWD should not be levied with any royalty by forest department. Therefore separate tree serial, separate conversion and passing list has to be made for calculation of royalty of forest trees and natural growth outside ROW within forested tracts, Jungle blocks etc.

The royalty of the growing stock on acquired forest land to be removed is to be calculated by the PIU with the help of the D.F.O having jurisdiction to settle the royalty and the same should be based on prevailing royalty levied on OFDC for NH widening activity within a year or so. The sale proceeds of the converted materials obtained from the trees minus the working cost as decided divided by the PIU and OFDC on 50% share basis as would be decided by the respective departments of

Works, Forest and OFDC management has to be settled before felling operation takes places and the final royalty should be calculated on the basis of actual passing of saleable materials in the field.

The OFDC shall be held responsible for theft of trees or felled materials and should employ watch and ward to ensure safety and security besides stock piling of such materials at strategic location or its depot.

The un salable trees /felled materials if any shall be finally inspected by a joint team of officers from OFDC, Forest Department and PIU after passing at the time of field inspection and recorded on the conversion register & passing list for reference and record.

All uprooting of stumps shall be so done that it goes 60 cm to 1mtr deep below the formation level or 30cm below the sub grade level which ever is lower.

The OFDC ltd. shall remove the materials to nearest depots for disposal and deposit the royalty as will be agreed upon by the respective authorities or as in vogue for such other projects.

The trees on Pvt. land and Govt. forest land are to be worked out separately as some are purchased by the OWD and handed over to the OFDC for felling and some are compensated by depositing the NPV with forest Deptt. In both the cases the sale proceeds minus the handling charges to be shared by 70:30 between PIU and OFDC ltd. respectively after accounting for the cost of the trees in addition to working cost approved for such trees to be removed.

The uprooted stumps can be dumped /stock piled at a place in heaps and sold in public auction for use as ornamental structures or fire wood as the case may be which shall be the responsibility of the PIU as uprooting has to be only carried out after the removal of staked materials of fire wood and timber from work site.

Tripartite discussion has to be made between OWD /PIU, Forest Deptt. OFDC ltd for setting the nity gritty of the operational details at high level so as to avoid delay and communication gaps, official red tapisim and beurocratic mishandling at all level and facilitate smooth removal of tree growth.

All trees those are retained shall have to be serially numbered from chainage 0 to end of the road and register maintained to that effect for reference, follow up action and disposal when any one is required to be removed etc. by maintaining separate serial number for the left and right side of road centre line.

For this all trees are to be provided with Aluminum foil punch marked numbers fixed to each tree by nailing at a height above 1½ mtrs. from down hill side visible to the road.

The record keeping shall be in the following manner, while carrying out the enumeration of trees to be retained.

Sl. No. of trees	Species	Girth at BH on the date of enumeration	Height of clear bole	Condition of the tree Hollow /Unsound /sound	Estimated quantity of fire wood	Remarks
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The pits formed due to removal of stumps shall be filled up with 20 cm layers of suitable Granular sub-base material and compacted.

All trees which have lost their major root system due to excavation of the road base for relaying if giant and old standing opposite to wind flow from North West or South East shall have to be carefully retained as there is a tendency of these old trees toppling down during local whirl winds or cyclone. The site Engineer and the Environment and Biodiversity supervision consultant shall decide the cause of action in such cases when removal of any such retained tree is considered imminent.

In all such cases a joint list of such trees are to be made again by local Forest, OFDC and site Engineer to obtain cutting and removal permission from the Forest Deptt. and Plant adequate number of avenue plants in lieu there of.

Felling of Ficus Kadamba, Mango, Arjun trees having birds nesting area may be delayed to wards the end of winter when the new borns are ready to fly out so as not to destroy the wild life concentration along the corridor.

Branch cuttings and offsets of all types of Ficus, Bamboo, Mango, Tamarind, Jack fruit etc. has to be taken for bud grafting in the nursery to retain the genetic diversity and to treat the cuttings directly with rooting hormone and grow rooted offsets in the nursery under mist chamber so that replica of the existing, vegetation can be recreated in the adjacent degraded forest lands and waste lands along the corridor for the wild life and site enhancement.

Precaution during felling and conversion of trees.

- ❖ All workers must wear safety helmet or "hard hat" (miners helmet).
- ❖ Traffic movement should be restricted when posting Traffic control operators with red flags so that they can warn the moving traffic to stop instantly is cutting down trees.
- ❖ No tree felling during rains and windy days to prevent accidental fall.
- ❖ There should be ropes tied to the Tree trunk at reasonable ht. in order to control the fall by operating through chain pully combination anchored to another stable tree or farm structure like pillars, posts, rock out crop crow bars as iron pegs pushed into the ground at 30⁰ incline.
- ❖ One centry is posted near the felling site to sought with a mouthpiece so that others at the traffic signal stop the traffic momentarily and the tree is brought down.
- ❖ The supervisor, hand sawer, axe or power chain saw operator should be so positioned that in case of sudden fall of the tree or any eventuality they can leave

the site for safety and the leaning direction, probable fall directions are well estimated ahead of cutting to locate the vintage points of cutters position and escape route ahead of cutting.

- ❖ Cleavages, Sun hemp or, HDPE ropes of required size depending on the girth and height of the tree with sufficient spare length have to be used for safety and reliability.
- ❖ The flying splinters and broken branches are widow makers and therefore should be watched out at the time of felling of trees so that workers, passers by and on looks are at safe distance.
- ❖ As soon as the tree falls, the side branches must be cut down with power chain saw or axe and billhook and removed from the road. Portable generators and power chain saw, wedge and axe, raker tooth saw, Bow saw should be kept ready at the work site for immediate action to clear the road with sufficient spare blades, chains, pulley and P.O.L.

Rescue and first aid kits, gumboots, tight fitting gloves are to be used at the worksite by the organization for safety and to avoid freak accidents.

Planting pattern at site enhancement locations

Bhawanipatna – Khariar road

There are changes in the alignment of the road at sharp curves and accident spots at 37/650, 54/630, 58/275 chainage besides the approach to the new proposed Tel river bridge on Bhawanipatna side. On account of these there are some surplus land within the loop so formed which are to be developed into site enhancement structures by providing concretes walls 1½ mtr high around with entry points for road users. Here some flowering shrubs, trees, palms, ornamental hedges shall be planted after the loop is filled up with surplus excavated materials, road demolition wastes at the bottom and good soil on top of it, leveled properly with landscaping befitting to the rolling terrain. The borders are to be provided with *Duranta plumerai* /*Justicia* (black leaf) trimmed to the level of the concrete wall. The centre shall have *Pongamea pinnata*, *Putranjiva roxburghai*, *Michelia champaka*, *Muraya coingi*, *Mimosops elengi*, *Ficus variegeta*, *Ficus benjamina*, *Ficus vulgaris*, *Ficus glomerata*, *Ficus comosa* so that the area becomes a resting place with prefabricated R.C.C. benches fixed in position (Like in old railway stations) and paved with pebbles and boulders excavated from the road and river beds and river beds, and broken to rectangular or square shapes and embedded on C.C. (m-15).

Provision for locating sweet scented flowering plants and attractive flowering creepers such as *Begunia*, *Lavender*, *Quiscalis indica*, *Cana*, (near water fronts), *Ipomea hederacia*, on the out skirts on rocky and waste ground or pre welded G.I. domes can be made with sowing of *Vinca rosea* seeds on embankment slopes and leveled up areas to get round the year flower.

It has been decided to provide for a truck lay bye at 57 km to 58.3 km location where a loop is available for changing the road alignment near a nala bridge and therefore the site enhancement shall be modified as per the requirements of a truck lay bye and

as far as possible the villagers losing their land in the area have to be given preference for earning, with the option of commercial activity.

Detail designs are enclosed as drawing no. **OSRP/CEG /SH /ENV /01 to 12** for site enhancement, Bus and Truck lay bye, Toll plaza, hospitals, temples, village road inter sections, schools, market places (weekly) etc., which may be referred to.

Hexagonal or round and tapering pillars 1½mtr long are to be fabricated in R.C.C. (m-20) and fixed in position in C.C., (m-15) with name of the village, market place, school, Hospital, College, Temple, monument, Rest house etc. written in Oriya and English language on all road corridors. Such R.C.C. boards as per IRC standard can be manufactured on site and installed. The location shall be as per the road strip map.

The fixing of metal boards or fiberboards or Reflector boards are prone to damage by hooligans, are stolen or damaged due to vandalism and target practice by nuxals and young groups. Therefore the cement concrete frame works of such boards as per IRC design are proposed to be constructed on site. The writings can be painted with glow paints to dazzle during night. The pillars are to be painted with black and white reflector paint with the name boards containing the names in Black over White flourscent paint letters.

Sequencing of Works of Biodiversity Action Plan and Environmental Mitigation Measures

At the outset maximum care has to be taken not to dig up and disturb the entire area before actual work starts.

- Especially the wildlife under passes and length of road before and after such location has to be left un-worked till the under pass is completed with all details so that the wildlife movement continues unabated in the adjoining area without distress.
- The biodiversity corridor development for elephants and approach plantations for all wildlife under pass can be taken up in advance excluding 15mtrs. from the centre line of SH outwards for construction activity, diversion and stock piling or dumping of materials. The areas beyond this for another 35mtrs for elephants and 20mtrs for other animals can be planted up with trees, shrubs and bushes, bamboos as per the action plan design on either side of the water channel or opening as the case may be.
- **If such lands are Govt. land, the planting should be carried out along the nala towards the forest or water sources either side using rooted offsets, uprooted and to be relocated young saplings and small trees, bushes etc. as has been prescribed in the proposal for relocating young trees, so that the banks of drainage channels are camouflaged before the road work is complete.**
- The gully plugging and check damming of such drainage channels as per design has to be taken up simultaneously so that the run off is reduced improving ground water recharge.

- The sequencing of the Bear under pass beyond Digapahandi between 26.5 to 27.2 km may be taken up now at chainage km 27.02 avoiding the feeder road as mean while the OWD has built one new box culvert at previous locations on SH-17 (as seen during World Bank mission verification of the bear pass locality on 31st January – 1st February 2007). This culvert has no earth cushion or required opening to facilitate movement of Bears and no retaining walls provided for preventing the bear from coming over the State Highway - 17. There is no need of second bear pass after the proposed bear pass now suggested at 27.020 km chainage. As vast stretch Ghodahada river basin and bridge is there to provide the desired passage.

The sequencing of all wildlife under pass should be in alternate 2km chainage points i.e. there should be minimum 2km gap between two under pass while construction work is taken up including the road construction and under pass. When the gap is lower than 2km both should be taken up simultaneously after erecting one water storage tank down hill and uphill each side artificially away from the road for storing drinking water for the wildlife in lined Polly eurothane sheets built up as artificial ponds raised 50cm above ground and 20cm deep below. The contractor in non-forest Govt. land should carry this out through the local forest department in forested areas or small ponds at a level ground, so that summer distress on either side of the under passes can be prevented. Minimum size of the structure should be around 2000 litres capacity in the shape of an irregular ditch with earthen bunds and polythene sheet lining at the bottom as well as top of the embankment. The thickness of such structures shall be minimum 1mtr and maximum 3.25mtr at the bottom and 1mtr at the top at a maximum cost of Rs.3,000 each. These structures will serve as the water source for local cattle and wildlife for several years till they venture to cross over the road through the under pass. This will also help reduce the distress of wildlife during summer after a year when the road construction activity starts in full swing. However the storage capacity of tanks up hill should be limited to 1000 ltrs. for preventing drowning and flash flood, which may impact road construction activity.

- The gully plugging on high hills and RFs, PFs to be done by the forest department under the guidance of Supervision Consultant much before Tree felling and wildlife under pass activity starts.
- **In acute water scarcity areas these make shift ponds may be filled with water from near by water sources through tankers and the wildlife is saved from distress owing to construction activity. These structures are to be erected at those nalas where wildlife under pass has been provided in each corridor on hills, forested areas and plains.**
- **In inter tidal zones there should not be any provision for providing line drains on the down stream to prevent the damage to agricultural land near the culvert opening as this will obstruct tidal water flow to the other side permanently and thus result in water logging and salinity of the fields.**

The result will be disastrous for breeding of aquatic, amphibian, reptilian as well as aviary fauna. In non inter tidal zone between 20 to 28 km stretch of Bhadrak – Chandbali SH-9 this will also create a head of water on the right side as build up of water level up to the height of the lined drain will be there

causing more flood damage than was previously occurring distressing more people including the land owner at bridge or culvert opening.

- Such structures to reduce the velocity of flow can be provided in the exit points of new culverts on SH-53, SH-17, and SH-16 where the right side is higher than the left or vice versa (as the case may be).
- **There should be Trap drains for all under passes in Bhadrak – Chandbali, Bhadrak – Anandapur, Berhampur – Taptapani corridor under passes, where amphibians, reptiles and rodents move across the road near wet lands and water bodies early in the pre monsoon and monsoon season so as to prevent the death of agro friendly frogs, Bandicoots, Snakes, Monitor lizards under the wheels of moving traffic. These wildlife can be diverted to move under the culverts or through the via duct 600mm dia cement pipes as provided in the drawing no. OSRP/ CEG /SH/Bio /Reptile pass.**

The chainage locations are in the corridor strip map and Table of impact mitigation designs in **Annexure –XXV (A) to (D)** of Biodiversity report.

The Barricading, planting on the islands created at road junctions, site enhancement plantations along Temples, Hospitals, Market places, Bathing ghats, Water body embankments, river banks, nala banks, Bus and Truck lay bye are to be taken up with tree guards for single row plants and barbed wire fencing over long stretches for which separate cost and design of Tree guard has been provided in **Annexure XXXVIII** which is to be only provided for ornamental brows able species. Care has to be taken to plant all non brows able species to the extent possible like Kaner, Karbir, Kamini, Karanj, Collophyllum, Nictanthes, (Hara singar), Karada (cleistanthes), Acacia nilotica, A.leocophlea, Neem, Mahaneem, Mahala (Ailanthus excelsa), Bougainville, Premna tomentosa etc.

The costing will be at the same rate applicable for plantation @ of 1600 plants /ha without the cost of barbed wire or tree guard fencing i.e. @10/- per plant for three years including casualty replacement.

The cost per tree guard (square mesh to be embedded in c.c. on the ground level as per design drawing and specification is enclosed in **Annexure – XXXVIII**. Corresponding to drawing no. **OSRP /CEG /SH /ENV /08**.

Tree cutting and removal from the RoW with up rooting of stumps and filling up of depression layer by layer as per instructions

Sl. No.	Items of work	Unit	Rate	No.	Amount
1	Cutting of Trees, including Cutting of Trunks, Branches and Removal (Cutting of trees, including cutting of trunks, branches and removal of stumps, roots, stacking of serviceable material with all lifts and up to a lead of 1000 mtrs and earth filling in the depression/pit.)				
(i)	Girth from 300 mm to 600 mm	each	80.00*	80	6400

(ii)	Girth from 600 mm to 900 mm	each	162.00*	70	11340
(iii)	Girth from 900 mm to 1800 mm	each	285.00*	100	28500
(iv)	Girth above 1800 mm	each	515.00*	582	299730
2	Clearing Grass and Removal of Rubbish	hectare	29138.00*		

*Refer Sl. No. 2.1 & 2.3 of Rate Analysis corresponding to MoRTH specification No. 201. The rates are subject to change according to the local conditions of the trees and the rates submitted by the OFDC for approval before commencement of tree felling.

Table: Schedule of Forest Land as per Land Records Available from Revenue Authority

Sl. No.	Name of the village	Plot No.	Kisam	Proposed area to be acquired (in ha.)	Village sheet no.	Tahasil
1	Baghajhari	1059	Village forest	0.05	05	Berhampur
2.	Baghajhari	1116	Village forest	0.102	05	Berhampur
3.	Baghajhari	Illegible	Village forest	0.132	05	Berhampur
4.	Mahugarahill	463	Village forest	0.043	04	Berhampur
5.	Balipada	Illegible	Village forest	0.124	03	Berhampur
6.	Nabarangapur	1080	Village forest	0.018	03	Digapahandi
7.	Nabarangapur	952	Patharabani (PB)	0.045	03	Digapahandi
8.	Nabarangapur	1154	Patharabani (PB)	0.016	03	Digapahandi
9.	P.laxminarayanpur	388	Village forest	0.07	02	Digapahandi
10.	P.laxminarayanpur	390	Village forest	0.02	02	Digapahandi
11.	P.laxminarayanpur	436	Village forest	0.005	02	Digapahandi
12.	P.laxminarayanpur	392	Village forest	0.013	02	Digapahandi
13.	Rajanpalli	7	Village forest	0.0333	01	Digapahandi
14.	Rajanpalli	9	Village forest	0.0267	01	Digapahandi
15.	Rajanpalli	234	Village forest	0.0768	04	Digapahandi
16.	Rajanpalli	169	Village forest	0.0288	03	Digapahandi
17.	Rajanpalli	575	Village forest	0.007	06	Digapahandi

18.	Rajanpalli	617	Village forest	0.0648	06	Digapahandi
19.	Rajanpalli	92	Village forest	0.0152	06	Digapahandi
20.	Rajanpalli	90	Village forest	0.0164	03	Digapahandi
21.	Rajanpalli	230	Village forest	0.0044	04	Digapahandi
22.	Rajanpalli	1161	Village forest	0.0044	01	Digapahandi
23.	Rajanpalli	1160	Village forest	0.0164	01	Digapahandi
24.	Rajanpalli	1159	Village forest	0.026	01	Digapahandi
25.	Daseipur	39	Village forest	0.0552	03	Digapahandi
Total		25 Plots	23 VF & 2 PB	1.0134	9	Berhampur -5 plots Digapahandi -20 plots

The maps of Mahugharahill, the hills at Tikarpada and Balipada on the left and right along with the forest land on the left opposite the Padarbali village and Mahurikalua road junction have not been accounted for as the detail map corresponding to the land schedule of the villages were not available. This will be added after the published maps are made available by Survey and Map publication Govt. of Orissa. This shows the total forest land affected comes within 1.0134ha. which is within the power of State Govt. under forest conservation act guideline to be release for road improvement activity.

Table showing abstract of biodiversity survey conducted on Phase-I road July to September 2007

Sl. No.	SH No.	Name of the SH	Particulars of stake holders interviewed					Total
			Forest Employees	Residents	Commercial establishment	Pedestrians	Auto mobiles	
1	SH-9	Bhadrak – Chandbali	5	30	10	5	15	65
2	SH-53	Bhadrak – Anandapur – Karanjia	5	45	15	15	10	90
3	SH-49	Karanjia – Tangabila (Jashipur)	1	5	3	5	10	24
4	SH-17	Berhampur – Bangi Jn.	11	65	20	45	25	166
5	SH-4	Bangi – Rayagada	4	18	11	10	8	51

6	SH-5 &6	JKPur – Muniguda – Bhawanipatna	8	12	10	10	10	50
7	SH-16	Bhawanipatna – Khariar	4	15	9	27	8	63
8	SH-65A to 64	Daspalla – Gania – Nuagada – Hindol – Mahidharpur – Angul	6	20	12	35	5	78
9	SH-7	Aska – Bhanjanagar	4	12	10	7	8	41
Total			48	222	100	159	99	628

- The result of the survey conducted involving 628 personalities of diverse background and views on wildlife indicated that many persons are having rudimentary ideas on need of wildlife and environment other than opining for protection of forest and preventing wildlife to come out of forest. Many persons declined to sign the documents and did not answer the forms given to them. In such cases their statement only recorded on the forms and it was reflected on the corridor strip map for wildlife survey.
- The survey could not provide specific information on accident of wildlife on the road, though lots of frogs, lizards, snakes, birds and small mammals reportedly come under the wheels near wet land habitat, water body, culverts, agricultural fields. The common man does not consider these creatures wildlife.
- The movement of tiger was not reported from any quarter through panthers were reported to be present in Satkosia RF and Chheratangara RF of Karanjia, nala ghat of Parelekhemundi, Saradhapur RF and Makundapur ghat of Rayagada forest divisions. Similarly movement of elephants, gaur, sambar, dear and Nilgai were reported from Taptapani to Bangi, Bangi to Rayagada, Bhawanipatna to JKPur, Narsinghpur to Hindol, Anandapur to Karanjia.
- The presence of civets, pythons, palm civets, fishing cats, otters, turtles, crabs, monitor lizard, yellow monitor and gray monitor, cobra, rat snake, jungle cat, jackals were reported from Chandbali – Bhadrak – Anandapur zone.
- Bears were singularly reported to be a threat for human beings between Digapahandi to Maulabhanja Bridge on SH-17, Anandapur to Kodapada on SH-53.
- The man animal conflict has been very severely affecting the economy of farmers and tribals within the forest and on the out skirts of forest where entire paddy crop and vegetable gardens of Potato, pumpkin, water melon, musk melon, cluster bin, asparagus bins, tomatoes, cauliflowers were devastated along with destruction of their house and store harvested paddy in Ganjam, Gajapati, Rayagada, Keonjhar, Mayurbhanj, Cuttack, Dhenkanal and Angul district. The steps to provide wildlife

underpass at specific points is therefore likely to influence adverse public opinion in elephant and bear menace sites along the corridor.

Number of Medium and Giant trees likely to be removed from the RoW as per proposed centre line of the SH-17 (Part) from 0/0km to 41/0 km

TREE COUNTING (KM 0-41)

BERHAMPUR-TAPTAPANI(0.0km TO 41.0km)				
SI No.	CHAINAGE	LEFT	RIGHT	TOTAL
1	0.0-1.0km	1	0	1
2	1.0-2.0km	3	0	3
3	2.0-3.0km	4	4	8
4	3.0-4.0km	8	11	19
5	4.0-5.0km	2	6	8
6	5.0-6.0km	13	18	31
7	6.0-7.0km	11	12	23
8	7.0-8.0km	10	8	18
9	8.0-9.0km	7	7	14
10	9.0-10.0km	4	8	12
11	10.0-11.0km	3	4	7
12	11.0-12.0km	1	2	3
13	12.0-13.0km	0	4	4
14	13.0-14.0km	3	1	4
15	14.0-15.0km	1	1	2
16	15.0-16.0km	1	2	3
17	16.0-17.0km	4	7	11
18	17.0-18.0km	1	7	8
19	18.0-19.0km	8	4	12
20	19.0-20.0km	4	3	7

21	20.0-21.0km	3	4	7
22	21.0-22.0km	2	7	9
23	22.0-23.0km	5	2	7
24	23.0-24.0km	8	3	11
25	24.0-25.0km	9	15	24
26	25.0-26.0km	7	2	9
27	26.0-27.0km	14	7	21
28	27.0-28.0km	9	7	16
29	28.0-29.0km	6	3	9
30	29.0-30.0km	2	6	8
31	30.0-31.0km	17	29	46
32	31.0-32.0km	34	27	61
33	32.0-33.0km	34	8	42
34	33.0-34.0km	15	29	44
35	34.0-35.0km	8	10	18
36	35.0-36.0km	21	16	37
37	36.0-37.0km	23	14	37
38	37.0-38.0km	36	10	46
39	38.0-39.0km	5	10	15
40	39.0-40.0km	16	13	29
41	40.0-41.0km	22	24	46
Total		385	355	740

Total no. of plants 2220 to be planted @1,84,900/- per 400 plants per km =Rs.10,26,195/-

There are 740 no. of trees about to be sacrificed on account of road improvement as per the final layout plan showing the proposed centre line. The left side of the corridor contains 385 such trees and the right side 355 trees. The actual number of trees may vary depending on the additional survey of tree growth that will be acquired and compensated for being the property of private parties, which has not been

evaluated and the trees over forest land, which has not been identified and enumerated due to want of Sabik, Kism and plot numbers as per Sabik RoR corresponding to the Hal RoR. The above table shows the km wise number of trees belonging to the OWD with a girth at BH (breast height) ranging from 1000 mm to 2400 mm and above. Compensatory plantation of 3 times the total number of trees (740X 3) or 2220 plants shall be taken up along the corridor including site enhancement plantations, so as to improve the environment.

The cost of such plantation shall be as per the cost norm furnished in accordance to in **Annexure – XXXVI (A) to (F)** of this report and the cost of fencing with painted wire mesh gabions @500/- per gabion as per design details in drawing no. **OSRP /CEG /SH /ENV /08**. (Cost norm details are in the DPR, which includes the materials, with cost of fabrication, painting, carriage and embedding in cement concrete M-15 at the planting site in a circular shape)

SL No.	ITEM	Unit	No	Length	Width	Area in sqm.	Rate /Sqm.	Amount	Total no.	Cost in lakh
1	Tree Guard including cost of fabrication, carriage, painting, installation & embedding in cement concrete	Kg	1	2.1mtr	0.75 mtr	4.95	150.00	743.00	2496	18.55

NO OF TREES FROM CH.2.000km TO 69.400km

BHAWANIPATNA-KHARIAR

(As per proposed centre line)

SI No.	CHAINAGE	LEFT	RIGHT	TOTAL
1	2.0-3.0km	32	14	46
2	3.0-4.0km	33	22	55
3	4.0-5.0km	23	20	43
4	5.0-6.0km	51	28	79
5	6.0-7.0km	46	33	79
6	7.0-8.0km	58	14	72
7	8.0-9.0km	54	30	84
8	9.0-10.0km	29	22	51
9	10.0-11.0km	17	23	40
10	11.0-12.0km	31	32	63
11	12.0-13.0km	35	34	69
12	13.0-14.0km	22	25	47

13	14.0-15.0km	34	37	71
14	15.0-16.0km	33	39	72
15	16.0-17.0km	41	38	79
16	17.0-18.0km	19	27	46
17	18.0-19.0km	35	27	62
18	19.0-20.0km	38	32	70
19	20.0-21.0km	37	18	55
20	21.0-22.0km	34	17	51
21	22.0-23.0km	41	36	77
22	23.0-24.0km	33	38	71
23	24.0-25.0km	17	14	31
24	25.0-26.0km	31	30	61
25	26.0-27.0km	23	12	35
26	27.0-28.0km	3	4	7
27	28.0-29.0km	0	0	0
28	29.0-30.0km	0	2	2
29	30.0-31.0km	2	9	11
30	31.0-32.0km	1	1	2
31	32.0-33.0km	8	6	14
32	33.0-34.0km	7	5	12
33	34.0-35.0km	3	2	5
34	35.0-36.0km	6	5	11
35	36.0-37.0km	3	4	7
36	37.0-38.0km	11	11	22
37	38.0-39.0km	23	24	47
38	39.0-40.0km	21	22	43
39	40.0-41.0km	9	13	22
40	41.0-42.0km	4	2	6

41	42.0-43.0km	5	4	9
42	43.0-44.0km	7	7	14
43	44.0-45.0km	24	10	34
44	45.0-46.0km	6	10	16
45	46.0-47.0km	12	13	25
46	47.0-48.0km	7	5	12
47	49.0-50.0km	2	5	7
48	50.0-51.0km	11	9	20
49	51.0-52.0km	17	26	43
50	52.0-53.0km	23	15	38
51	53.0-54.0km	7	6	13
52	54.0-55.0km	8	10	18
53	55.0-56.0km	14	7	21
54	56.0-57.0km	15	7	22
55	57.0-58.0km	90	31	121
56	58.0-59.0km	0	1	1
57	59.0-60.0km	5	1	6
58	60.0-61.0km	4	6	10
59	61.0-62.0km	27	25	52
60	62.0-63.0km	6	7	13
61	63.0-64.0km	8	5	13
62	64.0-64.4km	6	3	9
63	65.0-66.0km	10	8	18
64	66.0-67.0km	2	2	4
65	67.0-68.0km	9	15	24
66	68.0-69.0km	0	4	4
67	69.0-69.4km	1	2	3

Total no. of plants 6870 to be planted @1,84,900/- per 400 plants per km =Rs.31,75,6571/- or 31.75lakhs

There are 2290 no. of trees about to be sacrificed on account of road improvement as per the final layout plan showing the proposed centre line. The left side of the corridor contains 1274 such trees and the right side 1016 trees. The actual number of trees may vary depending on the additional survey of tree growth that will be acquired and compensated for being the property of private parties, which has not been evaluated and the trees over forest land, which has not been identified and enumerated due to want of Sabik, Kisam and plot numbers as per Sabik RoR corresponding to the Hal RoR. The above table shows the km wise number of trees belonging to the OWD with a girth at BH (breast height) ranging from 1000 mm to 2400 mm and above. Compensatory plantation of 3 times the total number of trees (2290X3) or 6870 plants shall be taken up along the corridor including site enhancement plantations, so as to improve the environment.

The cost of such plantation shall be as per the cost norm furnished in accordance to in **Annexure – XXXVI (A) to (F)** of this report and the cost of fencing with painted wire mesh gabions @500/- per gabion as per design details in drawing no. **OSRP /CEG /SH /ENV /08**. (Cost norm details are in the DPR, which includes the materials, with cost of fabrication, painting, carriage and embedding in cement concrete M-15 at the planting site in a circular shape)

Formation of Monitoring committee to Stream line and facilitate speedy implementation of the corridor development through inter and intra departmental coordination.

The inter agency coordination to oversee the environment and biodiversity related matter may be tackled by formation of committee under the;

- Chairmanship of local Conservator Forest
- Executive Engineer of the project as convener cum members secretary.
- Divisional Forest officer, wildlife /territorial division.
- Zonal manager OFDC ltd.
- Divisional Manager (commercial) OFDC ltd.
- Local Tahasildar
- Supervision Consultant of OWD

This committee will look after the identification of forestland, speedy enumeration of tree growth over such land, preparation of a register to record the number of trees to be retained along the corridor.

The committee will fix up modalities for early issue of felling, logging and passing orders by the concerned Divisional Forest Officer having jurisdiction over the area as soon as the clearance under forest (conservation) act is obtained from the competent authority and the enumeration list jointly prepared by the local forest department, PIU

of OWD and divisional staff of OFDC entrusted with the job of tree felling and removal.

The committee will take necessary steps for appointment of a specific officer of forest department not below the rank of a Range Officer to take up passing of converted trees within the acquired forest and non forest land from time to time.

The committee will fix up the modalities of passing at regular interval of 15 days and issue of permits by the passing officer, where the logs and fire wood is removed from the forest land, revenue land and other Govt. of private land.

The committee will assign specific tasks and agency to local Divisional Forest officer /Bana Samrakshayana Samiti to take up activities like plantation in degraded forest land adjacent to the corridor of wildlife movement, camouflage corridor planting on either opening of wildlife underpass, gully plugging and check damming other soil and water conservation measures in forest land and Podu ravaged areas, which shall be open to inspection and monitoring by the supervision consultant /environment expert of the OWD and the site engineer of OWD.

The committee will deliberate on difficulties and draw backs in the implementation and settling of all differences and bottlenecks in the field and office level.

The other invited member may be the contractor of the package, who has been interested with the job of avenue plantation and corridor soil and water conservation measure, habitat development as well as site enhancement activities within the RoW and up to the boundary of forest land beyond RoW.

The committee will entrust the job of monitoring the movement of wildlife after the project work is completed through the local range officer and the assistant engineer of the OWD together with any environment and Wildlife Expert /NGO active in the field of monitoring wildlife issues for evaluation of various biodiversity an environmental structures proposed to be erected as mitigation measures.

There shall be a district level committee under the Chairmanship of district Collector for monitoring and speedy implementation of activities relating to:

- Shifting of utilities
- Relocation of tube wells, stand posts, statues, religious structures.
- Shifting of the boundary walls, gates and other utilities of schools, colleges, hospitals, old age homes, burial grounds, water bodies, diversions etc.
- Monitoring the activities related to removal of trees and plantation activities along the corridor.
- Establishment of check posts on the proposed road.

The members of the committee shall be all the district level heads of authority relating to forest, wildlife, electric supply, water supply, health, community development, endowments, labour welfare, regional transport authority, police, panchayatraj

institution, education, tourism, district level disaster mitigation authority, prominent environment experts, non govt. agencies active in health and sanitation, socio economic development of rural areas. The sitting of both the committee shall be once every month to review the activities, progress and bottleneck for finding out the expeditious solutions for early disposal of the activities.

Schedule of plantation to be raised along the water bodies by relocating trees from the avenue and planting on the embankment of ponds, rivers, streams and wildlife underpass

Table showing right and left side Avenue planting

Sl. No.	Left Chainage		Total length (in mtr)	Right Chainage		Total length	No. of plants at 5mtr X5mtr	No. of shrubs /small trees at 5mtrX5mtr spacing
	From	To		From	To			
1	0.120	0.150	30	0.140	0.250	110	28	28
2	0.270	0.450	180	0.600	1.000	400	116	116
3	2.200	2.500	300	1.000	1.605	605	181	181
4	2.600	2.930	330	1.600	2.100	500	166	166
5	3.440	4.000	560	2.180	2.340	160	144	144
6	4.000	4.300	300	3.500	4.000	500	160	160
7	5.000	5.220	220	4.000	4.300	300	104	104
8	5.000	5.400	400	4.440	4.542	102	100	100
9	6.200	6.900	700	5.000	5.950	950	330	330
10	7.400	7.700	300	6.000	6.750	750	210	210
11	8.000	8.200	200	7.300	7.350	50	50	50
12	8.400	9.800	400	7.450	7.700	250	130	130
13	10.600	11.000	400	8.000	8.300	300	140	140
14	11.000	11.200	200	8.350	9.800	450	130	130
15	11.350	11.600	250	10.670	11.000	330	116	116
16	11.900	12.000	100	11.000	11.200	200	60	60
17	12.000	12.700	700	11.350	11.630	280	196	196
18	13.000	13.100	100	11.900	12.700	800	180	180
19	13.700	14.000	300	13.000	13.050	50	70	70
20	14.000	15.000	1000	13.700	14.000	300	260	260
21	15.300	15.600	300	14.000	14.100	100	80	80
22	16.000	17.000	1000	14.200	14.800	600	320	320
23	17.480	17.800	320	15.300	15.620	320	128	128
24	17.950	18.150	200	16.000	17.000	1000	240	240
25	19.150	20.000	850	17.450	17.800	350	240	240
26	20.000	20.400	400	17.950	18.150	200	120	120
27	21.100	21.600	500	19.180	19.250	70	114	114
28	22.000	22.200	200	19.900	20.000	100	60	60
29	22.250	22.525	275	20.390	20.590	200	95	95
30	24.800	24.900	100	21.100	21.650	550	130	130
31	25.500	25.900	400	21.800	21.900	100	100	100
32	26.000	26.350	350	22.000	22.200	200	110	110
33	26.550	26.800	250	22.250	22.700	450	140	140
34	27.000	28.000	1000	23.000	23.100	100	220	220
35	28.500	29.000	500	25.550	25.700	150	130	130
36	29.000	29.250	500	26.000	26.100	100	120	120
37	29.700	30.000	300	26.475	26.700	225	105	105
38	30.200	30.900	700	27.000	28.000	1000	340	340
39	31.550	32.000	450	28.500	29.000	500	190	190
40	32.500	32.230	270	29.000	29.250	250	104	104
41	32.230	32.300	70	29.600	30.100	500	114	114
42	33.333	33.700	377	30.200	30.295	95	94	94
43	33.700	34.050	350	31.550	32.000	450	160	160
44	34.900	35.700	800	32.050	32.230	180	196	196
45	36.145	36.204	59	32.300	32.350	50	22	22
46	36.400	36.600	200	33.350	33.700	350	110	110

47	36.800	36.950	150	33.700	33.960	360	102	102
48	36.210	38.200	1990	34.950	35.650	700	538	538
49	39.000	39.140	140	36.145	36.200	55	39	39
50	39.400	40.000	600	36.450	36.630	180	156	156
51	40.300	40.400	100	36.850	36.900	50	30	30
52	40.525	41.000	475	36.210	38.500	2290	553	553
53	-	-	-	38.600	38.800	200	40	40
54	-	-	-	40.300	40.500	200	40	40
55	-	-	-	40.700	40.890	190	38	38

Cost of planting with relocation of species brought from the avenues with 3-year maintenance

@500/- each 8189 no. of trees= Rs.40,94,500
 @150/- each 8189 no. of shrubs & bushes = Rs.12,28,350

The costing for corridor camouflage plantation shall be as per the cost norms of plantation furnished at **Annexure XXXVI (C)** @15900/- per ha. which shall be calculated as below for wildlife underpass in forested areas plantation of 10mtr X 50mtr on either side will be carried out leaving the culvert and streams open, so as to allow free movement of wildlife. There are all total 20 such locations as per the table no. **XXV (B) to (D)** for year-1 roads excluding the underpasses on Chandbali – Bhadrak and Bhadrak – Anandapur corridor, where there will be 1 wildlife underpass plantation at 40.242km chainage before Anandapur



Annexure 1: Questionnaire for Wild Life Survey (Discussion at Institutional Level)

The Foresters, Rangers and Forest Officers will be requested to provide specific information about the floral and faunal inventory in the area, location of water holes, location of road crossing, etc.

1	Do you know about OSRP? Yes / No	Yes
2	Which are the predominant wildlife species present in your area and provide species wise inventory.	Elephant, Tiger, Panther, Bear, Sambar, Dear, Barking dear, Monkey, Rattle, Hare, Snake, Mongoose, Monitor lizard etc.
3	Which are the identified wildlife corridor in the range under your jurisdiction? What is periodicity of movement of wildlife in these corridors?	Only 1 bear pass at 27km and occasional elephant crossing at 41km to 42km Movement during yearly winter up to end of summer i.e. mid September to mid June.
4	Which floral species are available in your range?	Trees like Sal, Sisoo, Biza, Tik, Arjun, Kadamba, Fasi, Asan, Pipal, Banion, Mahul, Mango, Tamarind etc. There are climbers, shrubs and herbs of many varieties.
5	What are the medicinal plants species available in your area?	Bel, Neem, Amla, Sandal wood, Ankula, Asperagus, Bridhadarak, Raulvolfia, Apamarga.
6	Kindly mark locations of water holes on a sketch with approx. distance from project road and size of the water hole.	There are no specific water holes except the river basins and ponds on either side of the road from 0km to 41km, which are used as water hole during summer by the wildlife.
7	Please give your suggestions for protection of wildlife and forests.	People participation in forest management, allowing farm forestry in podu cultivation areas, encouraging private plantations and removing restrictions on felling and transport of private grown timber and fire wood.
8	What are reasons of wildlife crossing in your opinion?	Search for mate, food and fodder, search for shelter and water, running away from forest fire, hunter, mining explosion, highway development and fragmentation of corridor.
9	Have you noticed any change in wildlife behavior, movement, multiplication in the past? In case yes, what are possible reasons for	Yes, Wildlife is entering into habitations and

	these changes?	agricultural area more frequently even though there is no food source in the field, because of the loss of habitat and biotic interference.
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Details official contacted

Name:	Designation:	Date:
S.C.Behera	Range officer Mohana	July 27 2006
R.C.Mohapatra	Range officer Digapahandi	July 27 2006
Suresh Mishra	Range officer Podamari	July 29 2006

Biodiversity Survey of Different Corridors

Berhampur Range

1. A. What are the wild life found in the area	Elephant, Bear, Rattel, Jackal, Hyena, Civet, Otter, Hare, Porcupine, Fox, Snakes, Bull frogs, Toad, Monitor lizard, Fresh water fish etc.
B. Timing of sighting animal	Night/Late Night, Dawn/Early Morning occasionally in the evening.
C. Where mostly found crossing of road	Chainage 1.52km to 2.5km, 9.0km to 10.0km, 13.0km to 17.0km
D. Season of crossing	Winter/Summer/ Rainy season
E. Reasons of Wild life movement	Mating, Feeding, Hunting, Nesting, Scavenging, escaping.
1. Traditional or Sporadic /Specific	Less Traditional more Sporadic or Specific at places
a. Annual migration b. Seasonal Migration	Seasonal
2. Summer movement for food /water.	Summer
3. Winter movement for crops foraging and feeding or hunting.	Yes
4. Under threat:	
a. Forest Fire	Yes
b. Podu Cultivation	Yes
c. Chased by hunters/ Predators	Yes
d. Man animal conflict.	Yes
5. For Salt lick and water holes.	For water holes.
6. Destruction of habitat / Stone quarry/ Movement of heavy machinery/ destructions of habitat.	Yes, Stone quarry, Destruction of habitat
Development project work/ any other factor	N.A.
F. Location of Perennial /Seasonal water source/ Waterholes/Salt licks/ponds/Marsh land a. Name of River/ Nallah / Spring / Pond / Artificial departmental water holes/ salt licks etc. b. Distance from the road.	Dakhinapur MIP and Rusikulya canal system. Lanjia ponds, Tikarpada MIP, Within the corridor limits.

<p>G. What are the preventive measures to be taken to Prevent Wild life crossing the road and to record their causative factors of movement more precisely</p> <ol style="list-style-type: none"> Departmental Community oriented/ signage etc. Protection measures like Food and Water source development. Development of the saltlick with water source in the forest. Optical illusion effects /Reflector /holographic reflectors. 	<p>No comments</p> <p>Development of habitat through protection of natural forest growth</p> <p>Not required</p> <p>It will have no effect.</p>
<p>H. From which area to which area across the road annual movement is noticed Name of forest blocks/ Rev. Village/ Chainage to be furnished as per the corridor length.</p>	<p>From Ramaguda RF on the left and water bodies on the right at Dakhinapur /Lanjia /Tikarpada /Padar bali.</p>
<p>1. Any damage to life and property by wild animals during last 3 years?</p>	<p>Elephants have done damaged property and life of human beings in Dakhinapur during the past 2 year and current year 2006.</p>
<p>2. Are there Forest fire? Yes /No Reasons Time of fire Month</p>	<p>Yes, Hardly any vegetation worth the name to be destroyed other than the rooted wastes of natural forest.</p>
<p>1. Do forest fires occur frequently? Yes /No When / How</p>	<p>No, Forest fire during winter and early summer for collection of fire wood, hunting of small animals like hare, porcupine, fox and civets for collection of mahua flower and seeds, mangoes.</p>
<p>Month of fire a. Accidental</p>	<p>February to April •</p>
<p>b. Natural</p>	<p>•</p>
<p>c. By food gatherers</p>	<p>•</p>
<p>d. Podu cultivators</p>	<p>•</p>
<p>e. Hunters/NTFP gatherers</p>	<p>Yes</p>
<p>f. Tourist and local vandalism</p>	<p>•</p>
<p>g. Lightning effect</p>	<p>•</p>
<p>3. Dependence on forest as a source of lively hood</p>	<p>•</p>
<p>1. Food/Fodder/Fire wood</p>	<p>Yes, Fire wood</p>
<p>MFP/NTFP</p>	<p>Yes, NTFP</p>
<p>2. Eco tourism</p>	<p>No</p>
<p>Protection measures suggested</p>	<p></p>
<p>1. Creation of water holes on site of corridor</p>	<p>There are number of natural water holes.</p>
<p>2. Creation of barriers/Vertical retaining walls on road side</p>	<p>Not required</p>
<p>a. Reflectors mounted on roadside.</p>	<p>Yes</p>
<p>b. Raising of food parks</p>	<p>It will not be effective due to grazing.</p>

c. Road under bridge for free passage with vertical wing walls.	Yes
d. Formation of village committees to prevent hunting and destruction of habitat/forest fire.	Yes
e. Voluntary conservation of rooted wastes to allow forest growth and restocking	Yes
f. Supplement gaps with source of food chain specific plantation of species, which are the source of food for wild life by educating the locals and residents alike on importance of wild life habitat and wild life for socio-economic and aesthetic consideration.	By conservation of natural growth with soil and water conservation measures in the nala and stream beds, creeks, prevention of erosion.
g. Creation of meadows.	Not applicable.
h. A gava planting in staggered manner along with tribulus territories herbal seed sowing to prevent elephant crossing.	Not required
i. Changing over to other crop	Not required

Name and address of the : Ramchandra Gouda, Dakhinapur, Ganjam
Pratam Kumar Ratha, Checknakaguard
Brundabana Gouda, Tikarpada, Po.Balipada, Ganjam
Minaketan Das, Lanjia, Po.Lanjia, Ganjam
27/09/2006

Biodiversity Survey of Different Corridors

Digapahandi Range

1. A. What are the wild life found in the area	Bear, Jackal, Hyena, Civet, Hare, Snakes, Bull frogs, Toad etc.
B. Timing of sighting animal	Night/Late Night occasionally in the evening.
C. Where mostly found crossing of road	Chainage 26.5km to 29.5km,
D. Season of crossing	Winter/Summer/ Rainy season
E. Reasons of Wild life movement	Mating, Feeding
1. Traditional or Sporadic /Specific	Traditional and Specific
a. Annual migration	Seasonal
b. Seasonal Migration	
2. Summer movement for food /water.	Movement for mating
3. Winter movement for crops foraging and feeding or hunting.	Yes
4. Under threat:	
a. Forest Fire	Yes
b. Podu Cultivation	No
c. Chased by hunters/ Predators	No
d. Man animal conflict.	Yes
5. For Salt lick and water holes.	For water holes.
6. Destruction of habitat / Stone quarry/ Movement of heavy machinery/ destructions of habitat.	Yes, Stone quarry, Destruction of habitat
Development project work/ any other factor	Development of road project work
F. Location of Perennial /Seasonal water source/ Waterholes/Salt licks/ponds/Marsh land	Ghodahada river, Natural springs, Dug wells in sugar cane fields, Ghodahada irrigation canal.
c. Name of River/ Nallah / Spring / Pond / Artificial departmental water holes/ salt licks etc.	
d. Distance from the road.	More than 3km to less than 500mtr
G. What are the preventive measures to be taken to Prevent Wild life crossing the road and to record their causative factors of movement more precisely	Yes
e. Departmental Community oriented/ signage etc.	
f. Protection measures like Food	Development of habitat through protection of natural forest growth

and Water source development. g. Development of the saltlick with water source in the forest. h. Optical illusion effects /Reflector /holographic reflectors.	Not required Yes, It will have effect.
H. From which area to which area across the road annual movement is noticed Name of forest blocks/ Rev. Village/ Chainage to be furnished as per the corridor length.	From Changudidei hills (PF) on the left and Jagannathpur PF on the right 6km away across river and agricultural land.
1. Any damage to life and property by wild animals during last 3 years?	Bears have damaged sugar cane, pea nut, water melon, cucumber, crops as well as maimed local villagers all around.
2. Are there Forest fire? Yes /No Reasons Time of fire Month	Yes, this is a rocky exposure of boulders on either side hills (PF) with spa race vegetation, forest fires are rare.
1. Do forest fires occur frequently? Yes /No	No,
When / How	Forest fire during early summer rarely for collection of fire wood, hunting of small animals like hare.
Month of fire	March
a. Accidental	•
b. Natural	•
c. By food gatherers	•
d. Podu cultivators	•
e. Hunters/NTFP gatherers	•
f. Tourist and local vandalism	•
g. Lightning effect	•
3. Dependence on forest as a source of lively hood	•
1. Food/Fodder/Fire wood MFP/NTFP	Yes, Fire wood •
2. Eco tourism	No
Protection measures suggested	
1. Creation of water holes on site of corridor	There are number of natural water holes.
2. Creation of barriers/Vertical retaining walls on road side	Not required
a. Reflectors mounted on roadside.	Yes
b. Raising of food parks	It will not be effective due to grazing.
c. Road under bridge for free passage with vertical wing walls.	Yes
d. Formation of village committees to prevent hunting and destruction of habitat/forest fire.	Yes
e. Voluntary conservation of rooted wastes to allow forest growth and restocking	Yes

f. Supplement gaps with source of food chain specific plantation of species, which are the source of food for wild life by educating the locals and residents alike on importance of wild life habitat and wild life for socio-economic and aesthetic consideration.	By conservation of natural growth with soil and water conservation measures in the nala and streambeds, creeks, prevention of erosion. Along with approach corridor development at either end of the underpass.
g. Creation of medows.	Not applicable.
h. A gave planting in staggered manner along with tribulus territories herbal seed sowing to prevent elephant crossing.	Not required
i. Changing over to other crop	Not possible

Name and address of the : P.Narsingh Reddy, Moulabhanja, Po. Digapahandi, Dist-Ganjam
C.S. Rajababu, Dherendi, Po. Digapahandi, Dist-Ganjam
Sambaru Sabara, Indrabasa Po. Digapahandi, Dist-Ganjam
Laxmi Reddy, Moulabhanja, Po. Digapahandi, Dist-Ganjam
P.R.K. Patra, shopkeeper, Moulabhanja, Po. Digapahandi, Dist-Ganjam

Biodiversity Survey of Different Corridors

Podamari Range

1. A. What are the wild life found in the area	Bear, Jackal, Hyena, Civet, Hare, Snakes, Bull frogs, Toad, Fresh water fish, Turtles, Otters etc.
B. Timing of sighting animal	Night/Late Night occasionally in the evening.
C. Where mostly found crossing of road	Chainage 28km to 31km
D. Season of crossing	Winter/Summer/ Rainy season
E. Reasons of Wild life movement	Mating, Feeding
1. Traditional or Sporadic /Specific	Traditional and Specific
a. Annual migration	Seasonal
b. Seasonal Migration	
2. Summer movement for food /water.	Movement for mating and feeding
3. Winter movement for crops foraging and feeding or hunting.	Yes
4. Under threat:	
a. Forest Fire	Yes
b. Podu Cultivation	No
c. Chased by hunters/ Predators	No
d. Man animal conflict.	Yes
5. For Salt lick and water holes.	For water holes.
6. Destruction of habitat / Stone quarry/ Movement of heavy machinery/ destructions of habitat.	Yes, Stone quarry, Destruction of habitat
Development project work/ any other factor	Development of road project work
F. Location of Perennial /Seasonal water source/ Waterholes/Salt licks/ponds/Marsh land	Ghodahada river, Natural springs, Dug wells in sugar cane fields, Ghodahada irrigation canal.
e. Name of River/ Nallah / Spring / Pond / Artificial departmental water holes/ salt licks etc.	
f. Distance from the road.	More than 3km to less than 500mtr
G. What are the preventive measures to be taken to Prevent Wild life crossing the road and to record their causative factors of movement more precisely	Yes
i. Departmental Community oriented/ signage etc.	
j. Protection measures like Food	Development of habitat through protection of natural forest growth

and Water source development. k. Development of the saltlick with water source in the forest. l. Optical illusion effects /Reflector /holographic reflectors.	Not required Yes, It will have effect.
H. From which area to which area across the road annual movement is noticed Name of forest blocks/ Rev. Village/ Chainage to be furnished as per the corridor length.	From Changudidei hills (PF) on the left and Jagannathpur PF on the right 6km away across river and agricultural land.
1. Any damage to life and property by wild animals during last 3 years?	Bears have damaged sugar cane, pea nut, water melon, cucumber, crops as well as maimed local villagers all around.
2. Are there Forest fire? Yes /No Reasons Time of fire Month	Yes, this is a rocky exposure of boulders on either side hills (PF) with sparse vegetation, forest fires are rare.
1. Do forest fires occur frequently? Yes /No	No,
When / How	Forest fire during early summer rarely for collection of fire wood, hunting of small animals like hare.
Month of fire	March
a. Accidental	•
b. Natural	•
c. By food gatherers	•
d. Podu cultivators	•
e. Hunters/NTFP gatherers	•
f. Tourist and local vandalism	•
g. Lightning effect	•
3. Dependence on forest as a source of lively hood	•
1. Food/Fodder/Fire wood	Yes, Fire wood
MFP/NTFP	•
2. Eco tourism	No
Protection measures suggested	
1. Creation of water holes on site of corridor	There are number of natural water holes.
2. Creation of barriers/Vertical retaining walls on road side	Not required
a. Reflectors mounted on roadside.	Yes
b. Raising of food parks	It will not be effective due to grazing.
c. Road under bridge for free passage with vertical wing walls.	Yes
d. Formation of village committees to prevent hunting and destruction of habitat/forest fire.	Yes
e. Voluntary conservation of rooted wastes to allow forest growth and restocking	Yes

f. Supplement gaps with source of food chain specific plantation of species, which are the source of food for wild life by educating the locals and residents alike on importance of wild life habitat and wild life for socio-economic and aesthetic consideration.	By conservation of natural growth with soil and water conservation measures in the nala and streambeds, creeks, prevention of erosion. Along with approach corridor development at either end of the underpass.
g. Creation of meadows.	Not applicable.
h. A gavae planting in staggered manner along with tribulus territories herbal seed sowing to prevent elephant crossing.	Not required
i. Changing over to other crop	Not possible

Name and address of the : Ghanshyam Tripathy, Dengaosta, Po.Dengaosta, Ganjam
 Rabindranath Patra, Dengaosta, Po.Dengaosta, Ganjam
 Rarayan Gouda, Kansamari, Po.Podamari, Ganjam
 N.Balkrushna Reddy, Podamari, Po.Podamari, Ganjam

**List of Biodiversity Structures and Signage as mitigation and management plan.
Name of the road: SH – 17 (Part), Berhampur to Taptapani 0 to 41km**

Sl. No.	Chainage	Structures	Dimensions	Reference drawings no.	Remarks
1	2.137	Box Culvert with reptile pass viaduct either side and trap drain	1/23/0 – 600mm hume pipe, 1mtr /0.75 /1mtr trap drain 10mtr from the culvert either side. 2.117 to 2.136, 2.144 to 2.164 viaduct at 2.127 and 2.154	Annex.XXV C, OSRP /CEG /SH /Bio /REP-1 ER /BC /S/B/WC /XXVI B-1	Drain & viaduct Culvert
2	9.780	Box Culvert with reptile pass viaduct either side and trap drain	1/23/0 – 600mm hume pipe, 1mtr /0.75 /1mtr trap drain 10mtr from the culvert either side. Drain at 9.806 to 9.786, 9.814 to 9.834 viaduct at 9.816 and 9.824.	Annex.XXV C, OSRP /CEG /SH /Bio /REP-1 ER /BC /S/B/WC /XXVI B-1	Drain & viaduct Culvert
3	24.700	Forest check gate with check naka shed and lay bye for parking	Barrier across the road relocated from 24.350km to 24.7km on account of Punjikayan junction, Digapahandi	As will be designed and fixed by the forest department	To check movement of forest and wildlife products
4	27.026	Sloth bear underpass	1 /22 /0 new culvert with high retaining wall and barricade to prevent bear movement over road. Barricade 26.975 to 27.005, 27.031 to 27.061km both side	Annex.XXV C, ER /BC /S/B/WC /XXVI B-1	Culvert
5	36.750	Reptile and small animal underpass	1 /22 /0 Box culvert	ER /BC /S/B/WC /XXVI B-1	Culvert
6	36.900	Forest check gate Podamari	Relocated from 36.800 to 36.900km on account of acquisition of land and building of forest department	As will be required and decided by forest department	For checking movement of forest and wildlife products
7	26.976	Left	Wildlife signage	SP – 36	Traffic signage
8	26.996	Left	Wildlife signage	SP – 37	Traffic signage
9	27.076	Right	Wildlife signage	SP – 36	Traffic signage
10	27.056	Right	Wildlife signage	SP – 37	Traffic signage
11	27.006	Left	Wildlife signage	SP – 47	Traffic signage
12	27.046	Right	Wildlife signage	SP – 47	Traffic signage
13	2.130	Left	Wildlife signage	SP – 49	Traffic

					signage
14	9.780	Left	Wildlife signage	SP – 49	Traffic signage
15	30.700	Left	Wildlife signage	SP – 49	Traffic signage
16	2.150	Right	Wildlife signage	SP – 49	Traffic signage
17	9.820	Right	Wildlife signage	SP – 49	Traffic signage
18	30.740	Right	Wildlife signage	SP – 49	Traffic signage
19	2.120	Left	Wildlife signage	SP – 40	Traffic signage
20	9.790	Left	Wildlife signage	SP – 40	Traffic signage
21	2.160	Right	Wildlife signage	SP – 40	Traffic signage
22	9.830	Right	Wildlife signage	SP – 40	Traffic signage
23	24.550	Left	Forest check gate	SP – 50	Traffic signage
24	36.950	Left	Forest check gate	SP – 50	Traffic signage
25	24.700	Right	Forest check gate	SP – 50	Traffic signage
26	37.000	Right	Forest check gate	SP – 50	Traffic signage
27	24.560	Left	Forest check gate	SP – 51	Traffic signage
28	36.960	Left	Forest check gate	SP – 51	Traffic signage
29	24.690	Right	Forest check gate	SP – 51	Traffic signage
30	36.990	Right	Forest check gate	SP – 51	Traffic signage



Form No. FCA – 1

SH No. _____ Name _____ Chainage from _____ to _____.

Sl. No.	Name of the village	Plot No.		Kisam		Proposed area to be acquired (in ha.)	Village sheet no.	Tahasil	District
		Hal	Sabik	Hal	Sabik				

The Sabik classification of all lands has to be verify as per the position of RoR entry prior to 1980 and those land, which were recorded as forest kisam of any description shall be brought under Sabik forest area going to be acquired in the project.

Form No. FCA – 2

Abstract of total forest land proposed to be acquired.

SH No. _____ Name _____ Chainage from _____ to _____.

Sl. No.	Name of Tahasil	District	Area under different Kisam of forest land					Total area
			RF	PRF	PF	VF /GJ	JB	

Form No. FCA – 3

Difference between Hal and Sabik forest area to be acquired.

Type of data.	Name of Tahasil	District	Area under different Kisam of forest land					Total area	
			RF	PRF	PF	VF /GJ	JB		PB
Hal									
Sabik									

RF – Reserved Forest, PRF – Proposed Reserved Forest, PF – Protected Forest, VF /GJ – Village Forest /Gramya Jungle, JB – Jungle Block, PB – Pathara Bani.

Form No. FCA – 4

Enumeration of growing stock on forestland to be acquired.

Table – 1 for Sample enumeration in case of areas more than 5 ha.*

Name of the forest block _____, Range _____ Division _____ From Chainage _____ to _____ SH No. _____
 Left / Right side of the road.

Sl. No.	Location chainage	Plot size	No. of plants under different category of girth class									Length of clear bole	Condition sound /unsound /others
			Species	30 – U/ 60cm	60 – U/90cm	90 – U/20cm	120 – U/150cm	150 – U/180cm	180 – U/210cm	210 – U/240	240 – and up		

**Note – The percentage of enumeration will decide the approximate number of trees per ha. which shall be 1% for a vast stretch of area, 5% for areas up to 10ha. and 10% for areas up to 5ha. and the figures multiplied after taking average of the enumerating results with total area. In case of areas 5ha. and below the total enumeration of trees has to be recorded. Separate enumeration list for separate type of forest land such as reserved forest /Proposed reserved forest /Protected forest /Village forest /Natural forest growth over non forest government land /plantation raised by forest department on any non forest land has to be prepared.*

Similar exercise for avenue plantations along the corridor has to be made for left and right side of the road separately as per the range /divisional jurisdiction of forest department.

Form No. FCA – 5

Species wise abstract of trees to be felled

Sl. No.	Class I /II /III	Name of the species	Girth Class							Total
			30 – U/ 60cm	60 – U/90cm	90 – U/20cm	120 – U/150cm	150 – U/180cm	180 – U/210cm	210 – U/240	

Note – This should be for all types of enumeration carried out over all types of land shown separately as per the enumeration list and appended to the enumeration list.

Form No. FCA -6

Estimation of NPV (Net Present Value) of the forest land for the total forest area to be acquired as per the Forest conservation act guideline F.No.5-1/98-FC(PT-II) MOEF Govt. FC division dated 17/18 September 2003@Rs.5.8 lakh to Rs. 9.2 lakh per ha. depending upon the quantity and density of land in question to be converted for non-forest use (as ordered by the Honorable Supreme Court of India)

Sl. No. of the Plot	Kisam of land	Area	No. of plants of enumerated	Density of the crop (per ha.)	Rate of NPV assessed to be applicable	Gross total cost (net present value of the growing stock)

List of Wildlife underpass in the corridor to facilitate movement of wildlife through sequencing of operation in such a manner that, the fauna is not over stressed or starved due to the fragmentation of the corridor.

Sl. No.	Name of corridor	Package No.	Construction activity								
			1 st Phase			2 nd Phase			3 rd Phase		
			Chainage		Structure	Chainage		Structure	Chainage		Structure
			Existing	Proposed		Existing	Proposed		Existing	Proposed	
1	SH - 9 (Part)	1	26.400	26.430	1/22 /0 Box	28.800	28.837	3/33/0 Box	40.95	40.974	1/23/0 Box
			30.050	30.154	3/33/0 triple Box	45.200	45.202	1/23/0 Box	31.600	31.700	1/43/0 Box
			36.005	35.825	3/33/0 Box	-	-	-	-	-	-
2	SH - 53 (Part)	1	13.800	13.507	1Mtr dia Pipe	17.200	17.002	1/22 /0 Box	12.200	11.869	1MT dia single pipe

			21.750	21.024	1/22/0 Box	34.040	34.040	Forest check gate to be shifted to feeder road	23.050	23.390	Unified forest check gate at toll plaza
			-	-	-	-	-	-	40.200	40.242	1/43/0 Box
2	SH-17 (Part)	1	2.140	2.137	1/23/0 Box	9.810	9.786	1/23/0 Box	39.930	39.935	Forest check gate with barrier
			24.600	24.634	Forest check gate with barrier and checking station building	26.850	27.020	1/22/0 Box	-	-	-
3	SH-16	1	18.850		1/34/0 Box	4.100		1/1M Single pipe	22.150		1/34/0 Box
			54.350		1/34/0 Box	65.100	64.900	1/33/0 Box	67.850		1/23/0 Box

Detail design of box culvert as per MOST specifications as per the Detail design furnished in the plan and profile of bridges and culvert drawings for each corridor. The special provision for wildlife shall be made as per the details of the drawings appended to Biodiversity Action Plan and Drawings of Bridges and Culverts.

Monitoring Form No.-1

Record of site enhancement to develop camouflage corridor on either side of wildlife underpass structure in Phase-I roads. Progress of activity

SH No	Name of the corridor	Total chainage	Location	Size of the Area planted	Species	Spacing	Total No. of plants	Date of planting	Date of completion

**Monitoring Form No.-2
Progress of cultural operations**

SH No. _____, Name, _____ Annual maintenance _____
 Inspected by _____ Designation _____
 Date and time of visit _____

Observations

1. Survival % on the date of Inspection.....
2. Progress of expenditure.....
3. Progress of activity.....
4. Deviation made if any
5. Minimum and maximum height of plants.....
6. Name of the promising species
attaining maximum growth.
7. Incidence of pests and diseases.....
8. Control measures taken.....
9. Any damage by wildlife /cattle /human being.....
10. Cause and preventing measures under taken.....
11. Recommendation /suggestion /modification /proposed.....

Signature date and time

Monitoring Form No.-3

Relocation of plants below 300mm girth at breast height at embankments, recreation sites, bus stop, water bodies, religious places, burial ground, weekly market, eroded and barren landscape degraded areas.

SH No. _____, Name, _____ Annual maintenance _____
 Inspected by _____ Designation _____
 Date and time of visit _____
 Location of the plantation _____

Observations

1. Date of planting
2. Survival % on the date of Inspection.....
3. Progress of expenditure.....
4. Progress of activity.....
5. Deviation made if any
6. Minimum and maximum height of plants.....
7. Name of the promising species
attaining maximum growth.
8. Incidence of pests and diseases.....
9. Control measures taken.....
10. Any damage by wildlife /cattle /human being.....
11. Cause and preventing measures under taken.....
12. Recommendation /suggestion /modification /proposed.....

Signature date and time

Monitoring Form No.-4

Plantation in degraded /eroded sides /avenue plantations

SH No. _____, Name, _____ Annual maintenance _____

Inspected by _____ Designation _____

Date and time of visit _____

Location of the plantation _____

SH No.	Name of the corridor	Total chainage	Location	Size of the Area planted	Species	Spacing	Total No. of plants	Date of planting	Date of completion

Observations

1. Survival % on the date of Inspection.....
2. Progress of expenditure.....
3. Progress of activity.....
4. Deviation made if any
5. Minimum and maximum height of plants.....
6. Name of the promising species
attaining maximum growth.
8. Incidence of pests and diseases.....
9. Control measures taken.....
10. Any damage by wildlife /cattle /human being.....
11. Cause and preventing measures under taken.....
12. Recommendation /suggestion /modification /proposed.....

Signature date and time

Monitoring Form No.-5**Study of biodiversity structures during construction**

SH No. and Name _____ Total chainage _____ Reference
biodiversity structure No. _____ Date and time of inspection _____ Name
of the inspecting officer _____
Name of the executive agency _____

Observation Details:

1. Whether location is as per the plan and design.
2. Date of commencement of work.
3. Progress made so far. (date of inspection)
4. Whether works are up to the specification and location specific.
5. Whether any temporary water holes have been erected on either side of the corridor to prevent stress of animals during pre and construction state.
6. Any modifications suggested in the design /location.
7. Recommendation /suggestion for improvement.
8. Probable date of completion.

Signature date and time

Monitoring Form No.-6

Progress of tree felling along the corridor:

SH No. and Name _____ Length _____ Report for the month ending _____
 From km _____ to _____ Left /Right

Sl. No.	Chainage	Total no. of tree marked	Total No. of tree felled			Total no. of logs obtained			Volume of logs			No. of firewood stacks			No. of logs passed for removal			Fire wood stacks passed for removal			No. of logs removed		
			P	N	T	P	N	T	P	N	T	P	N	T	P	N	T	P	N	T	P	N	T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

No. of fire wood stacks removed			Balanced trees to be felled	Balance logs to be removed	Balance fire wood stacks to be removed	Balance no. of trees to be felled	Reasons of non removal of materials
P	N	T					
25	26	27	28	29	30	31	32

Signature of the authority responsible for removal

Monitoring Form No.-7

For soil and water conservation measures including check dams, spurs gully plugging and embankment plantation along in the nala and gullies.

SH No. _____ Name _____ Date of inspection _____

Sl. No.	Location chainage	Left /right	No. of check dams constructed	Type of structure	No. of spurs erected	Type of spur	No. of trees planted	No. of shrubs planted	Date of completion	Present position	% of survival of plants

The report has to be submitted quarterly by the implementing agency to the resident engineer of PIU /Supervision consultant for inspection and recording of his observation in a register maintained in the field for such purposes.

Signature of the authority responsible for execution
/Inspecting authority

Monitoring Form No.-8

Post construction monitoring of wildlife movement

SH No. _____ Name _____ Date of inspection _____

Name of the officer recording the observations _____

Name of the inspection officer supervising the documentation _____

Sl. No. of the structure	Wildlife expected to use the facility	Date completion of the construction	Date on which wildlife was sited near /under the structure	Direction of movement	Time of movement	Probable reasons of movement	Name of the species	Number of animals sighted	Number of animal found avoiding the undermass	Whether camouflage corridor is used	Comments of the inspecting officer

Signature of the Inspecting authority /enumerator

Monitoring Form No. – 9

Study of corridor development and alternate cropping to avoid elephant and other wildlife menace near wildlife underpass locations.

SH No. _____ Name _____ For the qr. ending _____
 Biodiversity structure no. _____ Location chainage _____
 Officer monitoring the effect _____
 Period of study _____ Designation _____

Species of wildlife	Name of the village	Type of damage	Pattern of crops introduced	Results of damage recorded	Month of damage	Reasons	Suggestion for avoidance	Improvements /obstructions encountered	Local reaction if any

The date and period of collection of above data has to coincide with the season of movement of specific animal and period of previous damage pattern. The improvements suggested after minimum 3 years comprehensive study by motivating all the villagers /land owners to adopt uniform crop pattern, so as to repel the advance of wildlife to their area during the cropping season. The crops which were more susceptible to damage are to be identified out of the alternate crops recommended for introduction as a deterrent.

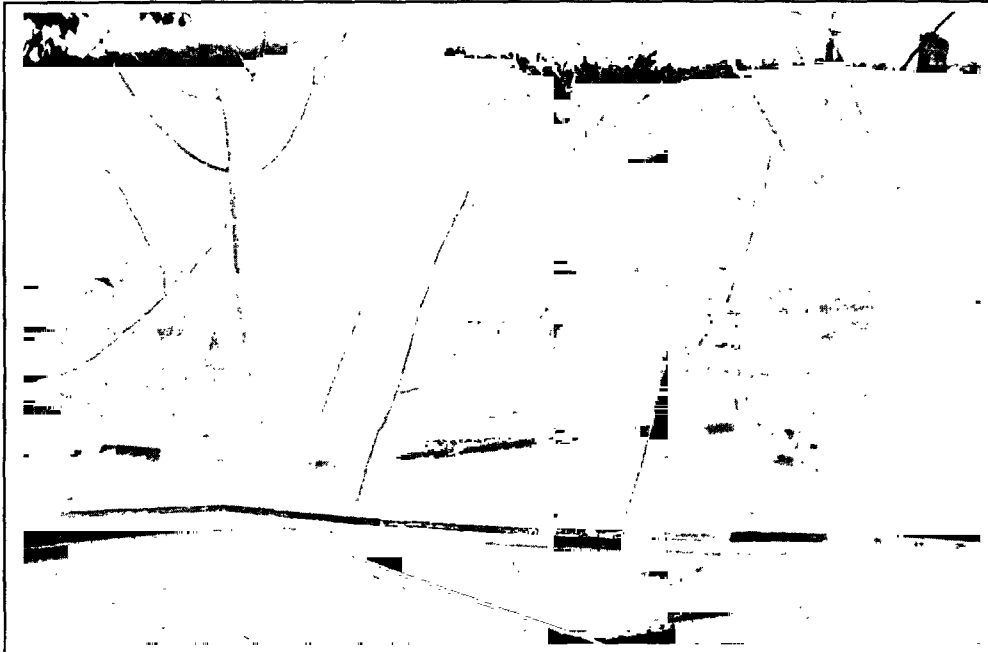
Signature of the reporting officer
 /search scholar /study group

References

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2. Orissa wildlife at a glance.
3. Wildlife map of Orissa.
4. State of Indian forest report – 2003
5. Statistical handbook of Orissa – 2004.
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7. Right of Passage – Elephant corridors.
8. Forest statistics – Orissa.
9. Similipal biosphere reserve.
10. Wild Orissa – 2004.
11. Road map of Orissa.
12. WB report on road projects of India.
13. District Gazetteers of the district.
14. WL (P) Act. – 1972.
15. Orissa forest Act. – 1972.
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17. Environment (protection) Act. – 1986 as amended up to September 2006 with latest guidelines.
18. Reference Orissa (Millennium Edition) A.N.Tiwari.
19. Untamed Orissa by wild Orissa.
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21. Man- Elephant conflict Similipal, Baripada. Karanjia divisions – Sar & Ray Choudhary.



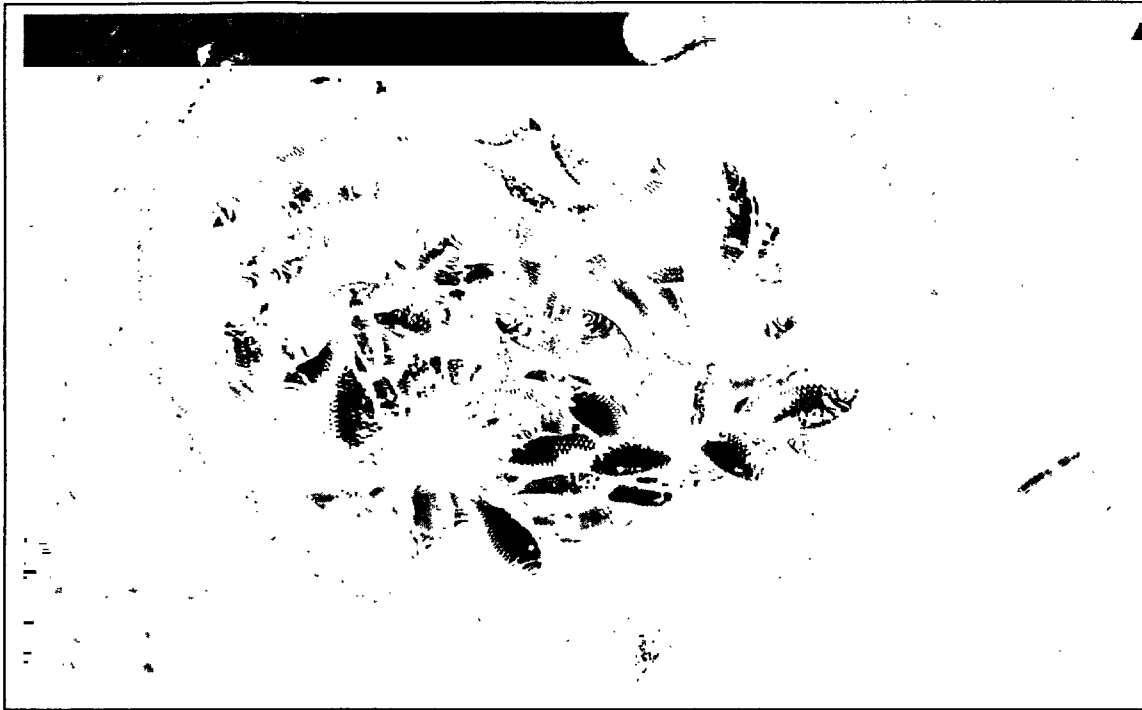
**PHOTOS OF WILDLIFE MOVEMENT CORRIDORS ON YEAR-I PHASE-I
ROADS.**



**Bear track At Changudidei hill
Chainage km 26.1 to 26.3 on SH-17**



**Effect of inter tidal channel and Wet land with sources of
income for villagers at chainage 30.5 SH-9**



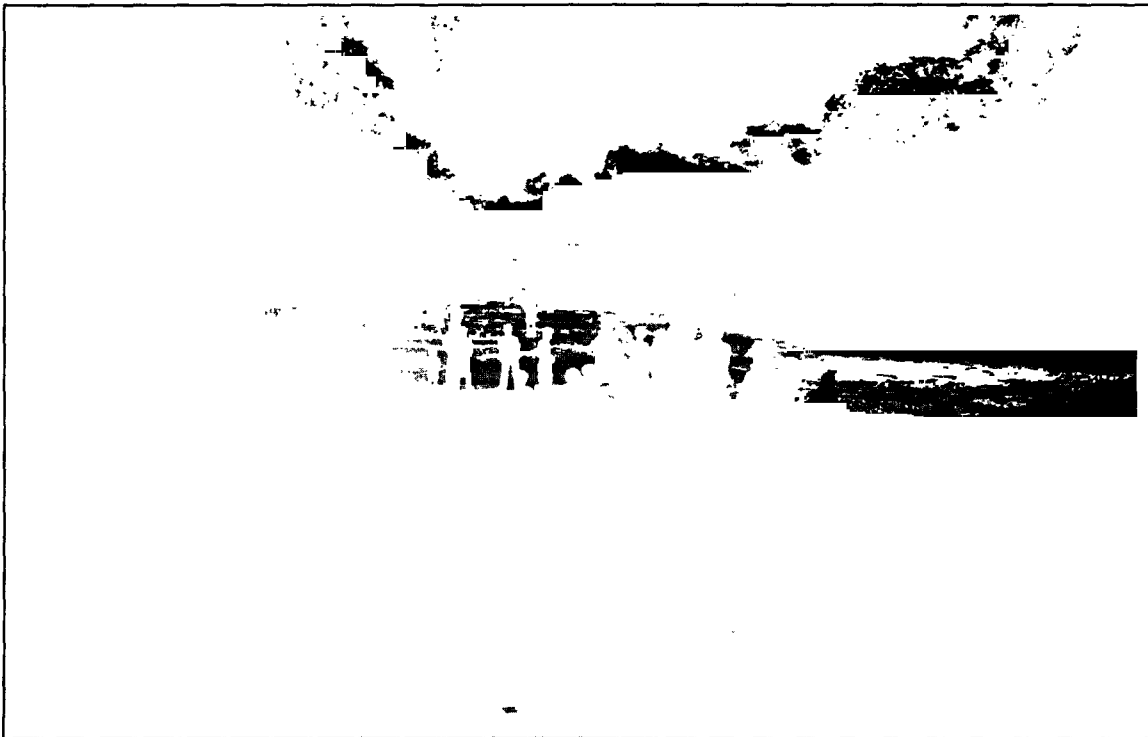
Flood plains and escape route at Chainage 26.4 km on SH-9



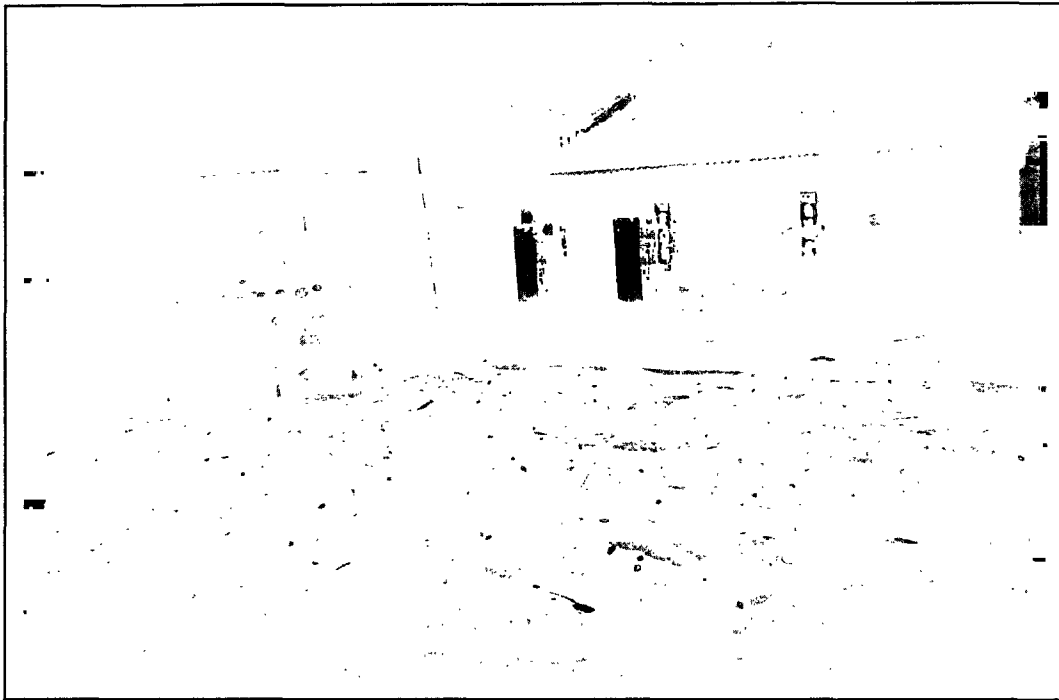
Flood plains and escape route at Chainage 28.8 km on SH-9



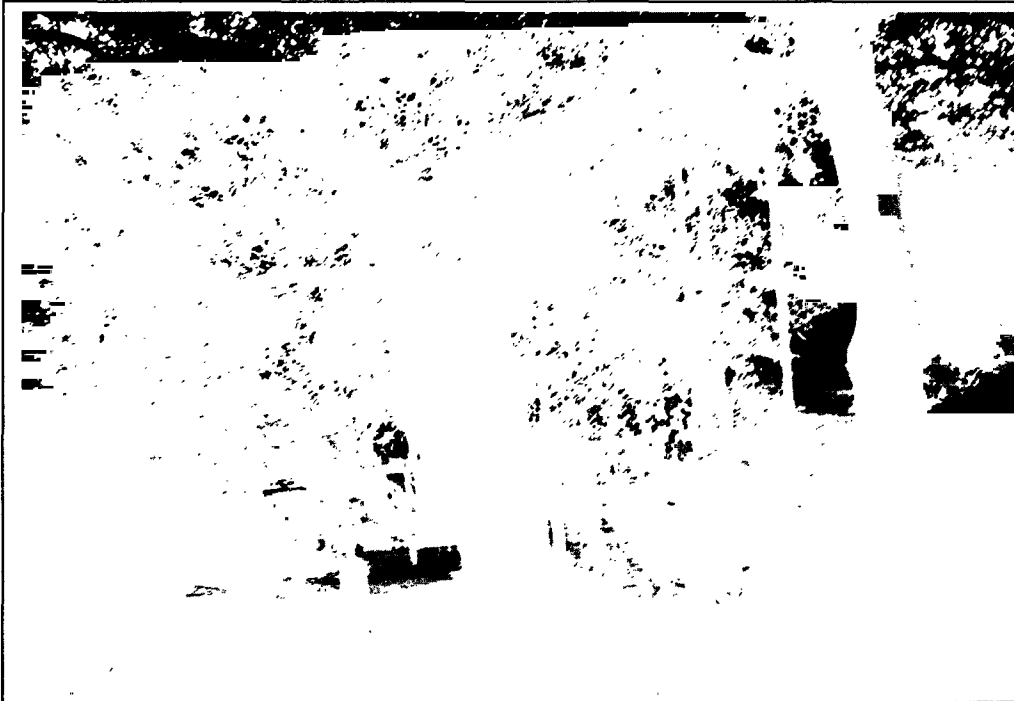
**Giant Peppal tree at Dhamara – Chandbali road Junction
near Ichhapur to be retained for Nesting Herons on SH-9**



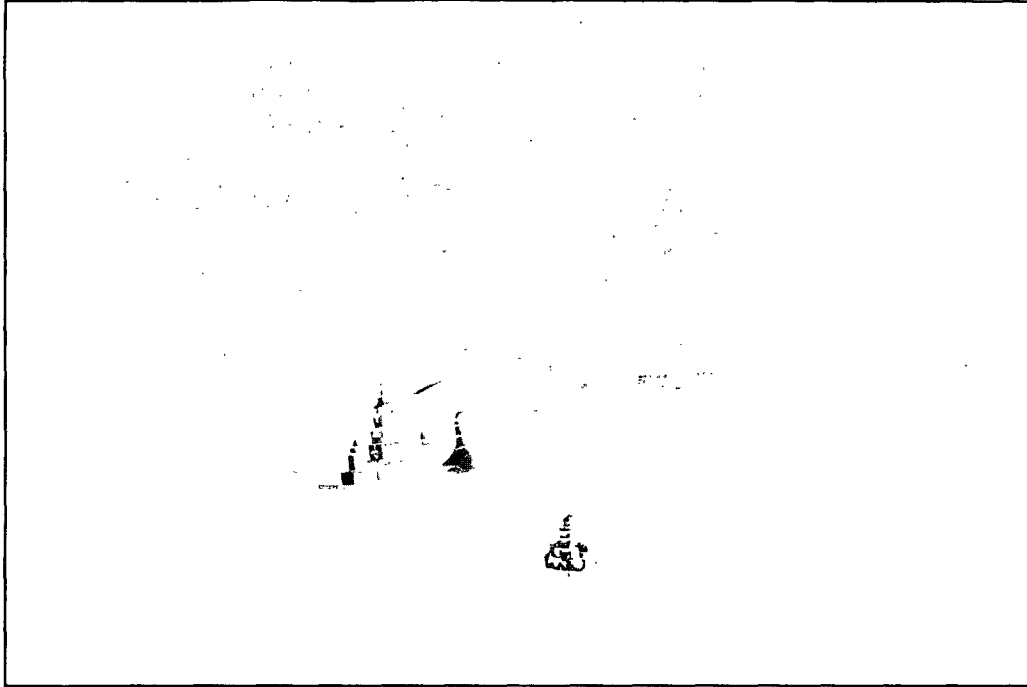
Submerged road near Ambagadia on SH-53



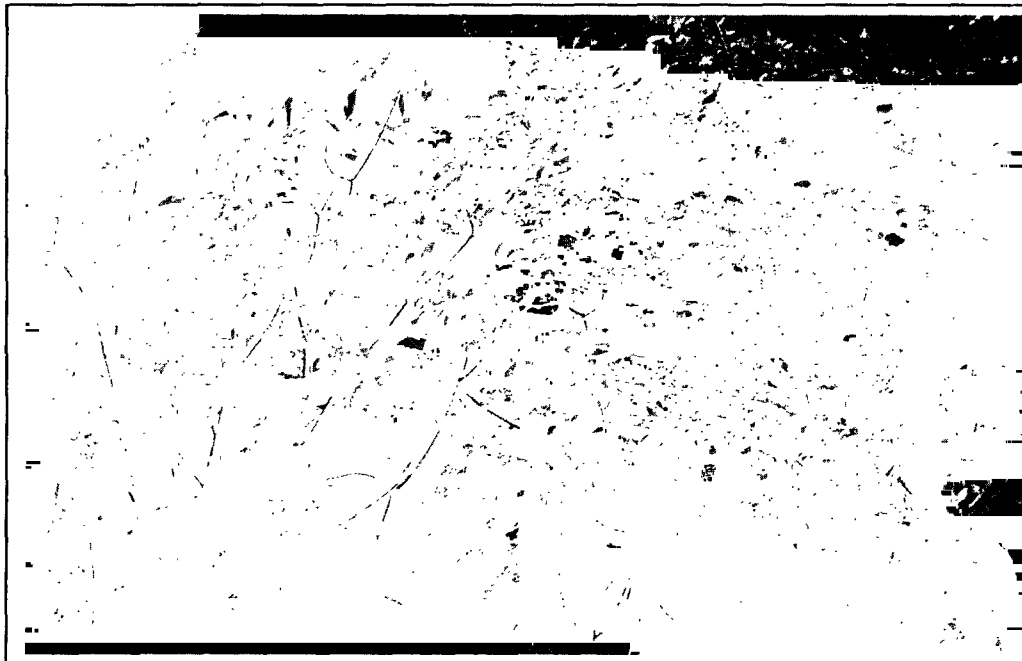
Puja Mandap within ROW at Bantho Bazar on SH-53



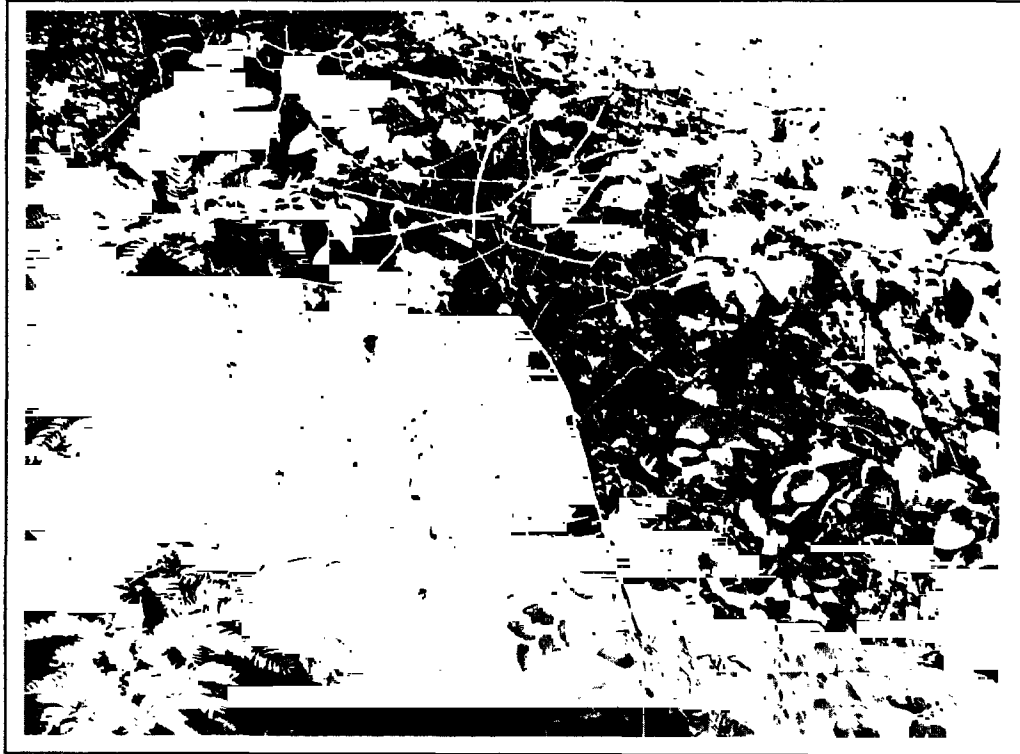
Giant Ficus tree in Bantho bazar within ROW after General post office on SH-53



Pond coming within proposed ROW in Bantho Bazar near Girls school.



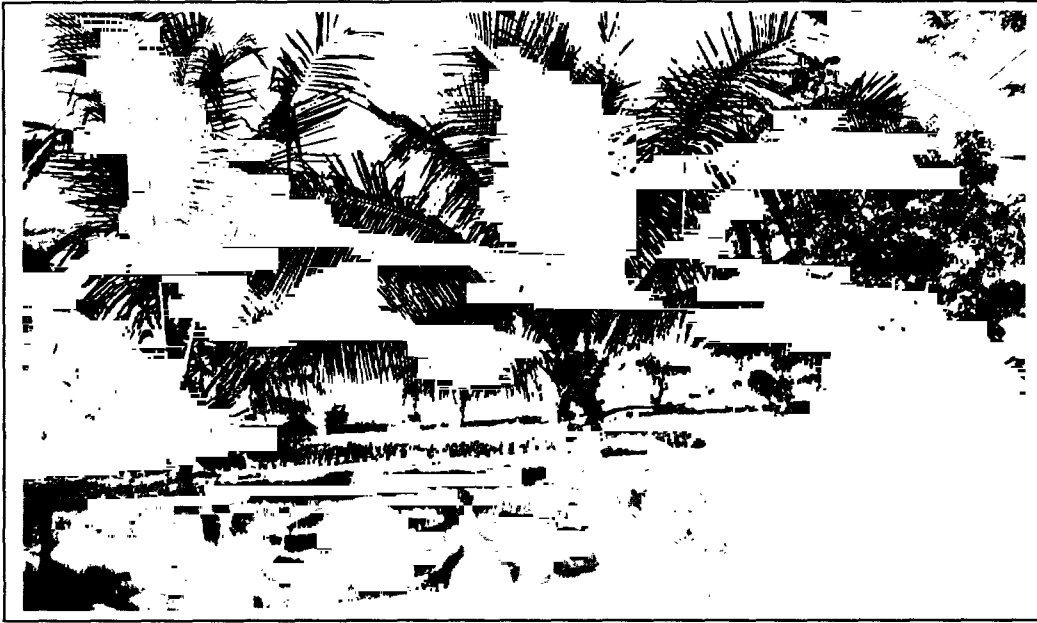
Raulwolfia tetraphylla Medicinal plant along SH-53 at Chainage 45.4 km



Sivalingi (*Diplocycles palmatus*) a Medicinal creeper at Chainage 26.9 km on SH-53



Wet land at Jamkhunta nala turning an ideal wildlife movement zone on SH-16



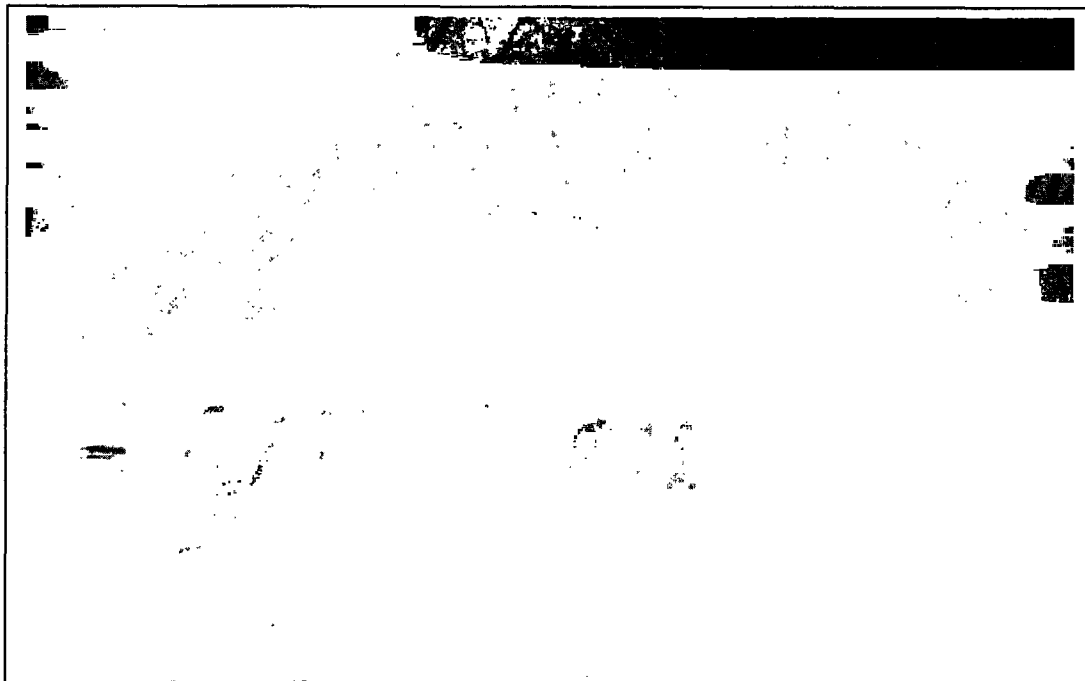
**Hérons and Large egrets feeding at Chainage 36 km
on SH-9**



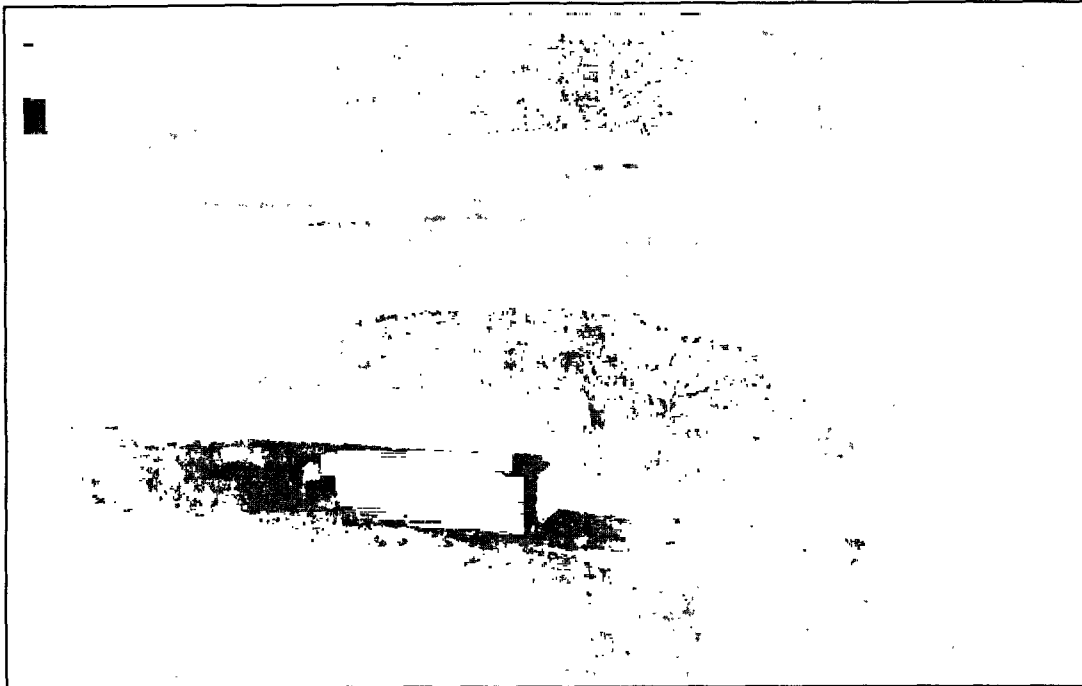
**Discussion with Mr. Binayam Reja and Mrs.Neha Vyas on Elephant
Underpass at Bankhedi Chainage 52.800km on SH-53 (Keonjhar District)**



Study of Habitat and Elephant Corridor at Chainage 52.800km on SH-53 with World Bank Team



Negotiating Giant Trees and Green Tunnels between Bhadrak to Railway over bridge on SH-53 with World Bank Team at Chainage 0.1km (Satsang Vihar)



Old culvert and Elephant corridor photographed at Chainage 52.8km on SH-53 between Anandapur to Godabhanga Forest check gate. This passage is a traditional migratory route from Hadagada sanctuary to other parts of Keonjhar district across River Baitarani



Elephant movement corridor in Chheratangar RF of Karanjia Forest division

Elephant movement path across SH-53 in Chheratangara RF in between km24/0 and km25/0 (km24.900) Mayurbhanj district

ANNEXURE	TITLE
I	List of Important Tree Species
II	Medicinal Plants
III	Fauna (Mammals, Reptiles, Aviary & Amphibians)
IV	The Protected Areas
V	Map of South Orissa Elephant Reserve
VI	Map of Mahanadi Elephant Reserve
VII	Map of Bhitarkanika Wildlife Sanctuary & National Park
VIII	Map of Satkosia & Baisipalli Sanctuary
IX	Map of Mayurbhanj Elephant Reserve
X	Map of Similipal Biosphere Reserve, National Park & Wildlife Sanctuary
XI	Network of Phase-I Roads
XII	Cost Norm for Plantation in Eroded Areas
XIII	Corridors as per Threat Perception
XIV	Corridors SH - 53 & 49
XV	Corridor SH - 9 (A)
XVI	Corridor SH - 9
XVII	Corridor Bhadrak - Anandpur SH - 53 Part
XVIII	Corridor SH - 16
XIX	Corridor SH - 7
XX	Corridors SH - 17
XXI	Corridors SH - 17 & 4
XXII	Corridor SH - 5
XXIII	Corridor SH - 6
XXIV	Corridors SH 65 (A) - 64 (B)
XXV	Engineering Intervention Measures on Year-1 Corridors with list of Abbreviations.
XXV (A)	SH - 9
XXV (B)	SH - 53 - Part
XXV (C)	SH - 17 - Part
XXV (D)	SH - 16
XXVI	Design Specifications of Wildlife Underpass:
XXVI (A)	Design Box Culverts with Earth Cushion - (Single & Double)
XXVI (B)	Box Culverts without Earth Cushion - (Single & Double)
XXVI (C)	Pipe Culverts - (Single & Double)
XXVI (D)	Trap Drains
XXVI (E)	Via Duct
XXVI (F)	Barricade

XXVI (G)	Road Signage & Marking
XXVII	Road Signages Suggested
XXVIII	Designs for soil and water conservation measures
XXIX	Planting in Eroded area and hill slopes
XXX	Plantation technique along avenue / approaches to wildlife underpass
XXXI	Surplus land plantation
XXXII	Specific list of rare and endangered flora and fauna in different corridors
XXXIII	Biodiversity Survey Questionnaire
XXXIV	Flow Chart
XXXV	Giant trees likely to be sacrificed along the year-1 roads
XXXVI	Plantation Design and Norms
XXXVII	Toe wall at Water bodies and Pond
XXXVIII	Tree guard

ANNEXURE-I

LIST OF IMPORTANT TREE SPECIES

Local Name	Scientific Name
Sal -	<i>Shorea robusta</i>
Biza Sal-	<i>Pterocarpus marsupium</i>
Asan-	<i>Terminalia tomentosa</i>
Mundi or Haldu or Kurum-	<i>Adina cordifolia</i>
Sisam- Sisu – Rose Wood-	<i>Dalbergia latifolia</i>
Sisso- Bali Sisu-	<i>Dalbergia sisoo</i>
Dhaura-	<i>Anogeisus latifolia</i>
Phasi-	<i>Anogeisus acuminata</i>
Hinjala-	<i>Barringtonia acutangula</i>
Mahul-	<i>Madhuca indica</i>
Jamun-	<i>Syzygium cuminii</i>
Bela -	<i>Aegle marmelus</i>
Aionla / Amla-	<i>Emblica officinalis</i>
Arjuna-	<i>Terminalia arjuna</i>
Mango-	<i>Mangifera indica</i>
Chandan-	<i>Santalum album</i>
Udumbar-	<i>Ficus glumerata</i>
Bara-	<i>Ficus bengalensis</i>
Aswath-	<i>Ficus religiosa</i>
Tamarind / Tentuli -	<i>Tamarindus indica</i>
Kangada-	<i>Xylia xylocarpa</i>
Moi-	<i>Lannea coromandalica</i>
Giringa-	<i>Pterospermum canescens</i>
Saguan-	<i>Tectona grandis</i>
Neem-	<i>Azadirachta indica</i>
Rohini-	<i>Soymida fabrifuga</i>
Jhau-	<i>Casuarina equisetifolia</i>
Kasi-	<i>Bridelia retusa</i>
Chadheigodi -	<i>Vitex peduncularis</i>
Bahada-	<i>Terminalia bellerica</i>
Harida -	<i>Terminalia chebula</i>
Tala -	<i>Borassus flabelifer</i>
Karada -	<i>Cleistanthus collinus</i>
Barakoli -	<i>Zizyphus oenoplea</i>
Bhumi barkoli -	<i>Zizyphus mauritiana</i>
Mahala -	<i>Ailanthus excelssa</i>
Patuli -	<i>Stereospermum swaveolense</i>
Achhu -	<i>Morinda tinctoria</i>
Chhatian -	<i>Alstonia scholaris</i>
Kamalagundi -	<i>Malotus philippinensis</i>
Fanfana -	<i>Oroxylon indicum</i>
Lodha -	<i>Symplocas racemosa</i>
Medha -	<i>Listea pollyantha</i>

ANNEXURE-II**MEDICINAL PLANTS**

Local Name	Scientific / Botanical Name
1. Puruni (Ghodapuruni)	<i>Boerhovia diffusa</i>
2. Apamarga	<i>Achyranthes aspera</i>
3. Bhui neem	<i>Andrographis paniculata</i>
4. Ayyapan	<i>Aristolochia indica</i>
5. Tihudi	<i>Operculina turpethum</i>
6. Muturi	<i>Smilax macrophylla</i>
7. Sugandhi	<i>Hemidesmus indicus</i>
8. Arka	<i>Calatropis gigantia</i>
9. Pippali / Banapipali	<i>Piper longum</i>
10. Gunja / Kaincha	<i>Abrus precatorius</i>
11. Chain katha	<i>Piper triocum</i>
12. Chitaparu (Rakta chitapru)	<i>Plumbago rosea (Red Flower)</i>
13. (Sweta) Chitaparu	<i>P.zeylanica (White flower)</i>
14. Pasaruni	<i>Pederia foetida</i>
15. Mersunga	<i>Muraya koengii</i>
16. Banatulasi	<i>Ocimum gratissimum</i>
17. Kateri/Chakadabheji	<i>Solanum xanthocarpum</i>
18. Bala	<i>Sida cordifolia</i>
19. Dengabheji	<i>Soalanum torvum</i>
20. Bahada	<i>Terminalia belerica</i>
21. Harida	<i>Terminalia chebula</i>
22. Arjun	<i>Terminalia arjuna</i>
23. Kamalagundi	<i>Malotus philippinensis</i>
24. Fanafana	<i>Oroxylon indicum</i>
25. Bidanga	<i>Embelia ribes</i>
26. Baibidanga	<i>Embelia tsjeriam</i>
27. Guduchi	<i>Tinospora cordifolia</i>
28. Salaparni	<i>Desmodium gangeticum</i>
29. Bankulthi	<i>Tephrosia purpuria</i>
30. Talamuli	<i>Curculigo orchoides</i>
31. Arrow root	<i>Curcuma aungostifolia</i>
32. Kachura or Sati	<i>Curcuma zedoria</i>
33. Karpura haldi	<i>Curcuma aromatica</i>
34. Daskerenta	<i>Barleria cristata</i>
35. Dahidahika	<i>Cocculus hirsutus</i>
36. Sunari	<i>Cassia fistula</i>
37. Satabari	<i>Asparagus racemosus</i>
38. Baidanka	<i>Muccuna Pruriens</i>
39. Ashoka	<i>Saraca asoca</i>
40. Bridhadaraka	<i>Argyreia nervosa</i>
41. Chhatian	<i>Alstonea scholaris</i>
42. Gokshura (Bada)	<i>Pedaliium murex</i>
43. Sangokshura	<i>Tribulus terrestris</i>
44. Gangasiuli Harsingar	<i>Nyctanthes arbortristis</i>
45. Patalgaruda	<i>Rauwolfia serpentina</i>
46. Dhataki	<i>Wood forida fruticosa</i>
47. Pitakeruan	<i>Wrightia tinctoria</i>
48. Keruan	<i>Holarhena antidysenterica</i>
49. Baruna	<i>Creteva religiosa /C. nurvula</i>

Local Name	Scientific / Botanical Name
50. Puruni/Atikapudi	<i>Trianthema portulacastrum</i>
51. Karanja	<i>Derris indica /Pongamea pinnata</i>
52. Bana Govi	<i>Elephanatapus scabber</i>
53. Bel	<i>Aegle marmelus</i>
54. Narguni	<i>Atlantia manophylla</i>
55. Nagarmatha	<i>Cyperus rotundus</i>
56. Kochila	<i>Strychnus nuxvomica</i>
57. Krushnaparni	<i>Uraria picta</i>
58. Sankarjata	<i>Urenia lagopoides</i>
59. Bana Piaz	<i>Urgenia indica</i>
60. Mendi or Anantamula	<i>Tylophora indica</i>
61. Keu	<i>Costus speciosus</i>
63. Gaigobra / Langalangalia	<i>Gloriosa superba</i>
64. Sankhapuspi	<i>Clitorea ternatia</i>
65. Gugul	<i>Comiphera caudata</i>
66. Bacha	<i>Achorous calamus</i>
67. Bhuini amla	<i>Phyllanthus fraternus</i>
68. Atibala	<i>Abutilon indicum</i>
69. Bala	<i>Sida cordifolia</i>
70. Chiller	<i>Caesal pinea sappan</i>
71. Gillo	<i>Caesalpinea cristata</i>
72. Bajradanti	<i>Barbaria crista</i>
73. Bakuchi	<i>Psoralia corrylifolia</i>
74. Sweta sorisha	<i>Cleome gynandra</i>
75. Sweta tila	<i>Digitalis purpurea</i>
76. Gohira	<i>Acacia leucophloea</i>
77. Babul	<i>Acacia nilotica</i>
78. Pasanabhedhi (Paunsa paunsia)	<i>Erva lanata</i>
79. Keshdura or Bhringaraj	<i>Eclipta prostrata /E. erecta</i>
80. Keshranjani	<i>Wadellia chinensis</i>
81. Bana alu	<i>Dioscorea digitalis</i>
82. Mundi	<i>Speranthus indicus</i>
83. Pokasunga	<i>Baliospermum montanum</i>
84. Pasanabhedhi	<i>Collius frescohli</i>
85. Bidarikand	<i>Pruraria tuberosa</i>
86. Gudmari	<i>Gymnema silvestre</i>
87. Bada Pokasunga	<i>Cineraria versicolour / Cineraria maritime</i>
88. Indramarisha	<i>Acalypha indica</i>
89. Indrayan	<i>Citrallus colocynthis</i>
90. Uturudi	<i>Pergularia damea</i>

Local Name	Scientific / Botanical Name
91. Sivalingi	<i>Diplocyclos palmatus</i>
92. Asadhua	<i>Caparis horrida</i>
93. Guduchi	<i>Tinospora cordifolia</i>
94. Baigoba	<i>Jatropha curcas</i>
95. Nalibaigoba	<i>Jatropha gossypifolia</i>
96. Gandhana	<i>Premna tomentosa</i>
97. Modafal	<i>Helectris isora</i>
98. Tundapoda	<i>Todalia asiatica</i>
99. Sunsunia	<i>Oxalis Corniculata</i>
100. Pita saga	<i>Malugo pentahyla</i>
101. Lahanga	<i>Cellosia arjenta</i>
102. Monsa rohini	<i>Soymida febrifuga</i>
103. Basanga	<i>Justacia adhatoda / Adhatoda vasica</i>
104. Bramhi	<i>Bacopa monieri</i>
105. Thalkudi	<i>Centella asiatica</i>
106. Kani khanda	<i>Ipomea haderacia / Ipomea nil</i>

ANNEXURE-III**FAUNA - MAMMALS, REPTILES, AVIARY & AMPHIBIANS**

List of animals with their scientific names:

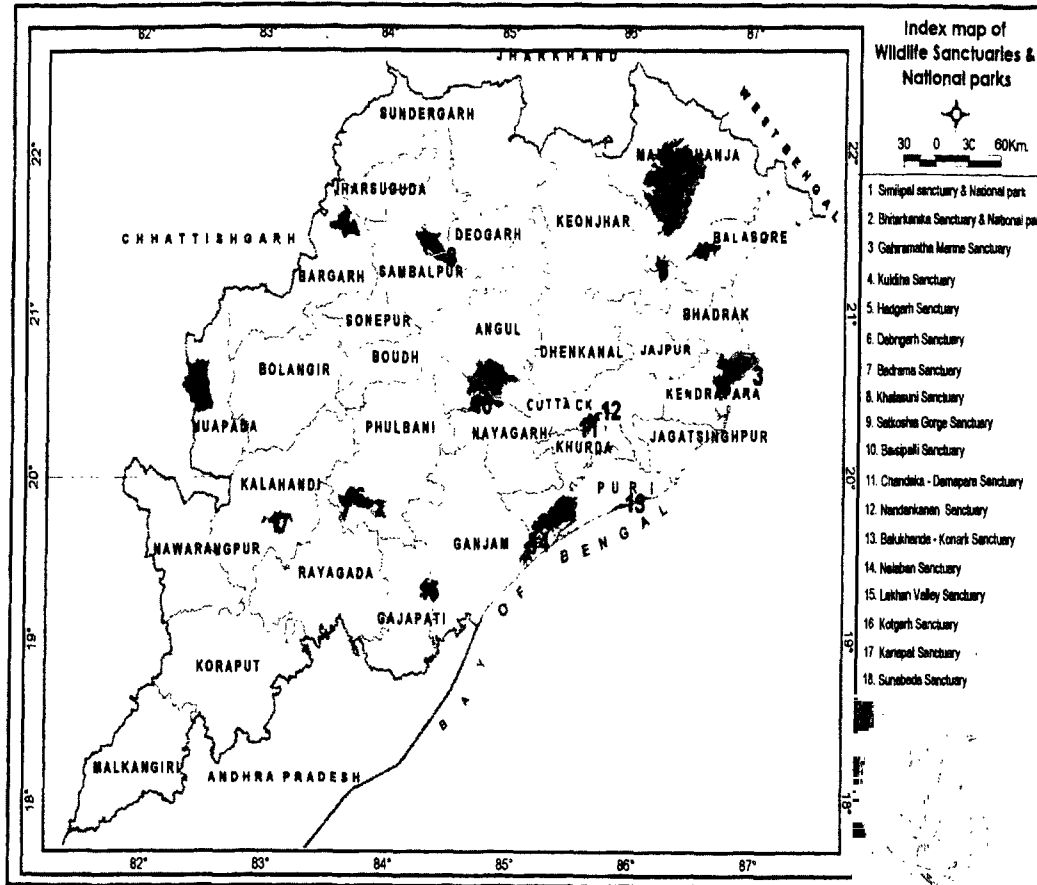
1. Mammalia:

	Common Name	Scientific Name
1.	Wolf	<i>Canis lepus</i>
2.	Wild Dog	<i>Cuon alpinus</i>
3.	Sloth Bear	<i>Melurses ursinus</i>
4.	Rattle (small Bear)	<i>Mellivora capensis</i>
5.	Wild Boar	<i>Sus crfa auristatus</i>
6.	Elephant	<i>Elephus mximus indicus</i>
7.	Gaur	<i>Bos gaurus</i>
8.	Sambar deer	<i>Cervus unicolor</i>
9.	Spotted Dear	<i>Axis axis</i>
10.	Mouse Deer	<i>Tragulus meminna</i>
11.	Chausinga	<i>Tetracerus quadricornis</i>
12.	Barking Buck Deer	<i>Muntiacus munt jack</i>
13.	Monkey	<i>Rheses macaque / Macaca mulata</i>
14.	Hanuman	<i>Presbytis entellus</i>
15.	Porcupine	<i>Hystrix indica</i>
16.	Pangoline	<i>Manis crassicaudata</i>
17.	Mongoose	<i>Herpestes edwardsii</i>
18.	Small mongoose	<i>Herpesters javanicus</i>
19.	Giant squirrel	<i>Ratufa indica</i>
20.	Flying squirrel	<i>Petaurista magnificuls</i>
21.	Bat	<i>Cynopterus sphinum</i>
22.	Jungle cat	<i>Fellis chans affinis</i>
23.	Jackle	<i>Canis aureus</i>
24.	Hyaena	<i>Hyaena hyaena</i>
25.	Small squirrel	<i>Funambulus penanti</i>
26.	Tody cat	<i>Paradoxurus hermaphroditus</i>
27.	Fox	<i>Vulpes bengalensis</i>
28.	Nilgai	<i>Boselaphus tragocamelus</i>
29.	Otter	<i>Lutra perspicillata</i>
30.	Civet	<i>Viverricula indica</i>
31.	Hare	<i>Lepus nigricollis</i>
32.	Rat(Wild)	<i>Ratus ratus</i>
33.	Leopard	<i>Panthera pardus*</i>
34.	Tiger	<i>Panthera tigris*</i>
*	Rarely occurring	
II	Amphibia	
1	Toad	<i>Bufo melanostictus</i>
2	Bull frog	<i>Rana tigrina</i>

Common Name		Scientific Name
III	Reptilia	
1.	Chameleon	<i>Chameleon calcuratus</i>
2.	Calotis	<i>Calotis vericolor</i>
3.	Mabuya	<i>Mabuya bibro</i>
4.	Lizard	<i>Hemidactylus flaviviridis</i>
5.	Varanus	<i>Varanus salvator</i>
6.	Cobra	<i>Naja naja naja</i>
7.	Keutia (Naga)	<i>Naja naja Kaouthia</i>
8.	Krait	<i>Bungarus caeruleus</i>
9.	Green snake	<i>Dryophis nasutus</i>
10.	Rat snake	<i>Ptyas mucosus</i>
11.	Water snake	<i>Natrix piscator</i>
12.	Blind snake	<i>Typhlops brahminus</i>
13.	Sand Boa	<i>Eryx stolata</i>
14.	Indian python	<i>Python molurus</i>
15.	Saw scaled viper	<i>Echis carinatus</i>
16.	Russell's viper	<i>Vipera russelli russelli</i>
IV	Aves	
1.	Snake bird	<i>Anhinga rufa</i>
2.	Pond Heron	<i>Ardela grayii</i>
3.	Pea fowl	<i>Pavo cristatus</i>
4.	Brown dove	<i>Streptopilia senegalensis</i>
5.	Parakeet	<i>Psittacual eupatria</i>
6.	Crow pheasant	<i>Centopus sinensis</i>
7.	King fisher	<i>Alcedo atthis</i>
8.	Wood pecker	<i>Dinopium bengalense</i>
9.	Myna	<i>Acridotheres tristis</i>
10.	Bulbul	<i>Pycnonotus cafer</i>
11.	Sparrow	<i>Passer domesticus</i>
12.	Crow	<i>Carvus spelendens</i>
13.	Grey Hornbill	<i>Tockus birostris</i>
14.	Pied hornbill	<i>Anthracoceros coronatus</i>
15.	White belliled drongo	<i>Discrurus caeruleus</i>
16.	Sun bird	<i>Nectarinia asiatica</i>
17.	Little egret	<i>Egretta garzetta</i>
18.	Median egret	<i>Mesophoryx intermedia</i>
19.	Cattle egret	<i>Bubulcus ibis</i>
20.	Large egret	<i>Casmerodius albus</i>
21.	Cormorants	<i>Phbalacroco raxniger</i>
22.	Indian roller or Blue Jay	<i>Coracias bengalensis</i>

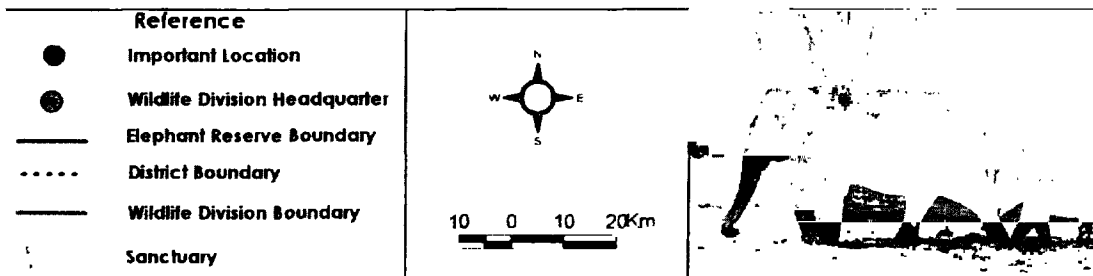
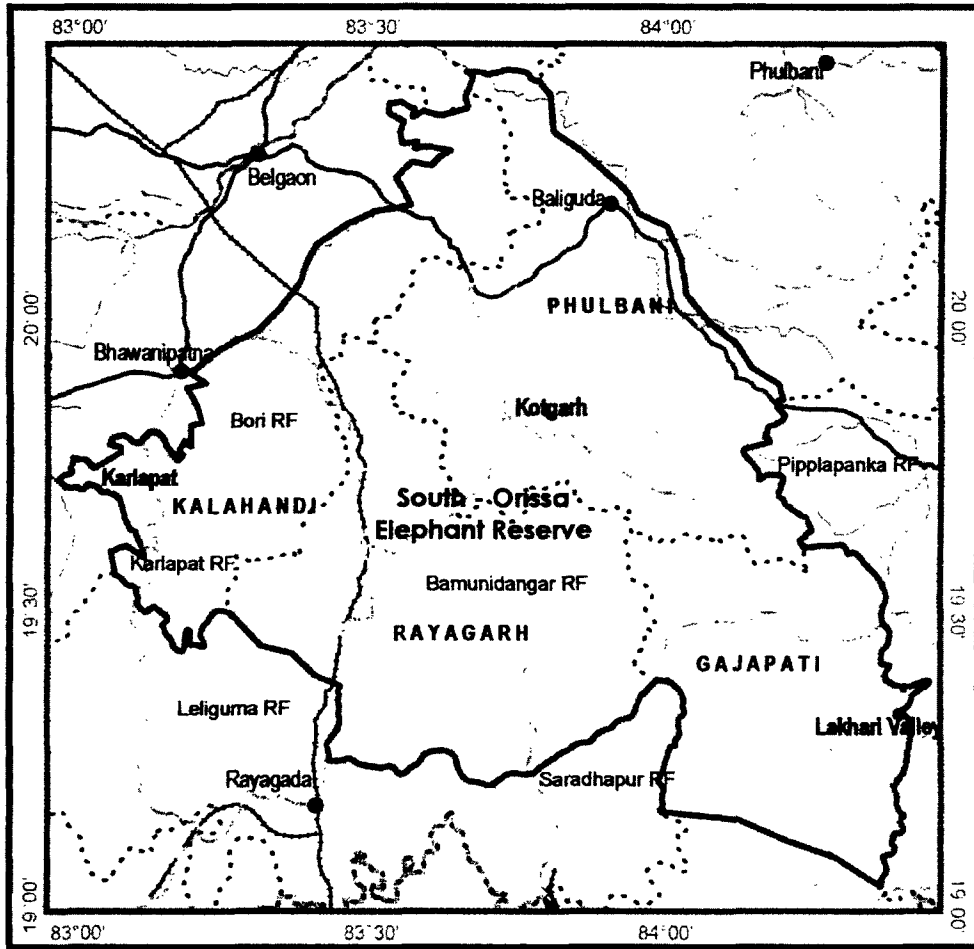
ANNEXURE-IV

THE PROTECTED AREAS



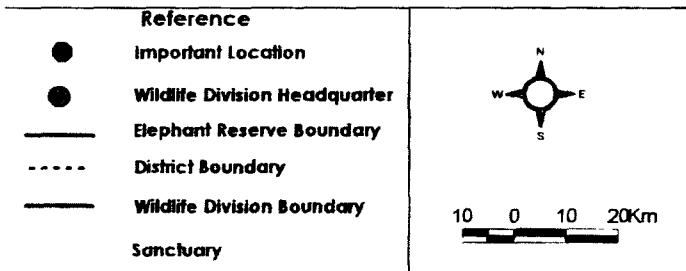
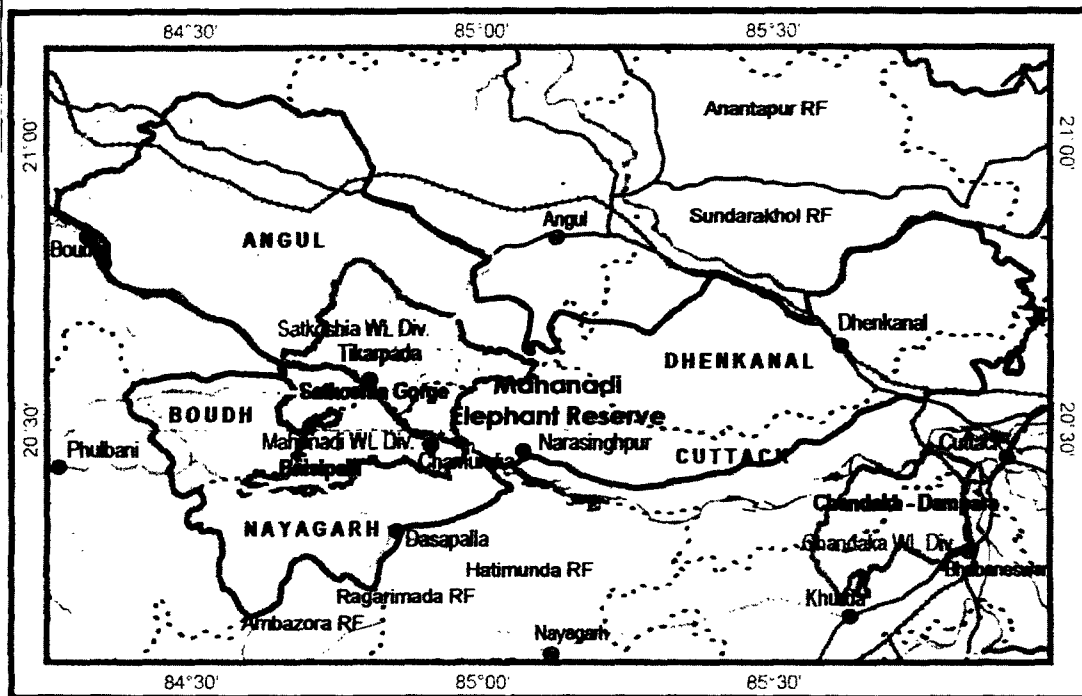
ANNEXURE-V

MAP OF SOUTH ORISSA ELEPHANT RESERVE



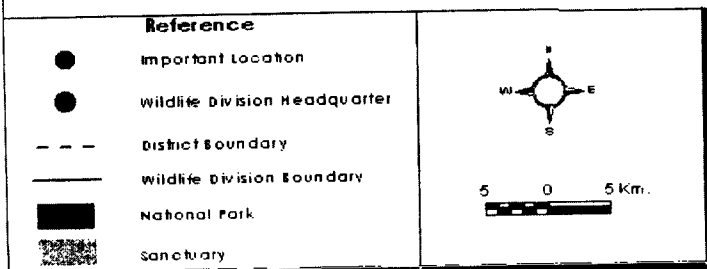
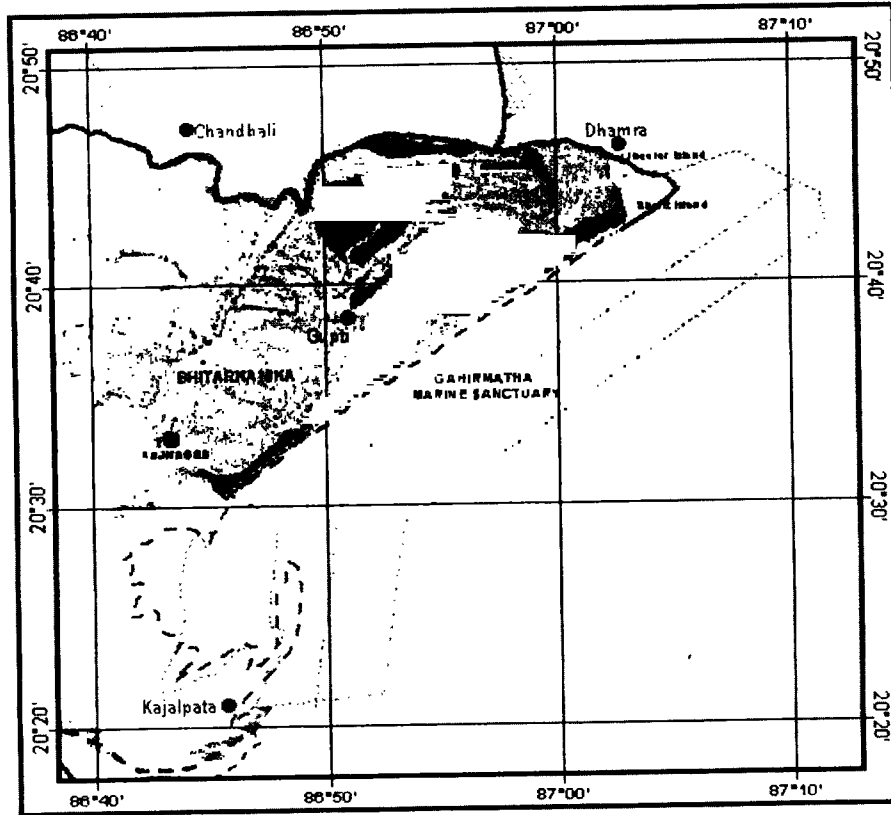
ANNEXURE-VI

MAP OF MAHANADI ELEPHANT RESERVE



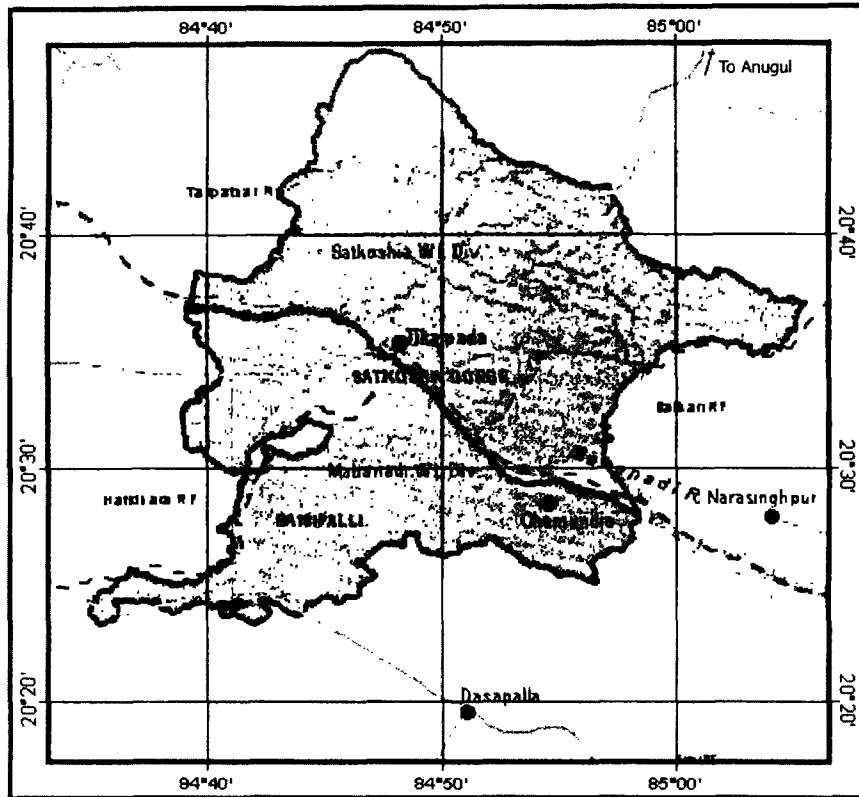
ANNEXURE-VII

MAP OF BHITARKANIKA WILDLIFE SANCTUARY AND NATIONAL PARK

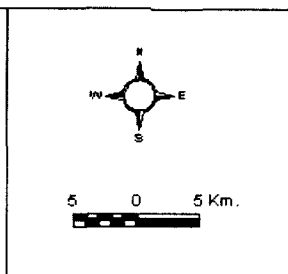


ANNEXURE-VIII

MAP OF SATKOSIA & BAISIPALLI SANCTUARY

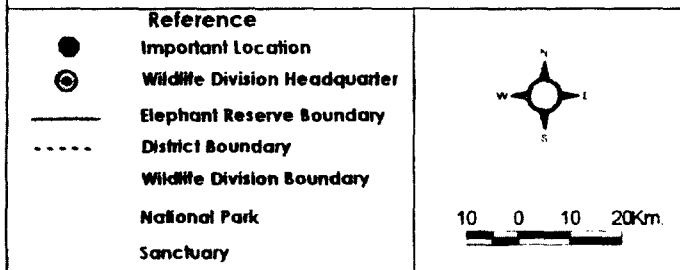
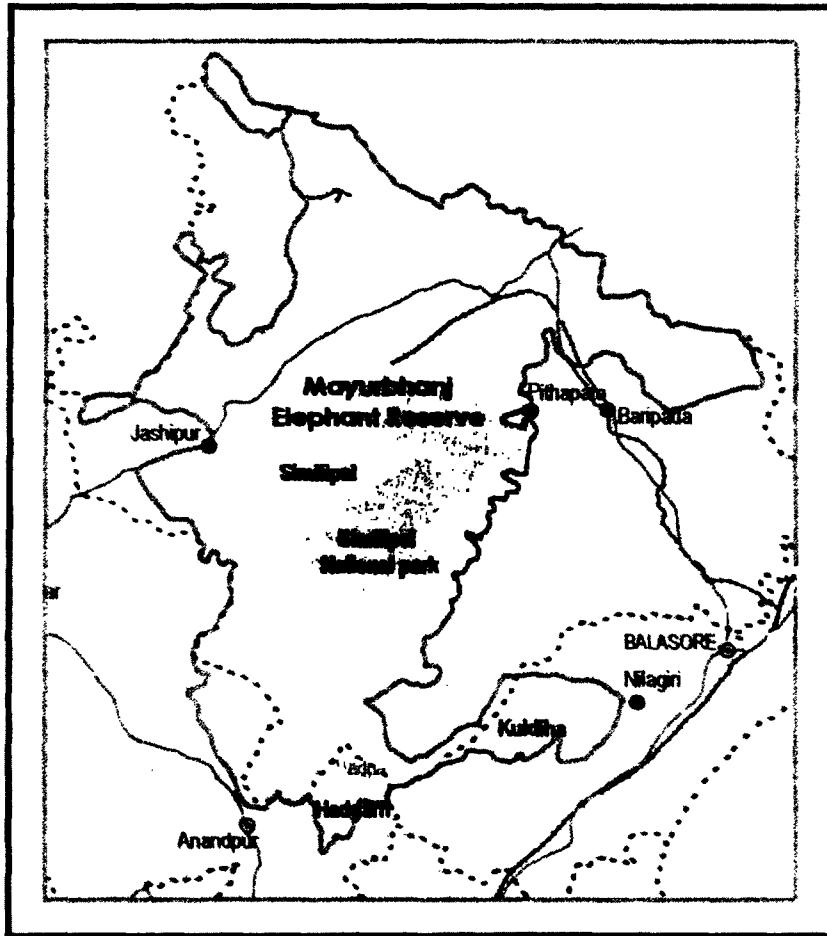


Reference	
●	important location
●	wildlife division Headquarter
- - -	District boundary
—	wildlife division boundary
	sanctuary



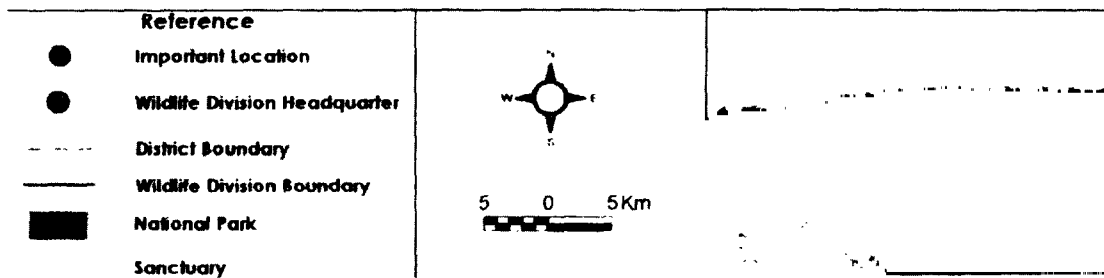
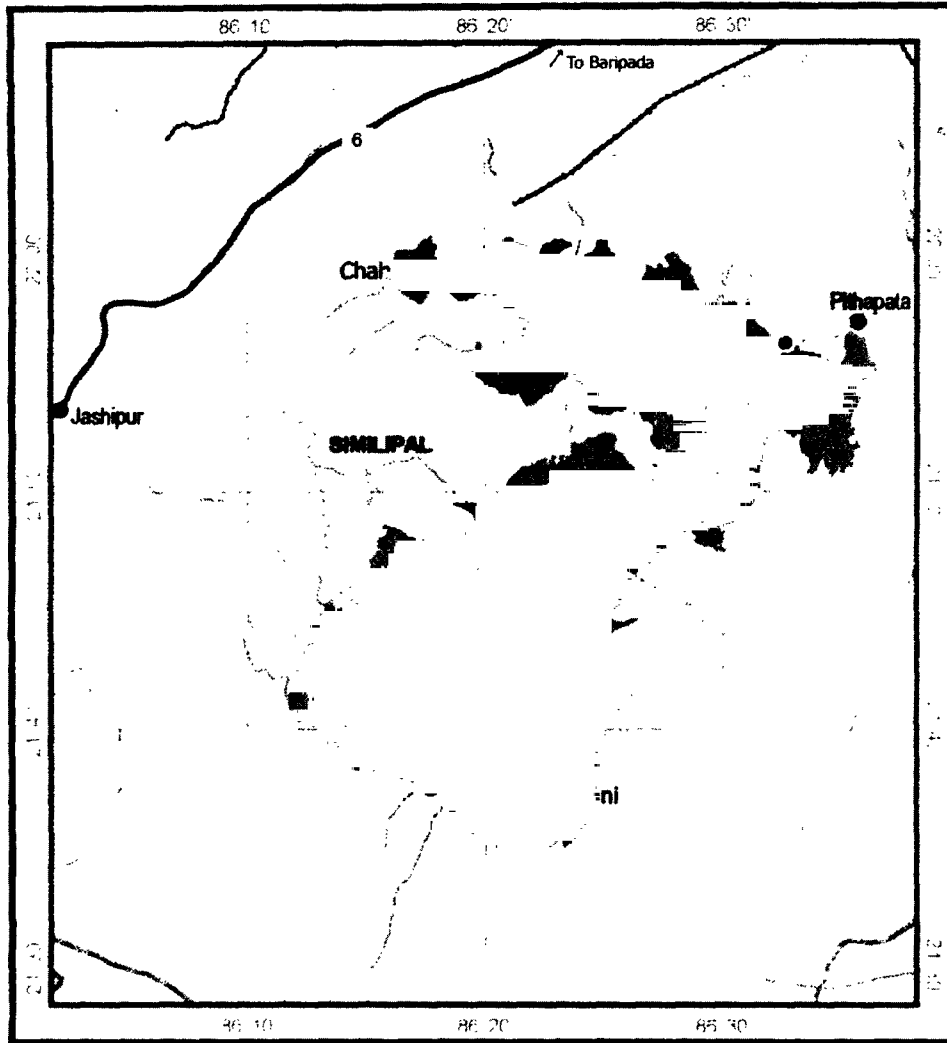
ANNEXURE-IX

MAP OF MAYURBHANJ ELEPHANT RESERVE

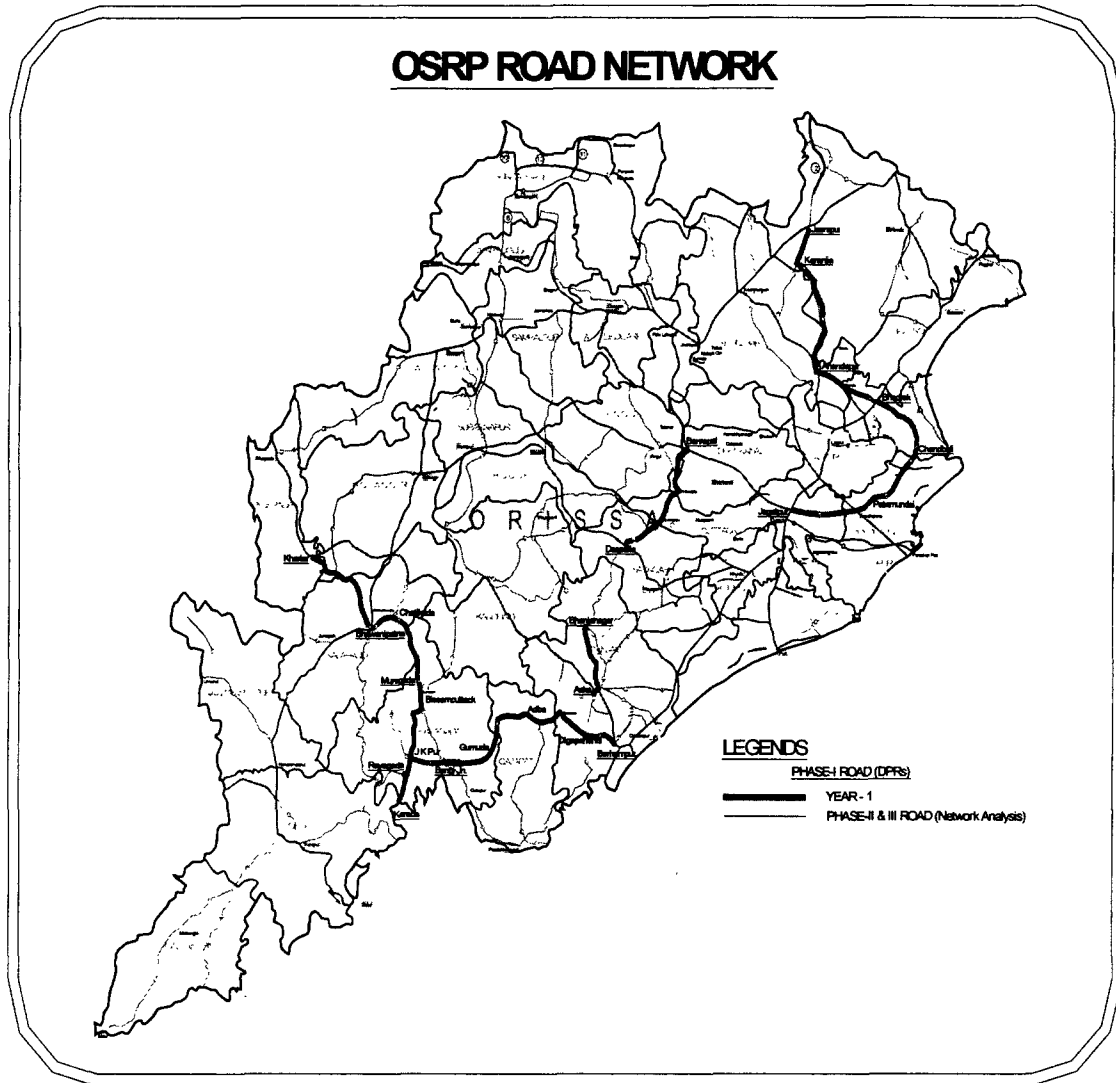


ANNEXURE-X

MAP OF SIMILIPAL BIOSPHERE RESERVE



ANNEXURE-XI



NETWORK OF PHASE-I ROADS

ANNEXURE-XII**COST NORM FOR PLANTING IN ERODED AREAS**

Sl. No.	Items	Mandays No. of labour	Rates @	Cost Per Hectare		
				Labour only	Material Cost etc.	Total
1.	Survey, Demarcation and pillar posting at 5.5mtr interval approximately 10posts/ha	2	70	140.00	R.C.C. posts 10cm X 10cm X 180cm @90/- 900.00	1040.00
2.	Preparation of contour marks and pegging with water level using transparent PVC pipe filled with water – 50mtr long (contour interval 0.5mtrs – Pipe dia 10mm)	6	70	420.00		420.00
3.	Stacking along the contour line	2	70	140.00		140.00
4.	Digging of pits 30cm cube at 2mtr interval on the contour line, supplemented with intermediate trench bonding 200mm high along the contour during early rains for dibbling sowing of grass, Periwinkle, Cassia tora, Tephrosia purpurea, Cassia occidentalis, Chiller, Acacia nilotica, Cassia fistula, Alstonea scholaris, Jatropha gossypifolia chistanthes collinus, Nictanthes arbortristis, Bhuineem seeds on the Trench bunds (2500 pits/ha)	50	70	3500.00		3500.00
5.	Nursery cost for 18month old (Part) seedlings of (Part) Khair, Soyimida fabrifuga, Madhuca latifolia, Sal, Terminalia arjuna, Azadirachta indica, Alangium lemarkii, Cleistanthes collinus, Zizyphuz zozoba, Z.rugosa, Z.muritiana, Z.oenoplea, Shorea robusta, Buchnanian Lanjan, Albizia lebec, Nictanthes, Aegle marmelus, Feronea limonea, Ficus glumerata, Ficus hispida, F.bengalensis, F.religiosa, Bamboo, Chiller (Caesalpinea sappan), Embelia ribes, Pungumea pinnata, Dalbergia sisoo, Malotus phillipinensis, Acacia nilotica, A.leocophlea, Alstonea scholaris, Schleicheria oleosa, Aegle marmelus				4200.00	4200.00
6.	Over head charges				191.00	191.00
	Total	60		4200.00	5291.00	9491.00

B/F		60		4200.00	5291.00	9491.00
7.	Cost of pipe, stacks, seeds, for dibbling sowing on the countour lines.				500.00	500.00
Oth Year cost Total		60		4200.00	5791.00	9991.00
1st Year Operation						
8.	Nursery cost (18 months seedlings) balance				3892.00	3892.00
9.	Carriage and Planting	30	70	2100.00	1980.00	4080.00
10.	Birth watering insecticide, fertilizer application before planting.	5	70	350.00		350.00
11.	Bucket weeding near planted seedlings only and no weeding else where other than removal of climber on natural vegetation, planting of grass slips in crow bar holes intermittently between 2 rows of plants at places of scouring and open patches (Grass slips of Eulaliopsis, Sacahrum, Palmarosa, Cymbopogon, Citronella, Elephanta, Vetiver along the contour only (across the slope)	5	70	350.00		350.00
12.	Manu ring – only a decoction of Cow dung manure, Neem oil seed cake, urea and Potash, Super mixed in the ratio of 20kg + 20kg + 2kg + 5kg + 5kg mixed with 2000 liters of water fermented over a week and then carried in pots to irrigate the plants after soil working around each plant. No other fertilizer or pasticide is necessary. Andrographis (Bhuneem) plants will be fermented in the vat with above substances /Bhuineem 10kg per vat of 2000 litres). This will keep down fugues and white ant damage while providing organic and inorganic nutrient to the plants.	5	70	350.00	500.00	850.00
13.	Soil working to improve the cup saucer type water harvesting around each plant on the slopes and degraded patches and providing mulching with loose clods No. 2 nd weeding is necessary in eroded areas what ever growth comes that is a booster for soil conservation efforts.	10	70	700.00		700.00
Total		115		8050.00	12163.00	20213.00

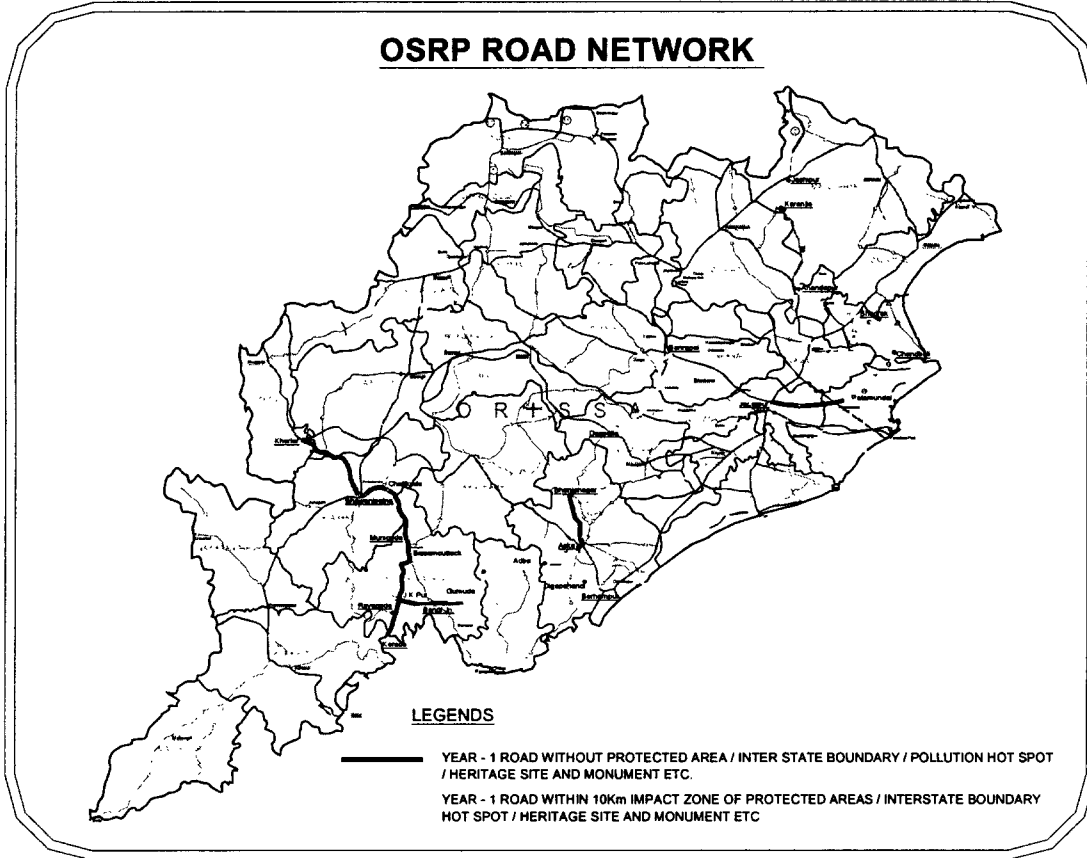
B/F		115		8050.00	12163.00	20213.00
14.	Gully plugging with empty cement bags filled with soil and used as check damming slabs or brushwood check dams with twigs and branches of <i>Justica adhatoda</i> , <i>Duranta plumcrai</i> , <i>Vitex negundo</i> , <i>Dodonea</i> , <i>Jatrophacurcas</i> , <i>Grauga</i> , <i>Cypedesa</i> , <i>Woodfordia</i> , bamboo rhizomes on eroded patches, brush wood and split bamboo gabions, random stone check dams only Cost of cement bags (empty), bamboos, brush wood collective carriage and stock piling in appropriate locations.	7	70	490.00	450.00	940.00
15.	Cost of cemented vat of 5X5X1mtr. lined with stone or bricks, (which is easily available in the locality) and can serve as a source of water (for wild life latter on) plastered and punning done to preserve water to be used in fermenting cow dung and Neem seed cake with <i>Bhuineem</i> . (Structure will be only 30cm above ground). The bottom will be random broken brick khoa and stone rammed together or epidomite material with cement and sand 1:4:6 and the side walls in random stone or brick in cm 1:4:6 with plaster & punning.				2000.00	2000.00
16.	Watch and ward.	65	70	4550.00		4550.00
1st Year Cost Total		187		13090.00	14613.00	27703.00
2nd Year Operation						
17.	Soil conservation measures like repair to damaged dams, spurs, gabions	3	70	210.00	290.00	500.00
18.	Material cost like empty gunny bags, collection of sand morrum, soil for filling, bamboo, brush wood and fixing in position after stock piling (cost up to stock piling)				450.00	450.00
Total		190		13300.00	15353.00	28653.00

B/F		190		13300.00	15353.00	28653.00
19.	Casualty replacement all casualty replacement shall be with mahula & Kusum plants only or with Tamarind and Bahada, Amla and Harida Plants for shrubs and bushes only bamboo and Adhatoda, Jatropha only.	12	70	840.00		840.00
20	Bucket weeding around each plant in pits and singling out of all prominent tree species that have germinated and survived by providing earthen saucer around on down hill side for moisture retention and thus creating a pit on up hill side near the plant for arresting water flow.	6	70	420.00		420.00
21	Manuring as per 1 st year operation including all established seedling and grasses, branch cutting etc.	7	70	490.00	700.00	1190.00
22	Sowing of seeds collected from last years planting and mulching with earthen clods collected from staggered trenches dug up at places to allow collection and percolation of water (after early rains) trench size 1mtrX30cmX30cm	7		490.00		490.00
23	Watch and ward	15	70	1050.00		1050.00
2nd Year cost Total		237		16590.00	16053.00	32643.00
3rd year operation						
24	Soil conservation repair of spurs check dams and brushwood gabions	4	70	280.00		280.00
25.	Application of fertilizer on all plant with weeding around the tree species only.	7	70	490.00		490.00
Total		248		17360.00	16053.00	33413.00

	B/F	248		17360.00	16053.00	33413.00
26.	Cost of fertilizer (Same methodology except the quantity is increased to cow dung 50kg, Neem sad oil cake-30kg, urea-5kg, Bhuneem-40kg, Potash-10kg phosphate 10kg, mixed in two doses and fermented in 4000 liters of water and applied on the plants, grasses shrubs and bushes like watering. This has to be done after the materials for over a week. Before application there should be moisture on the soil so that plants utilize the petrified mixture, which repels insects and browsing animals have fully fermented in the vat. Additional water can be added to be added to the petrified mixture for dilution till the entire mixture is exhausted from the vat.				1000.00	1000.00
27.	Sowing of the seeds of Bhuneem grasses and shrubs, zizy plus, Ficus in ploughed up beds irrigated with fermented water at blanks to cover up the eroded land during early monsoon.	5	70	350.00		350.00
28.	Watch and ward	15	70	1050.00		1050.00
	Total	268		18760	17053	35813

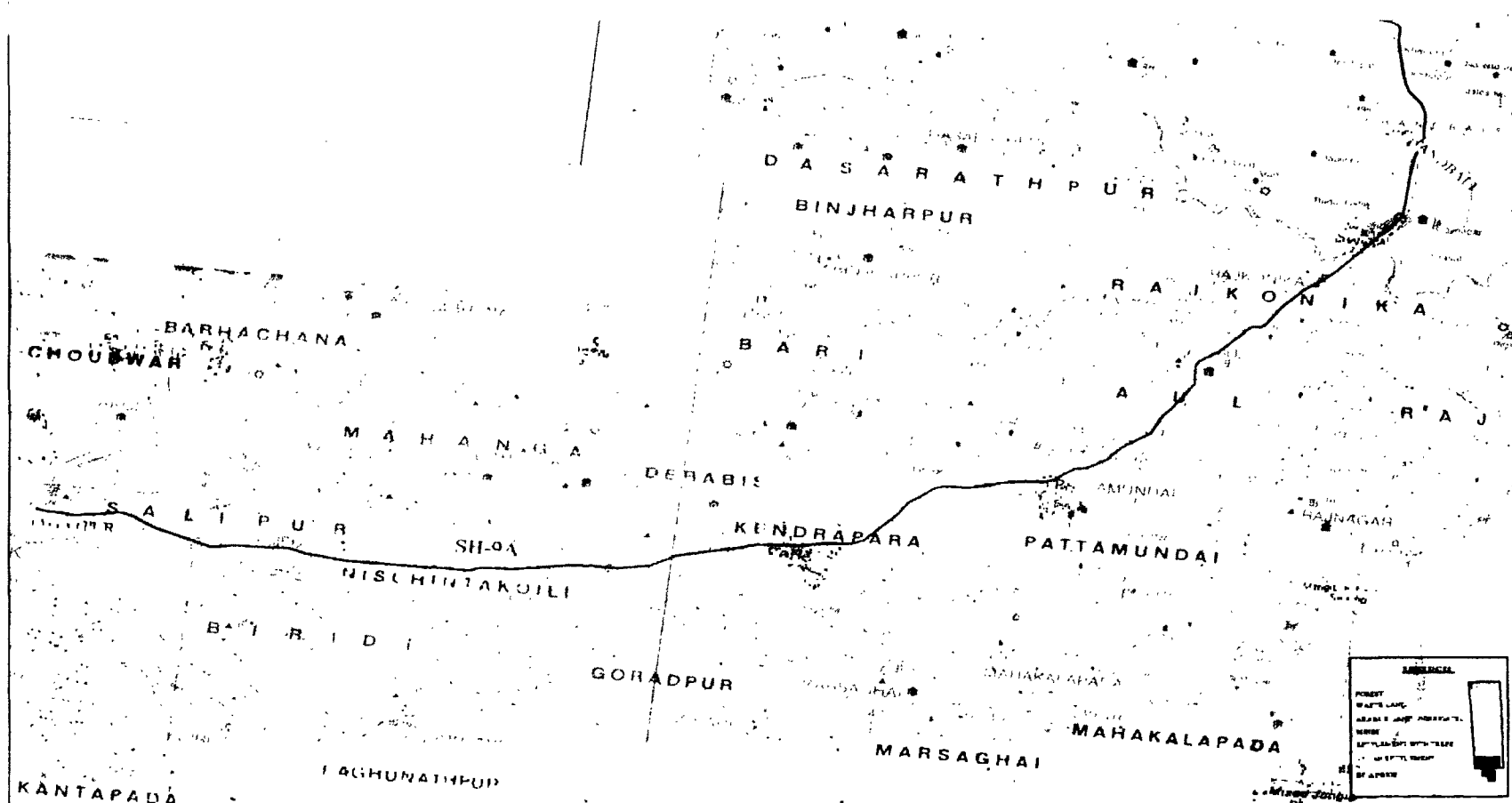
ANNEXURE-XIII

Corridors as per Threat Perception (Environment Impact)



ANNEXURE-XV

(Jagatpur-Chandbali SH-9 (A))



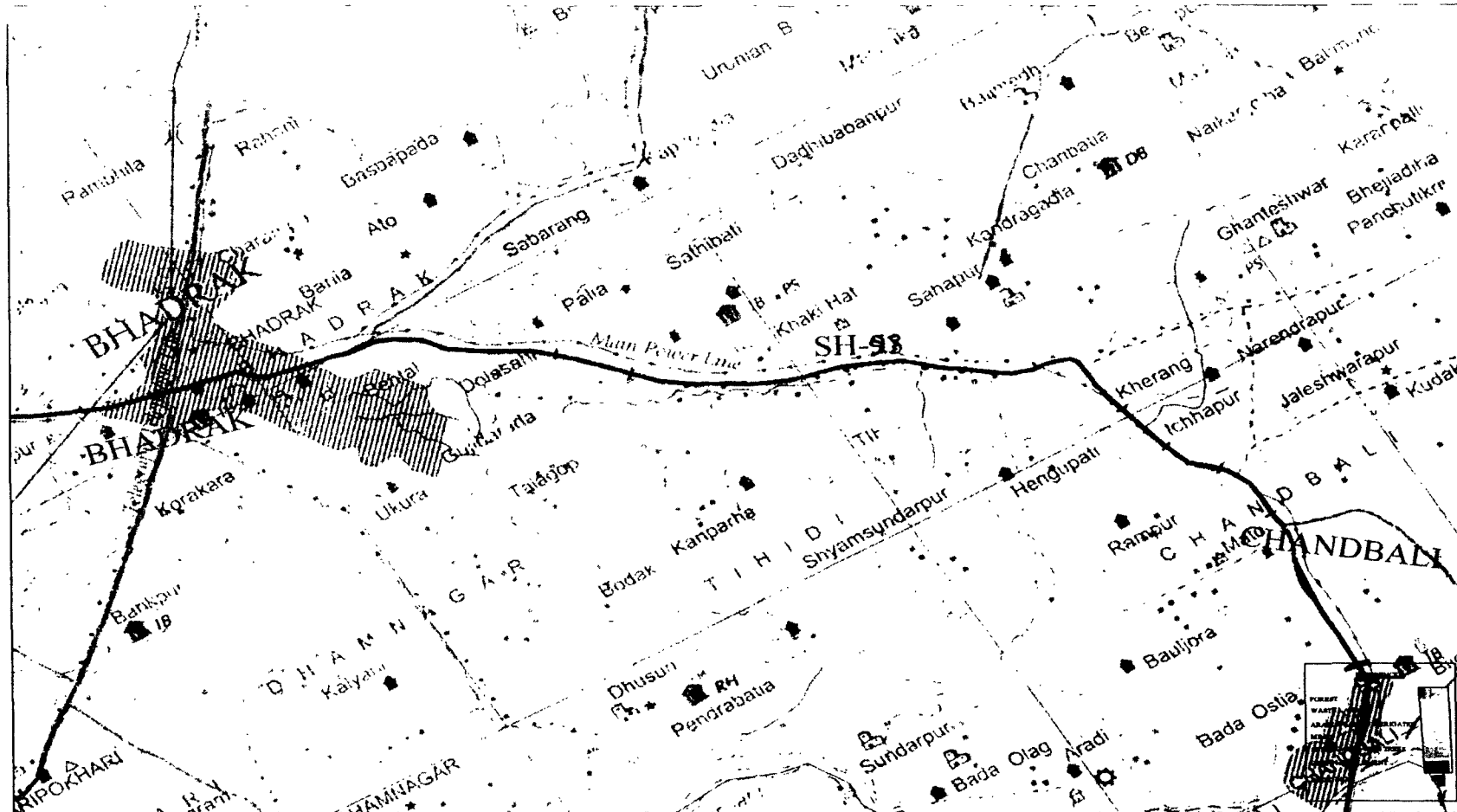
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 Tel: +91-141-2520899, 2521899, 2520556
 Fax: 2521348, e-mail: ceg@cegindia.com

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 FOR ORISSA STATE ROAD PROJECT UNDER WORLD BANK
 ASSISTANCE

PROJECT ROAD LOCATION MAP							
JAGATPUR-KENDRAPADA-CHANDBALI (SH-9A)							
DRG NO.	DATE	REV.	RD	SCALE	BY	CHKD.	APPD.
SH-9A				NTS	BM	RJ	RRDK SG

ANNEXURE-XVI

(Chandbali-Bhadrak) (SH-9)



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**PROJECT ROAD LOCATION MAP
 CHANBALI TO BHADRAK (SH-9)**

DRG NO.	DATE	REV	RO	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
SH NO.							
SCALE	NTS			BM	RJ	R.R.D.K	SG

ANNEXURE-XVII

(Bhadrak-Anandpur) (SH-53)

xvii



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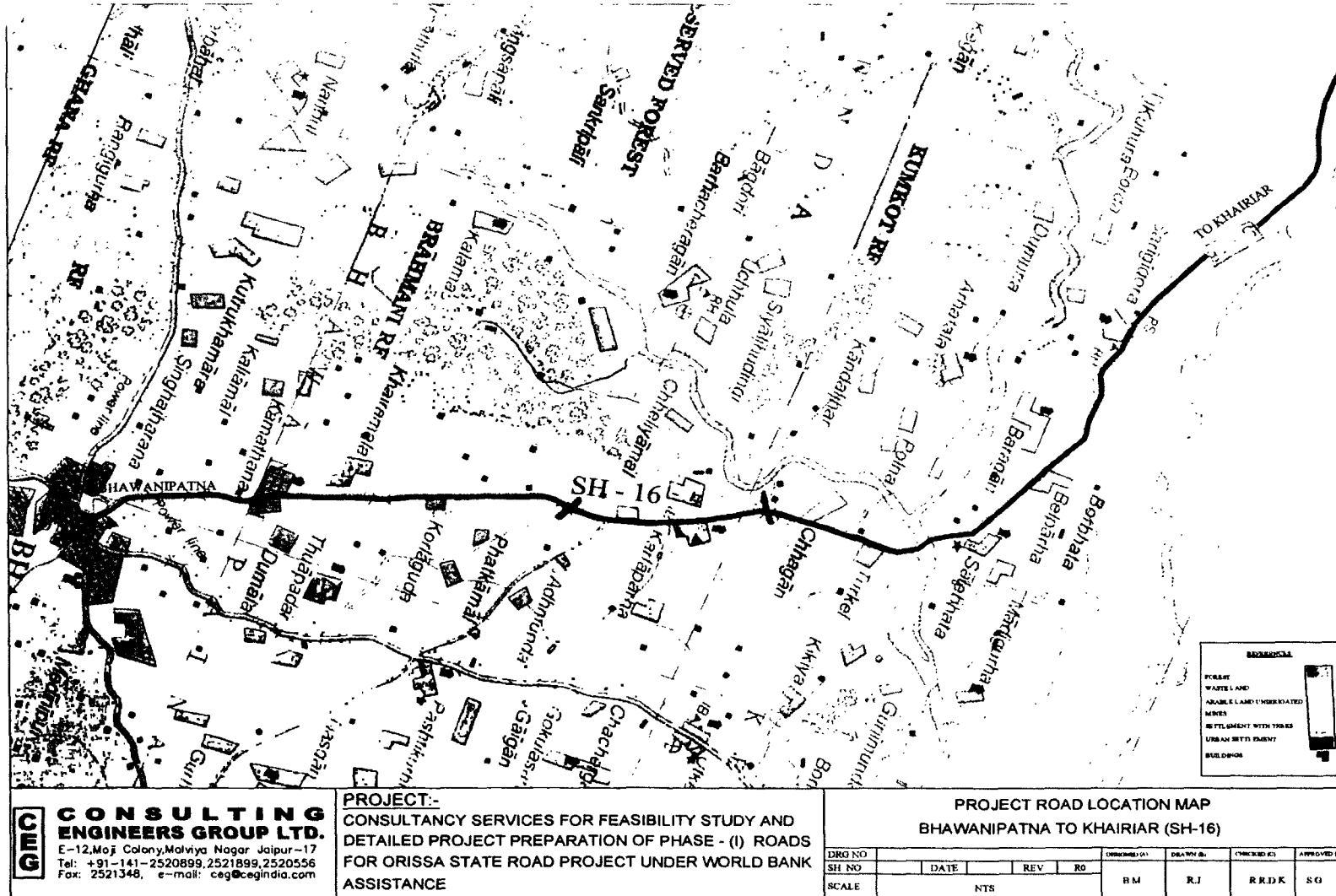
**PROJECT ROAD LOCATION MAP
 BHADRAK TO ANADPUR (SH-53)**

DWG NO	DATE	REV	RO	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
SH NO.				B.M	R.J	R.RON	S.G
SCALE	NTS						

Consultancy Service for Feasibility Study and Detailed
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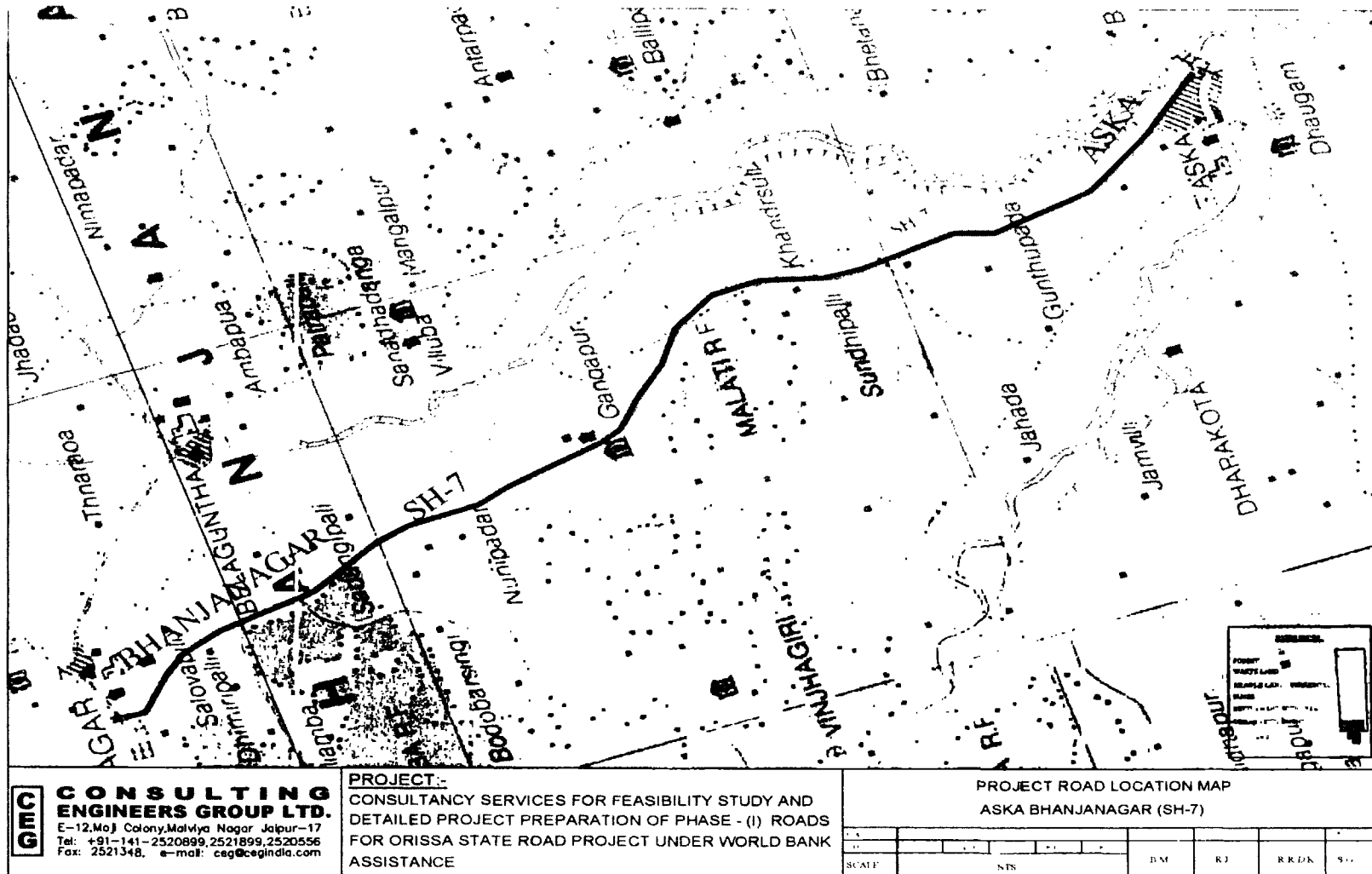
ANNEXURE-XVIII(i)

(Bhawanipatna-Khairiar) (SH-16)



ANNEXURE-XIX

(Bhanjanagar-Aska) (SH-7)



ANNEXURE-XX(i)

(Berhampur-Tapatapani) (SH-17)



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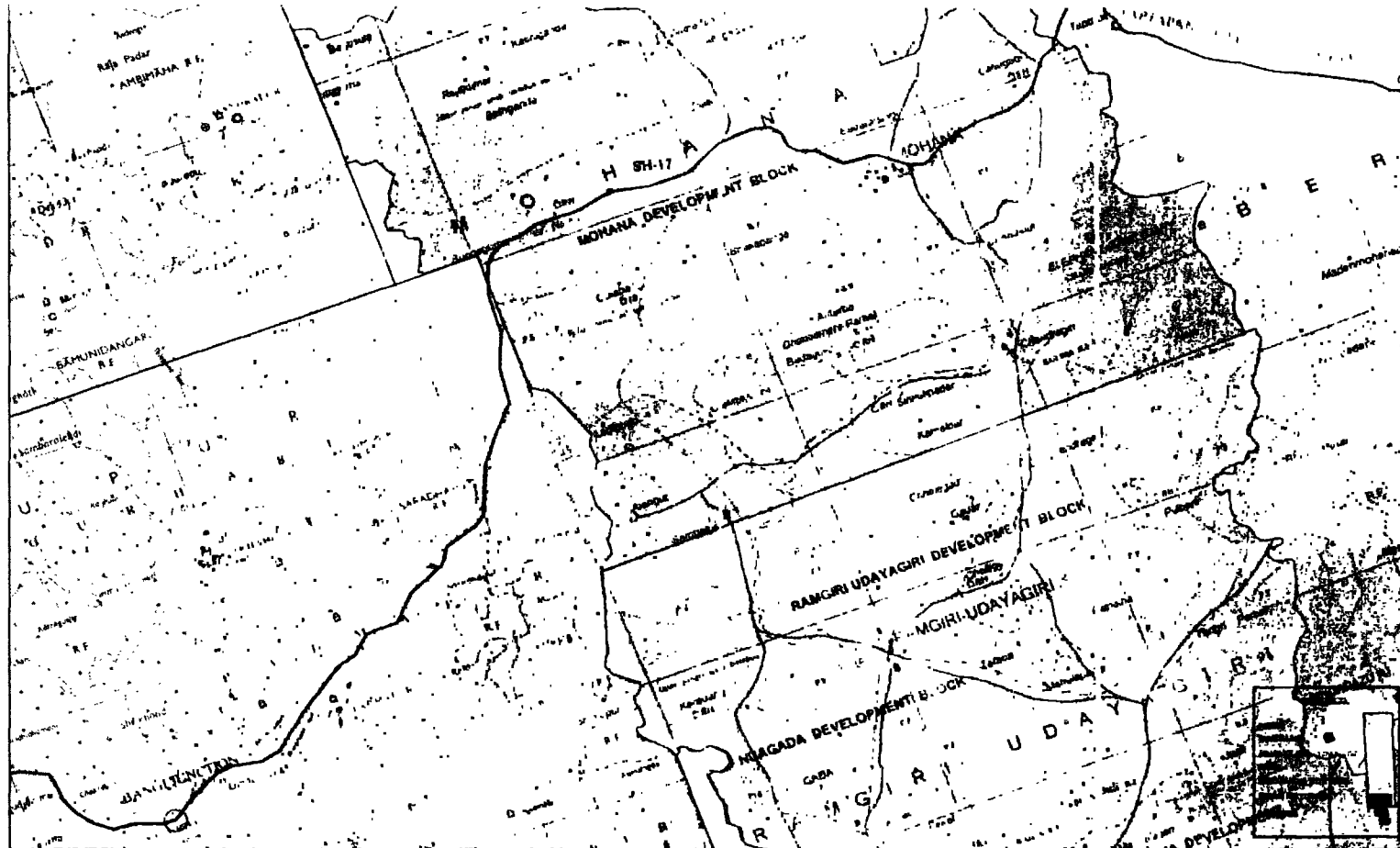
PROJECT:-
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**PROJECT ROAD LOCATION MAP
 BERHAMPUUR TO TAPTAPANI GHAT (SH-17)**

SCALE	1:50,000	1:25,000	1:10,000	1:5,000	1:2,500	1:1,250	1:625
	1:50,000	1:25,000	1:10,000	1:5,000	1:2,500	1:1,250	1:625

ANNEXURE-XX (ii)

(Taptapani – Bangi Junction)) (SH-17)



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**PROJECT ROAD LOCATION MAP
 TAPTAPANI GHAT TO BANGI JUNCTION (SH-17)**

SCALE	1:1000	1:2000	1:5000	1:10000
	BM	RJ	RRDK	SG

ANNEXURE-XXII

(Muniguda-JK Pur) (SH-5)



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**PROJECT ROAD LOCATION MAP
 MUNIGURHA TO JK PUR (SH-5)**

NO.	DATE	REV.	BY	CHKD.	APP'D.
1					
SCALE	NTS			BM	RJ
				RRDJA	SG

ANNEXURE-XXIII

(Bhawanipatna-Muniguda) (SH-6)

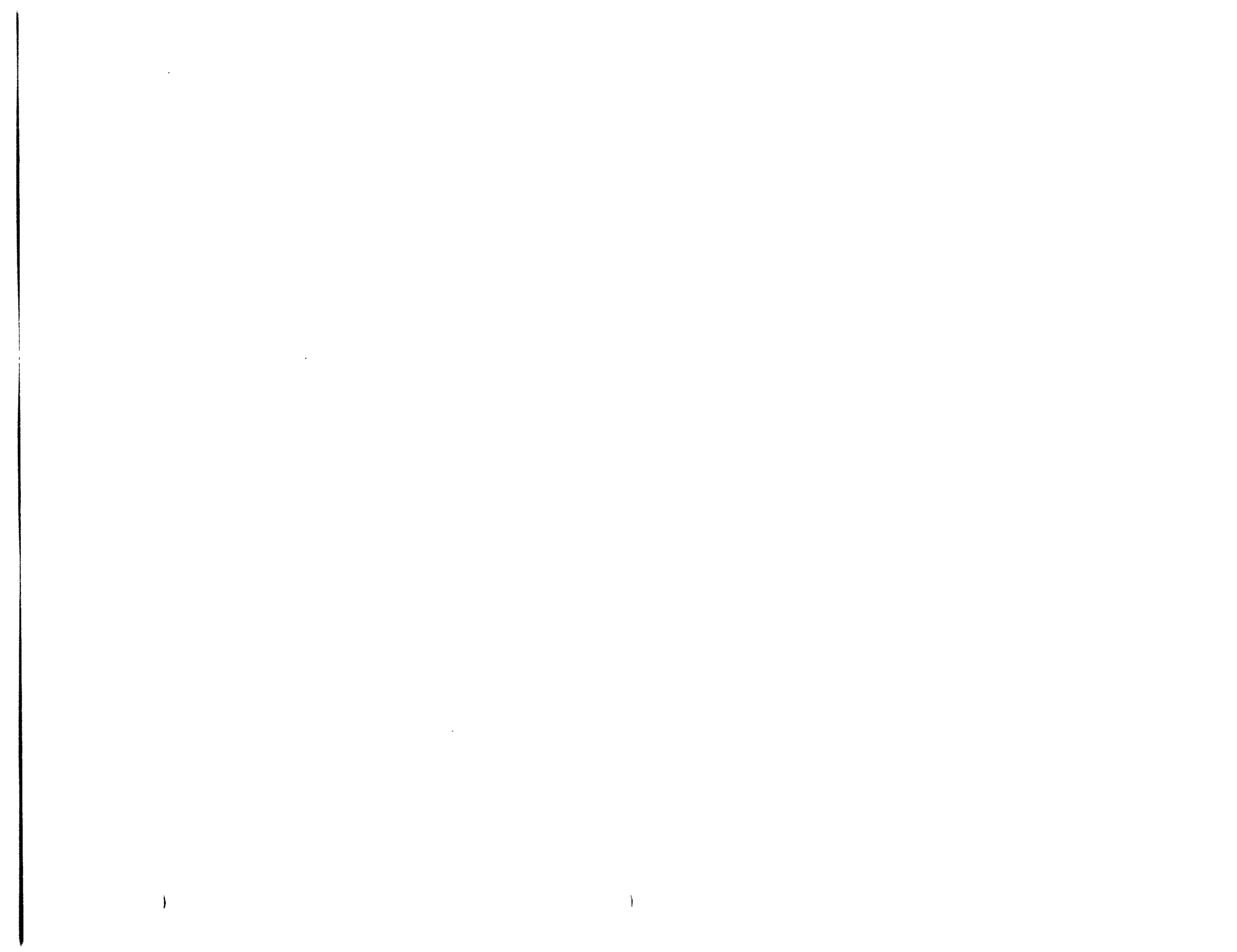


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**PROJECT ROAD LOCATION MAP
 BHAWANIPATAHA TO MINUGURHA (SH-6)**

DRG NO	DATE	REV	RO	SCALE	DATE	APP. ETC
SH No						



Annexure – XXV**Abbreviations used for Engineering Interventions for Biodiversity Action Plan**

- | | | |
|-------------|---|--|
| 1. WC | - | Without Earth Cushion |
| 2. EC | - | With Earth Cushion |
| 3. B | - | Biodiversity Under Pass |
| 4. PC | - | Pipe Culvert |
| 5. BC | - | Box Culvert |
| 6. PC/S | - | Pipe Culvert Single Cell |
| 7. PC/D | - | Pipe Culvert Double Cell |
| 8. BC/S | - | Box Culvert Single Cell |
| 9. BC/S/WC | - | Box Culvert Single Cell Without Cushion |
| 10. BC/D/WC | - | Box Culvert Double Cell Without Cushion |
| 11. BC/S/EC | - | Box Culvert Single Cell With Earth Cushion |
| 12. V | - | Viaduct |
| 13. TR | - | Trap Drain |
| 14. ER | - | Existing / Now to be Reconstructed |
| 15. C/W | - | Carriage Way |
| 16. ROW | - | Right of Way |
| 17. WL/S | - | Wild life Sanctuary |
| 18. B/R | - | Biosphere Reserve |

Name of Corridor: Bhadrak - Chandbali SH-9
Engineering Details of Interventions

Annexure-XXV-A

Sl. No.	Chainage	Species		Structures (Existing/New)	Technical Details		
		Scientific Name	Local Name		Type	Dimension	Drawing No.
1	26.430	Hemiodontilous flavivirdls	Land monitor	Existing pipe culvert	Proposed box culvert	1/22/0 box With trap drain and viaduct connectivity	ER/BC/B/S/XXVI B1 OSRP/CEG/SH/ENV/12
		Varanus bengalensis	Water monitor				
		Varanus flavescens	Yellow monitor				
		Lutra perspicillata	Otter				
2	28.837	Felis viverina	Fishing cat	Existing 6.0X2.5x0	Reconstruction Triple cell box	3/33/0 Triple cell	ER/BC/B/WC/T/ XXVI B1 OSRP/CEG/SH/ENV/12
		Vivericula indica	Civet				
3	30.154	Paradoxurus hermaphroditus	Palm civet	Existing 10x2.0	Reconstruction (RC) Triple cell box	3/33/0 Triple cell	ER/BC/B/WC/T/XXVI B1 OSRP/CEG/SH/ENV/12
		Canis aureus	Jackal				
4	31.700	Hyaena hyaena	Hyaena	Existing arch culvert at 31.600km	New single cell box at 31.700km	1/43/0 single cell	ER/BC/B/WC/S/XXVI B1 OSRP/CEG/SH/ENV/12
5	35.825	Rheses macaque	Monkey	Existing 10x2.1	Reconstruction (RC) Triple cell box	3/33/0 Triple cell box	ER/BC/B/WC/T/XXVI B1 OSRP/CEG/SH/ENV/12
		Presbitis entelus	Langur				
6	40.974	Xenochrophis piscator	Water snake	Existing	Reconstruction (RC) box	1 /23 /0 single cell	ER/BC/B/S/XXVI B1 OSRP/CEG/SH/ENV/12
		Ptyas mucosus	Rat snake				
		Python molurus	Boda/Python				
		Naja naja	Gokhar				
7	45.202	Naja naja kaouthia	Kolathia naga	Existing	RC box single cell	1/23 /0 single cell	ER/BC/B/WC/S/XXVI B1 OSRP/CEG/SH/ENV/12
		Bungarus caeruleus	Chiti				
		Bungarus fasciatus	Rana				
		Athaetulla nasutus	Laudankiya				
		Vipera russeli	Russels viper				
		Felis chauls	Jungle cat				
		Herpestes edwardsi	Mongoose				
		Rana tigrina	Bull frog				
		Rana cyanophlyctis	Toad				

ER/BC/B/S/XXVI B1 - Existing/ Reconstructed/ Box culvert/ Biodiversity/Single cell/Triple cell/ Drawing No.XXVI B1 & OSRP/CEG/SH/ENV/12

Name of Corridor: Bhadrak - Anandapur SH-53 (Part) Km 0 to Km48

Annexure-XXV-B

Engineering Details of Interventions

Sl. No.	Chainage	Species	Local Name	Structures (Existing/New)	Technical Details Type	Dimension	Drawing No.
		Scientific Name					
1	11.869	Canis aureus Presbytis entellus	Jackal Langur	ER	Single pipe	1.0M. Dia Single pipe	ER/PC/B/S/XXV-C1 OSRP/CEG/SH/ENV/12
2	13.507	Rhesus macaque Viverricula indica	Apes Civet	ER	Single pipe	1.0M Dia single pipe	ER/PC/B/S/XXV-C1 OSRP/CEG/SH/ENV/12
3	17.002	Varanus bengalensis Varanus flavescens	Land monitor Yellow monitor	ER	Single cell box culvert	1/22/0 Box	ER/BC/B/S/WC/XXV-B1 OSRP/CEG/SH/ENV/12
4	21.024	Herpestes edwardsi	Mongoose	ER	Double pipe	1.0 m dia double pipe	ER/PC/B/D/WC/XXV-C2 OSRP/CEG/SH/ENV/12
		Echis carinatus Vipera-russeli	Water snakes Chandraboda				
		Naja naja kaouthia Naja naja Ptyas mucosus	Kolathia naga Gokhara Dhamana				
		Bungarus fasciatus Xenochrophis piscator	Rana Pani dhanda				
		Python molurus Bungarus caeruleus	Ajgara Chiti				
		Lissemis punctata	Turtle				
5	23.500	Rana tigrina Hystricis indica	Bull frog Porcupine	Forest check gate	Unified forest check gate & Toll plaza.	With lay bye for checking vehicles	Relocation of existing structures at Urali Jn.
6	34.000	Ratus ratus	Rats	Forest check gate	Forest check gate shifted to feeder road from Hadagada WLS.	Barrier type	To be shifted to the feeder road from Hadagada at Bancho Jn. on the right with check gate shed.
7	40.246	Suscrfa auristatus Hyena hyaena	Wild boar Hyena	ER	Single cell box culvert	1/43/0	ER/BC/B/S/WC/XXV-B1 OSRP/CEG/SH/ENV/12
		Felis chansaffinis	Jungle cat				
		Lutra perspicillata	Otter				

ER/PC/B/S/XXV-C1-

Existing to be reconstructed /Single pipe /Biodiversity drawing No.XXV-C1

ER/PC/B/S/XXV-C2-

Existing to be reconstructed /Double pipe /Biodiversity drawing No.XXV-C2

ER/BC/B/S/WC/XXV-B1-

Existing to be reconstructed /Single cell box /Biodiversity/With out cushion drawing No.XXV-B1

Name of Corridor: Bramhapur to Bangi Jn. (SH-17)
Engineering Details of Interventions

Annexure-XXV-C

Sl. No.	Chainage	Species	Local Name	Structures (Existing/ New)	Technical Details	Dimension	Drawing No.
		Scientific Name			Type		
1	2.137	Hemidictilous flavivirdis	Monitor lizard	E/R	Box	1/23/0	ER/BC/S/B/WC/ XXVI B1 OSRP/CEG/SH/ENV/12
2	9.786	Rana tigrina Rana cyanophlyctis Herpestes edwardsi	Bull frogs Water skipper Mongoose	E/R	Box	1/23/0	ER/BC/S/B/WC/ XXVI B1 OSRP/CEG/SH/ENV/12
3	24.700	Vivericula indica	Civets	Forest check gate	Cross bar barricade relocated with check gate shed new construction	Vehicle parking Lay bye	E/R with Lay bye & bus stand due to expansion for road Jn. and dismantling the existing structure.
4	27.020	Bear under pass Sloth Bear	Melursus urcinus	New Bear pass with metal barricade beyond retaining wall	Box culvert with retaining wall either side	1/22/0	New/BC/S/B/WC/ XXVI B1 OSRP/CEG/SH/ENV/12
		Lutra perspicillata	Otters				
		Felis chaus	Jungle cats				
		Varanus flavescens	Snakes				
		Felis viverina	Fishing cat				
		Vivericula indica	Civet				
		Paradoxurus hermaphroditus	Palm civets				
		Canis aureus	Jackal				
		Hyaena hyaena	Hyena				
		Rheses macaque	Ape				
		Presbitis entelus	Langur				
		Xenochrophis piscator	Water snake				
		Ptyas mucosus	Rat snake				
		Python molurus	Python				
		Naja naja	Gokhara				
		Naja naja kaouthia	Kolathia naga				
		Bungarus caeruleus	Chiti				
		Bungarus fasciatus	Rana				
		Athaetulla nasutus	Laudankiya				

		Vipera russeli Felis chauls	Chandra boda Jungle cat				
		Herpestes edwarsi Rana tigrina	Mongoos Bull frog				
		Rana cyanophlyctis	Skipping frog				
5	36.900	Sauscraea auristatus	Wild boar	Existing cross bar check gate Podamari shifted	Cross bar Forest check gate at new location with check gate shed	Dismantled and acquired old check gate shifted to new location.	E/New cross bar forest check gate with shed at new locations, as per forest department design.
6	41.350	Muntiacus muntjak	Barking Deer	E	Bridge	1/105/0	Only approach improvement
7	56.350	Melursus urcinus Cervus unicolor	Slouth bear Sambar	E/R	Box	1/22/1.5 EC	ER/BC/S/B/EC/ XXVI A1
8	66.050	Axis axis	Spotted deer	E/R	Double pipe	1.5 ø x EC	ER/PC/D/B/EC/ XXVI C2
9	75.300			E/R	Single pipe	1.5 ø x EC	ER/PC/S/B/EC/ XXVI C1
10	80.000	Forest check gate		E/R	Cross bar check gate	Vehicle parking Lay bye	
11	91.300	Tragulus memina	Mouse deer	E/R	Box	1/22/1.5 EC	ER/BC/S/B/EC/ XXVI A1
12	93.000			New	Box	1/22/1.5 EC	New/BC/B/EC/XXVI A1
13	96.020	Ratus ratus	Rats	E/R	Box	1/22/1.5 EC	ER/BC/S/B/EC/ XXVI A1
14	105.900	Canis lupus pallipes Cuon alpinus	Wolf Wild dog	E/R	Box	1/22/1.5 EC	ER/BC/S/B/EC/ XXVI A1
15	118.005	Elephas maximus	Elephant	E/New	Box with EC	1/58/1.5EC	ER/BC/S/B/EC/ XXVI A1
16	121.800	Bos gaurus	Gayala	E/R	Box	1/22/1.5 EC	ER/BC/S/B/EC/ XXVI A1
		Panthera pardus	Cheeta/ Pendra				
		Panthera tigris	Mohabala/ Bagha				

New/BC/S/B/EC/ XXVI A 1 New construction/Box culvert/single cell/Biodiversity/Earth cushion/drawing no. XXVI A 1

New/BC/S/B/EC/ XXVI B 1 -Existing /Reconstruction /Box culvert/single cell/Biodiversity/Earth cushion/drawing no. XXVI

B 1

ER/BC/B/S/WC/XXVI B 1 -Existing/ Reconstructed/ Box culvert/ Biodiversity/single cell/ without cushion/ ER/BC/B/S/WC/XXVI B 1

ER/PC/B/S/XXVI C 1 -Existing/ Reconstructed/ Pipe culvert/ Biodiversity/double cell/ ER/PC/B/S/XXVI C 1

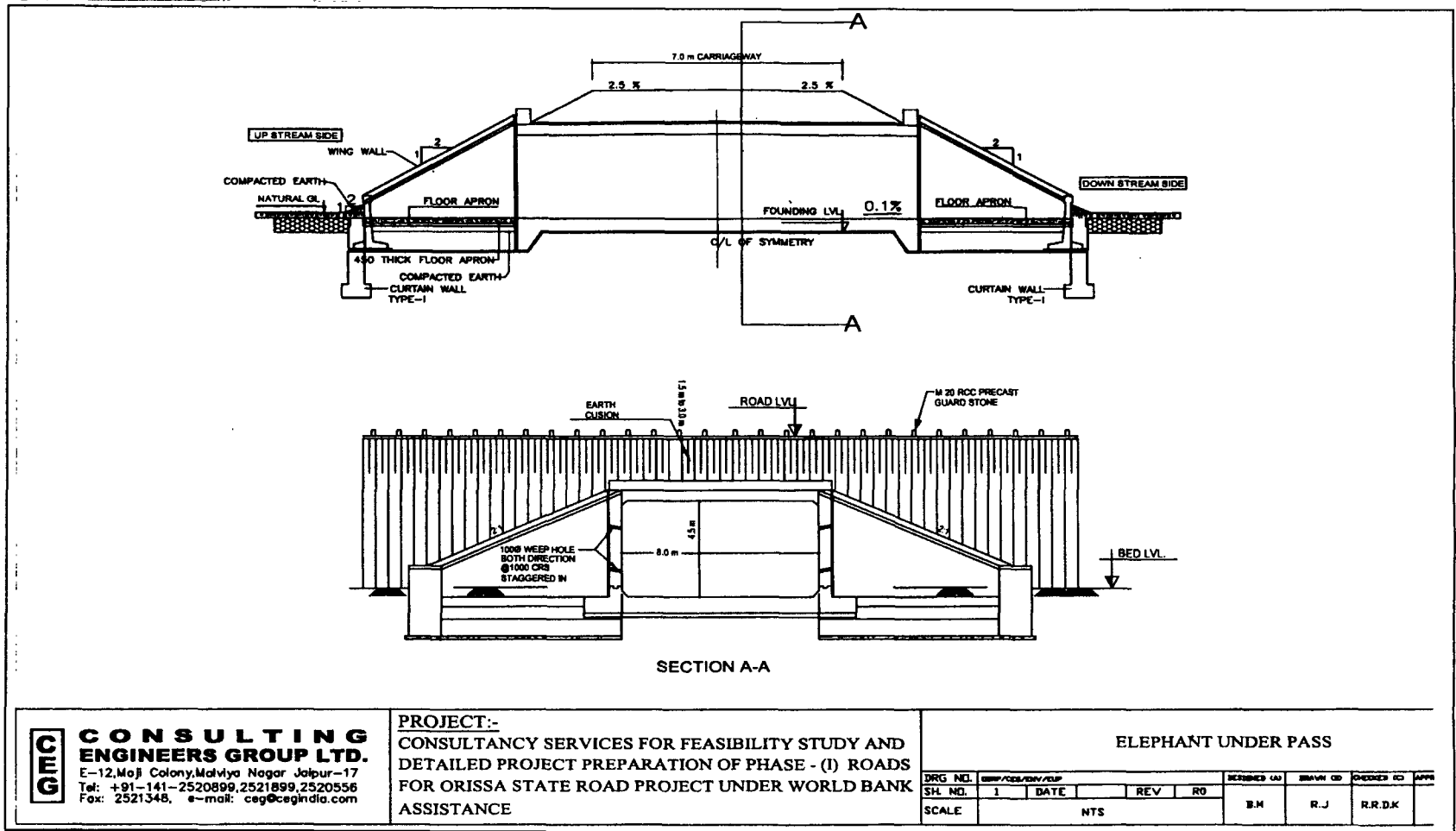
ER/PC/B/D/XXVI C 2 -Existing/ Reconstructed/ Pipe culvert/ Biodiversity/double cell/ ER/PC/B/D/XXVI C 2

Annexure-XXV-D**Name of Corridor: Bhawanipatna to Khariar (SH-16) Km 2 to Km70****Engineering Details of Interventions**

Sl. No.	Chainage	Species		Structures	Technical Details		
		Scientific Name	Local Name	(Existing/New)	Type	Dimension	Drawing No.
1	4.100	Canis aureus	Jackal	EX	1x0.6m single pipe	1x0.6m single pipe	
2	18.850	Varanus flavescens Lutra perspicillata	Yellow monitor Otter	ER	Box Culvert	1/34/0	ER/BC/B/S/WC/XXVI- B1
		Viverricula indica	Civet				
3	22.150	Paradoxurus hermaphroditus	Palm civet	ER	Single cell box	1/34/0	ER/BC/B/WC/S/ XXVI-B1
		Manis crassicaudata	Pangolin				
4	54.350	Hyaena hyaena	Hyaena	ER	Single cell box	1/34/0	ER/BC/B/WC/S/XXVI B1
5	64.900	Rhesus macaque Presbitis entelus	Monkey Langur	ER	Single cell box	1/33/0	ER/BC/B/WC/S/XXVI B1
6	67.850	Xenochrophis piscator Ptyas mucosus	Water snake Rat snake	ER	Single cell box	1 /23/0	ER/BC/B/WC/S/XXVI B1
		Python molurus Naja naja	Boda/Python Gokhar				
		Naja naja kaouthia Bungarus caeruleus	Kolathia naga Chiti				
		Bungarus fasciatus Hystrix Indica	Rana Porcupine				
		Vipera russeli Felis chauls	Russels viper Jungle cat				
		Herpestes edwardsi Rana tigrina	Mongoose Bull frog				
		Rana cyanophlyctis	Toad				

ER/BC/B/S/WC/XXVI B1 -Existing/ Reconstructed/ Box culvert/ Biodiversity/single cell/ without cushion/Drawing No.XXVI B1

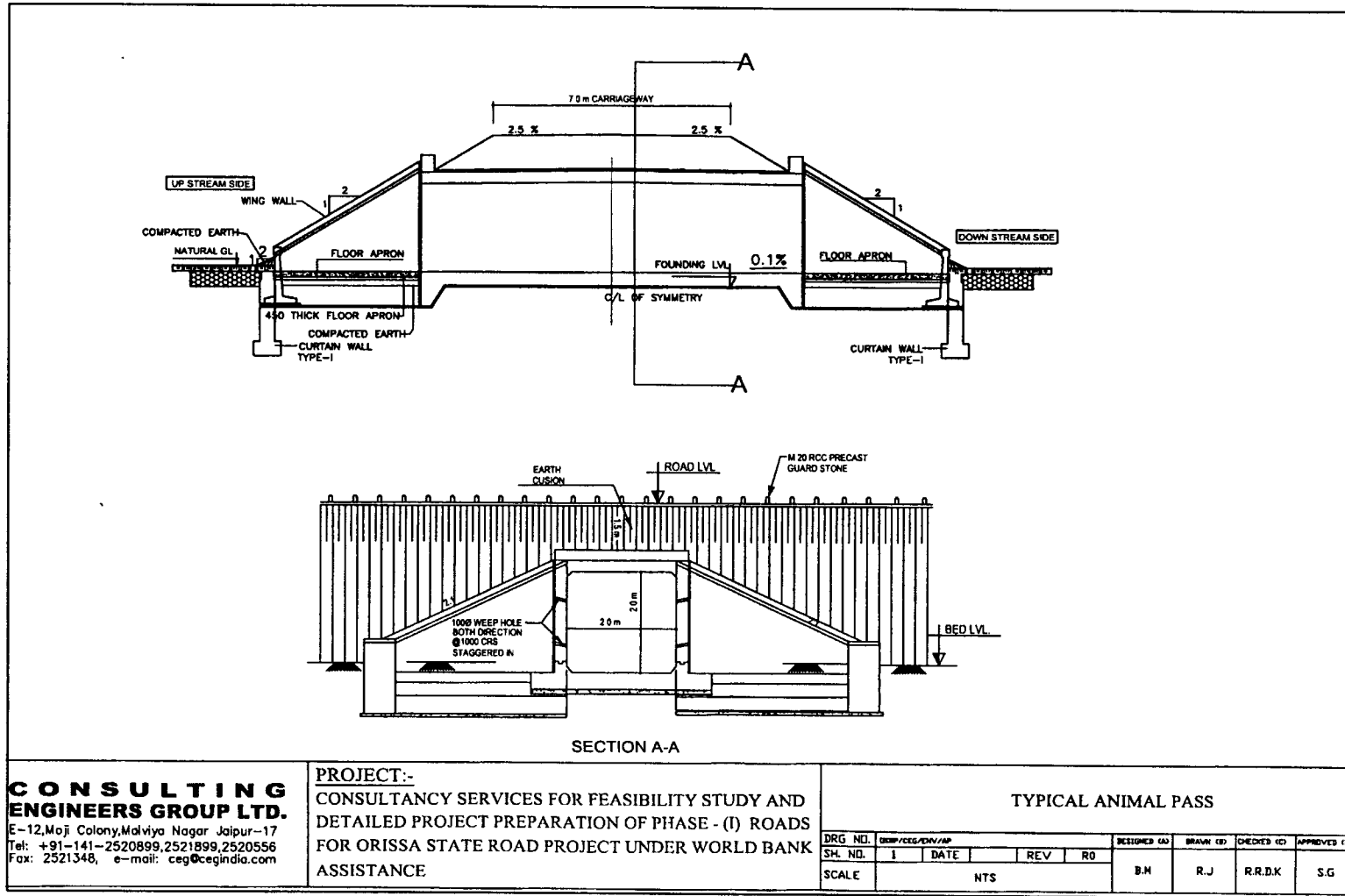
ANNEXURE- XXVI (A-1)



ELEPHANT PASS—ENGINEERING INTERVENTION (8m Wide X 4.5m High with 1.5m Cushion)

Consultancy Service for Feasibility Study and Detailed Project Preparation for Proposed Orissa State Road Project

ANNEXURE- XXVI (A-2)



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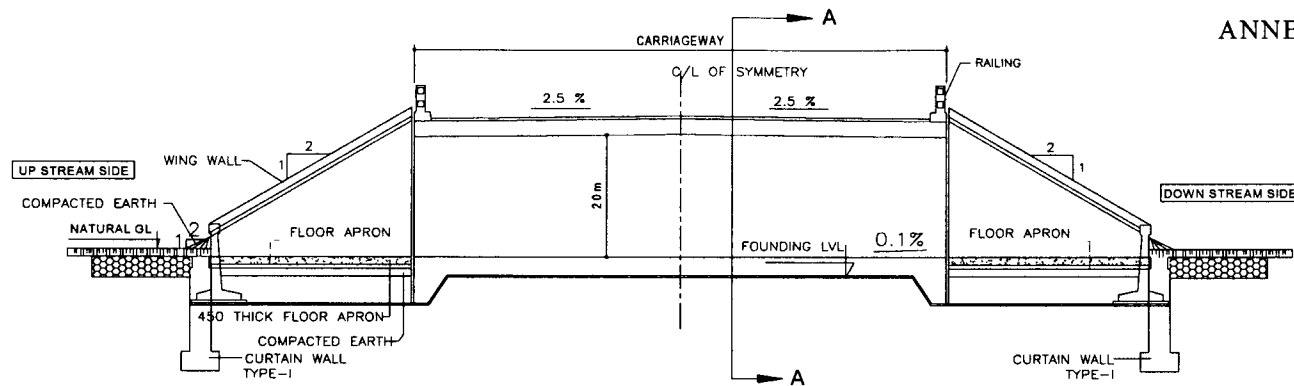
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TYPICAL ANIMAL PASS							
DRG. NO.	DATE	REV	RO	DESIGNED (S)	DRAWN (S)	CHECKED (S)	APPROVED (S)
SH. NO. 1				B.H	R.J	R.R.D.K	S.G
SCALE				NTS			

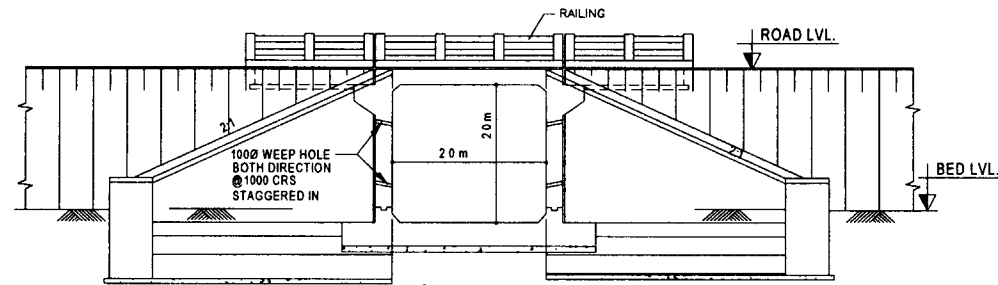
ANIMAL PASS—ENGINEERING INTERVENTION (2m Wide X2 m High with cushion)

Consultancy Service for Feasibility Study and Detailed
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ANNEXURE- XXVI- (B1)



LONGITUDINAL SECTION



SECTION A-A



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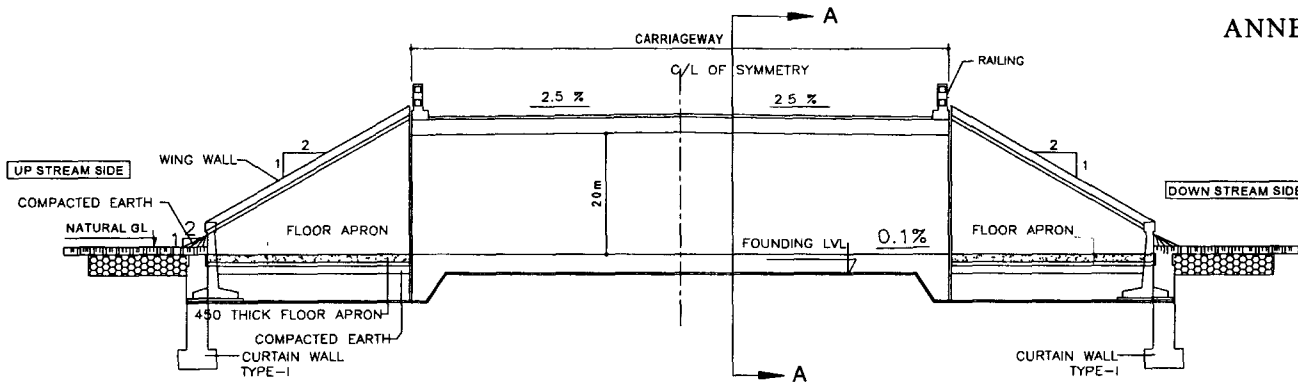
PROJECT:-
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 DETAILED PROJECT PREPARATION OF PHASE - (I) ROADS
 FOR ORISSA STATE ROAD PROJECT UNDER WORLD BANK
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TYPICAL ANIMAL PASS

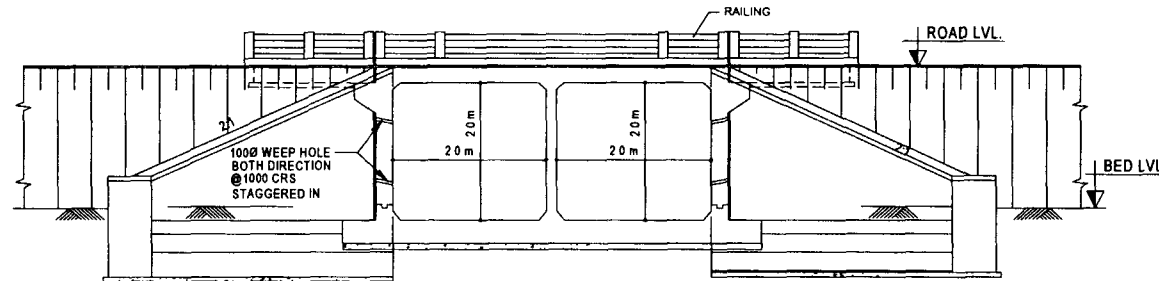
DRG. NO.	OSRP/CEG/ENV/AP-1				DESIGNED (A)	DRAWN (B)	CHECKED (C)	APPROVED (D)
SH. NO.	1	DATE	REV	RO	B.M	R.J	R.R.D.K	S.G
SCALE	NTS							

ANIMAL PASS - ENGINEERING INTERVENTION (2 M.x2 M. SINGLE CELL BOX WITHOUT CUSHION)

ANNEXURE- XXVI- (B2)



LONGITUDINAL SECTION



SECTION A-A



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 FOR ORISSA STATE ROAD PROJECT UNDER WORLD BANK
 ASSISTANCE

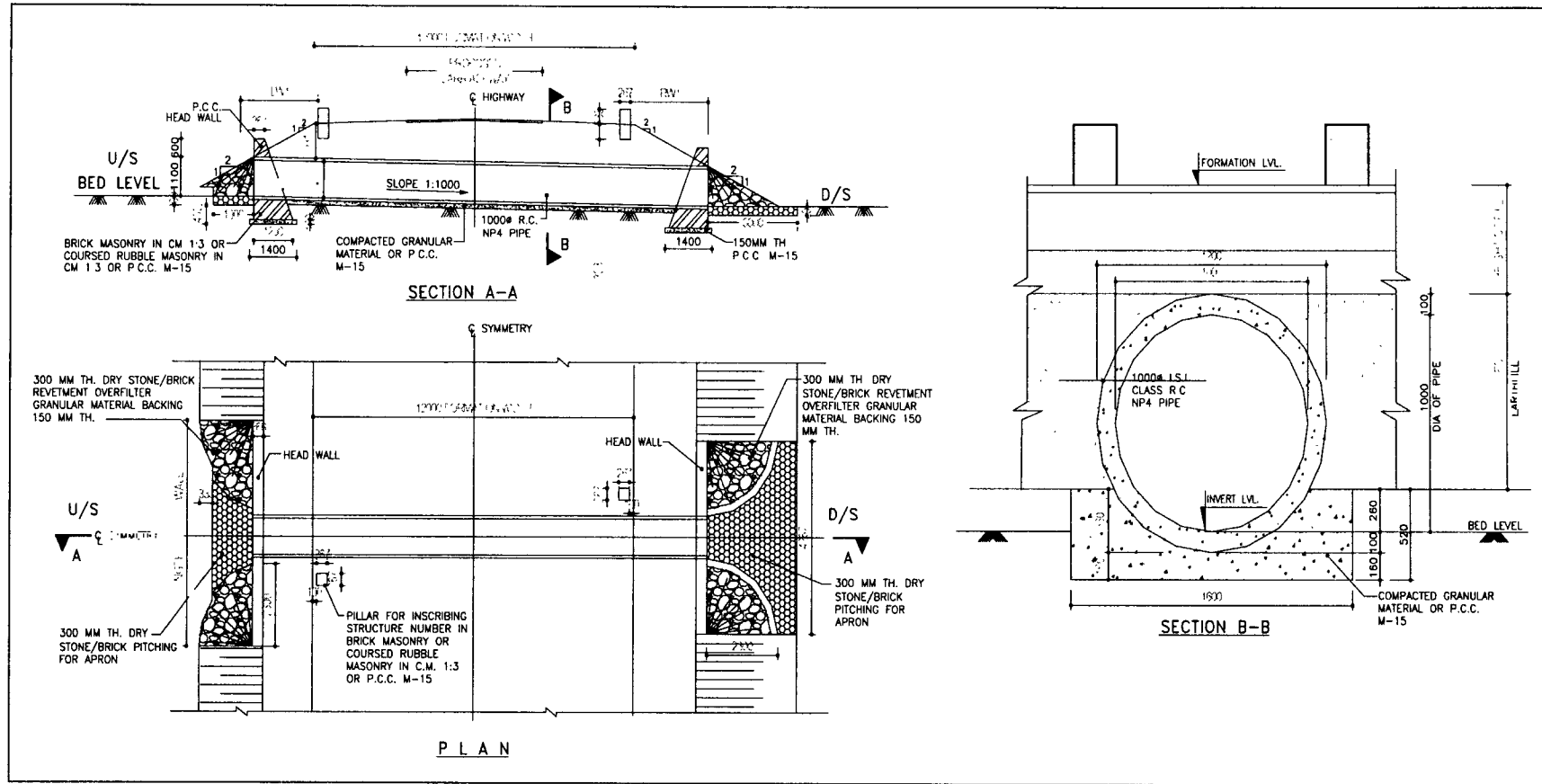
TYPICAL ANIMAL PASS

DRG. NO.	GSRP/CEG/ENV/AP-2				DESIGNED (A)	DRAWN (B)	CHECKED (C)	APPROVED (D)
SH. NO.	1	DATE	REV	RO	B.M	R.J	R.R.D.K	S.G
SCALE	NTS							

ANIMAL PASS ENGINEERING INTERVENTION (MCM DOUBLE CELL BOX WITHOUT CURB)

Consultancy Service for Feasibility Study and Detailed
 Project Preparation for Proposed Orissa State Road Project

ANNEXURE- XXVI (C)(i)



SMALL ANIMALS AND AMPHIBIANS—ENGINEERING INTERVENTION (SINGLE PIPE)



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