Consultancy Services for carrying out Feasibility Study, Preparation of Detailed Project Report and providing pre-construction services in respect of 2 Laning of Hungpung (km 43/129) to Longpikajui (km 79/552) on NH-202 on Engineering, Procurement and Construction mode in the state of Manipur

BIODIVERSITY IMPACT ASSESSMENT REPORT

Client:

NHIDCL
BUILDING INFRASTRUCTURE - BUILDING THE NATION

Consultant:

S.M. CONSULTANTS
Plot No. 130, S.M. Tower, Mancheswar Industrial Estate
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TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

SHIROI NATIONAL PARK

CHAPTER 1: SHIROI NATIONAL PARK

1.1 INTRODUCTION

Ministry of Road Transport and Highways (MoRTH) through National Highways & Infrastructure Development Corporation Ltd. (NHIDCL) (the "Authority") intends to develop the national highways of the state. As a part of this endeavour, the Authority has decided to undertake the twolaning of the following roads through EPC basis.

- Yaingangpokpi-Nagaland Border Road on NH 202 in the state of Manipur

The project stretch comes under the Shirui National Park from design chainage of 43.129 km to 79.552 km. The biodiversity of the particular project stretch needs to be studied for minimising the adverse effect during the construction process

Figure 1: Location Map

1.2 ABOUTS

1.2.1 Project Corridor

The road starts at the Yaingangpokpi near Gwaltabi and ends on Nagaland Border on NH 202. The entire road passes through hill terrain. The land use pattern observed along this road is built-up, agricultural land, and barren land. The Eco Sensitive Zone of the Shiroi National Park starts from Hungpung (43.129 km) to LongpiKajui (79.552 km). The total length of the project stretch that comes under the ESZ Boundary is 36.423 km. Along the section within the ESZ

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boundary, we encounter settlements such as Hungpung, Hunphun, Choithar,Langdang, Shirui, Lunghar and LongpiKajui.

1.2.2 Significance

Shirui National Park is a national park located in the state of Manipur in India. It was established in 1982. Among the animals that make their homes here include the tragopan, the tiger and leopard. It is here that the famous shirui lily (Liliummaclineae) grows naturally. The main peak of Shirui abounds with flowers during the monsoon and it is a veritable paradise.

The ShiruiKashong Peak near Ukhrul is a marvelous hill top view point located at a height of 2,835 meters above sea level.

A number of rivers originate from the cracks and slopes of this peak. The exotic Shirui lily flower (Liliummackliniae) blooms on the hilltop in the month of May - June. The flower attracts hundreds of scientists and tourists every year.

SHIRUI LILY" flower is rare and famous flower in the world. It is rare because it cannot be transplanted.Shirui Lily flower is a seasonal flower plants. Its best blooming season is in the month of May and June. The peak season of its bloom is in between 15th May to 5th June. The height of the plant is between 1 to 3 ft. or 30 to 90 cms tall and 1 to 7 flowers per plant. In early years one could see even up to 11 / 12 flowers per plant, which is very rare now and will hardly find. Shirui Lily is native to Manipur and the species belongs to the liliane family distributed in the damped alpine areas of Shirui peak. The flower is light pinkish in colour.

1.2.3 Basic Information

Table 1: Basic Information about the Shirui National Park

Area	100 sq. km
Date of Establishment.	25/11/1982 (proposed & settlement proceeding not yet completed)
District	Ukhrul
Altitude	1715m . 2567 m (Shiroi) M.S.L
Temperature	Avg.2.8°C to 33°C. (occasional snowfall)
Forest type	East Himalayan wet temperate Forests.

1.2.4Flora

As many as 5 (five) Quercus species and 7 (seven) Rhododendron species at the upper ridges are found in the Park. The other dominating species are Micheliamanipurensis; Magnolia cambellii; Pinuskesiya; Castanopsis species; Phoebe hainesiana etc. Most importantly, the unique and endemic ground lily locally known as Shiroi Lily (scientific name:Liliummacklinae).

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1.2.5 Fauna

The sanctuary supports 42 species of mammals, 74 species of aves, 29 species of reptiles, 6 species of amphibia, 86 species of fishes.

Mammals :- Hoolock gibbon; Himalayan Black bear; Barking deer; Sambar; Leopard; Jackal; Migratory Indian elephant along Indo-Myanmar,; Pangolin; Wild boar; Jungle cat; Flying squirrel, Martens; Clouded leopard; Golden cat; Slow loris; Hog badger; Serow; Stump tailed macaqe; Bison; Otter; etc.

Birds: - Jungle fowl; Parakeet; Mrs.Humes barred backed pheasant; Blythstragopan; Horn bills etc.

Reptiles:- Tortoise; Viper; Krait; Cobra; Python; Land monitor lizard, Green snake; Rat snake; Varanus; Buff striped keelback etc.

Amphibia: - Salamandar

Reptiles: - Python, cobra etc.

1.3 PROTECTED AREA AND ZONATION

The Protected Area is divided into 2(two) zones of influence based on ecological boundaries.

Table 2: Zone Classification of the National Park

Sl. No.	Zones	Area in sq.km.
1	Core Zone/Critical Wildlife Habitat	25
2	Eco-Development Zone/Eco-Sensitive Zone	All the forest areas within a radius of 5 km to10 km from the periphery of the ProtectedArea excluding the eastern part as it is inMyanmar side i.e. 598 sq. km.

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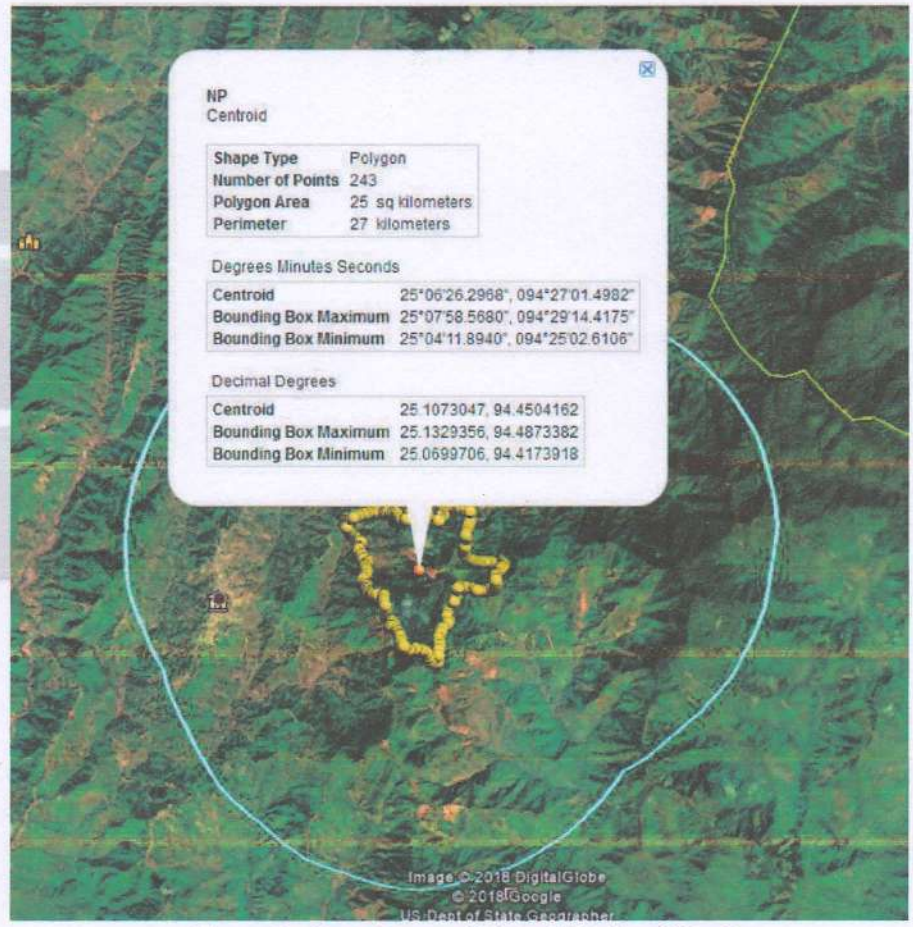

Figure 2: Core Zone of Shirui National Park

Figure 3: Eco-sensitive Zone of Shirui National Park

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1.3.1 Core Zones/Critical Wildlife Habitat

These zones are to provide complex protection and conservation to some areas against all forms of biotic interference for conservation of Bio-Diversity and to allow natural course of ecological succession. The area in the core zone is 25 sq. km.

1.3.2 Eco-Development zone/Eco-Sensitive zone

All the forest areas within a radius of 5 km to 10 km from the periphery of the PA are included in this zone. Area covered is around 598 sq. km. This is also known as Multiple-use Zone where Wild Life and people derive their benefits

1.3.3 Tourism Zone

Tourism activities would be confined withinthis zone to avoid disturbance in the other parts of PA as well as to regulate tourist movements on the prescribed tourism roads in specific areas. The existing forest roads are adequate to cater to the needs of the tourists.

1.4 BIODIVERSITY IN SHIROI NATIONAL PARK

1.4.1 Floral Species

This national park represents the North-Eastern mountainousfloral and fauna species. It is an ecosystem representing the mountainous Biodiversity as the park is located in hills of Manipur.

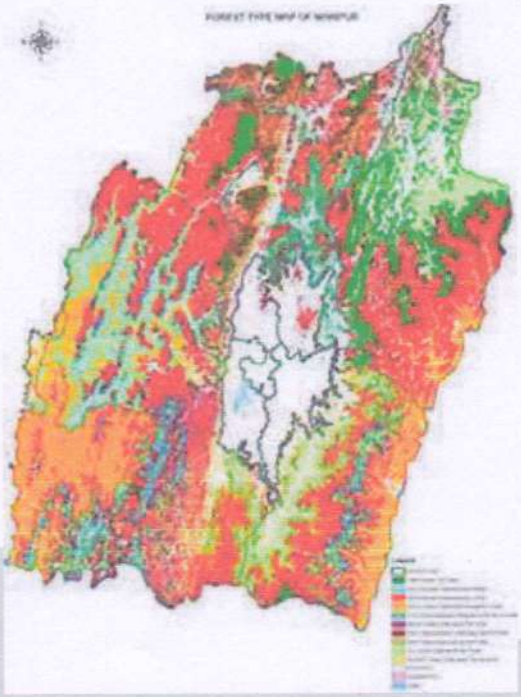

Figure 4: Classification of Forests in the Manipur State

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Figure 5: Forest Mapof Manipur State

Table 3: Forest Classification in the Protected Area

Sl.No.	Type of Forest
1	Evergreen Forest
2	Pine Forest
3	Deciduous Forest
4	Grassland

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Table 4: AGRODIVERSITY IN SHIRUI ECO-SENSITIVITY BOUNDARY

CROP PLANTS

Crop	Scientific Name	Local Name	Variety	Landscape/Habitat	Approx Area Shown	Local Status		Cropping Season	Community/ Kowledge Holder
						Past	Present		
Maize	Zea mays	Mathei	Local	Terrace	NA	Rare	Rare	February-June	Farmer's Club
Rice	Oryzasativa	Zaat	Local	Terrace	NA	Plenty	Plenty	June-November	Farmer's Club
Soya Bean	Glycine max	Theirathei	Local, JS-335	Terrace and Jhum	NA	Rare	Plenty	June-September	Farmer's Club
Potato	Solanumtuberosum		KhurfiMegha	Terrace	NA	Rare	Plenty	February-June	Farmer's Club
Cabbage	Brassica oleracea	Gobi	Rare Ball, Green Hero	Jhum and Terrace	NA	Rare	Plenty	Feb-April, June-Aug, Sept-Nov	Farmer's Club
Cauliflower	Brassica oleracea	Gobiwon	Snow white, Pushasharad	Jhum and Terrace	NA	Rare	Rare	Sept-Nov	Farmer's Club
Ginger	Zingiberofficinalis	Hui	Local	Jhum	NA	Rare	Rare	Feb-Nov	Farmer's Club
Chilly	Capsicum annum	U-Morok	Local	Jhum, Backyard and Terrace	NA	Plenty	Plenty	Feb	Farmer's Club
Broccoli	Brassica oleracea		Everest	Jhum and Terrace	NA	Nil	Rare	Sept-Nov	Farmer's

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Crop	Scientific Name	Local Name	Variety	Landscape/Habitat	Approx Area Shown	Local Status		Cropping Season	Community/ Kowledge Holder
						Past	Present		
									Club
Dolichos Bean	Dolichospurpureus		Local	Terrace	NA	Rare	Rare	August-October	Farmer's Club
French Bean	Phaseolusvulagaris		Local and Anupama	Jhum	NA	Rare	Rare	Feb-April	Farmer's Club
Colocassia	Colocasiaesculenta	Hankopai	Local	Jhum, Terrace	NA	Plenty	Plenty	May-Oct	Farmer's Club
Garden Pea	Pisumsativum		Arkel and Azad	Terrace, Jhum	NA	Rare	Plenty	May-July, Aug-Oct, Oct-Dec	Farmer's Club
Pumpkin	Cucurbitamoschata	Khaimathei	Local	Jhum	NA	Rare	Rare	March	Farmer's Club
Chow-Chow	Sechiumedule		Local	Backyard	NA	Plenty	Plenty	June-November	Farmer's Club

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CROP PLANTS

Crop	Scientific Name	Local Name	Variety	Landscape/Habitat	Approx Area Shown	Local Status		Cropping Season	Community / Kowledge Holder
						Past	Present		
Plum	PrunusDomestica	Plum/Heikhathei	Santarosa, grrenage, Alfaalfa etc.	Farm Area, Home stead etc.	NA	Abundant	Abundant	May-August	Knowledge holder
Pear	PyrusCommunis	Pear/Naspati	China smith, Ligonti etc.	Farm Area, Home stead etc.	NA	Abundant	Abundant	July-August	Knowledge holder
Apple	Pyrusmalus, Maluspumila, Malussylvestries	Apple	Kashimiri, Royal delicious, Vence Delicious Low chilling variety etc.	Farm Area, Home stead etc.	NA		Rare	August-October	Knowledge holder
Passion Fruit	Passifloraedulis	Passion fruit/Sitaphal	Passifloraedulis (purple/yellow)	Farm Area, Home stead etc.	NA	Abundant	Abundant	May-November	Community
Peach	Prunuspercica	Peach/ Mayangthei/ Chumbrei	Early cream, Early Amber, Local variety etc.	Farm Area, Home stead etc.	NA	Rare	Abundant	May-July	Community
Banana	Musa paradisiaca	Banana/Mothei /Laphoi	Hill Banana Local	Farm Area, Home stead etc.	NA	Abundant	Abundant	Throughout the year	Community

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Crop	Scientific Name	Local Name	Variety	Landscape/Habitat	Approx Area Shown	Local Status		Cropping Season	Community / Kowledge Holder
						Past	Present		
Walnut	Juglansregia	Walnut/ Shilangthei	Local, Eureka etc.	Farm Area	NA	Abundant	Abundant	Oct-December	Community
Cherry	Prunusavium	Cherry/ Saharthei	Early revers, Local, Australian etc.	Farm Area, Home stead etc.	NA	Abundant	Abundant	March-May	Community

WEEDS

Crop	Scientific Name	Local Name	Affected crop	Impact	Landscape /Habitat	Approx Area Shown	Local Status		Cropping Season	Community/ Kowledge Holder
							Past	Present		
Herb	Cyperusdifformis		Aquatic							
Herb	Sciprus spp.		Aquatic							
Herb	Echinochloacrusgalli		Aquatic							
Herb	Echinochloacolonum		Aquatic							
Herb	Monocharia spp.		Aquatic							
Herb	Ageratum conyzoides		Open Forest							
Herb	Borreriahispida		Open Forest							
Herb	Erigeron Canadensis		Open Forest							

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Crop	Scientific Name	Local Name	Affected crop	Impact	Landscape /Habitat	Approx Area Shown	Local Status		Cropping Season	Community/ Kowledge Holder
							Past	Present		
Herb	Imperatacylindrica		Open Forest							
Herb	Osbeckia crinite		Open Forest							
Herb	Panicumoxymum		Open Forest							
Herb	Phragmatisspp		Open Forest							
Herb	Saccharumspontaneum		Open Forest							
Herb	Solanum app		Open Forest							
Herb	Canabissativa		Open Forest							
Shrub	Eupatorium odoratum	Kambirei	Forest							
Shrub	Lantana camara	Namthibi	Forest							
Shrub	MikaniaCordata	OoriHingjabi	Forest							

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MEDICINAL PLANT

Crop	Scientific Name	Local Name	Variety	Landscape/Habitat	Approx Area Shown	Local Status		Community/ Kowledge Holder
						Past	Present	
Creeper	Sitabolt	Passifloraedulis	-	Cultivated	NA	Rare	Reduced	Whole village
Tree	Shakshathei	Phyllantusniruri	-	Deciduous forest	NA	-do	Same	Most of the village
Herb	Phanang	Achyranthusaspera	-	Roadside, fallow	NA	Abundant	Same	S.Z.Terasa S.Z. Ramnganging
Tree	Khamkhuithei	Rhus japonica	-	Forest	NA	Abundant	Reduced	Most of the village elders
Herb	-	Ranunculussceleratus	-	Field, wet places	NA	-do-	Same	S.Z. Teresa
Tree	Kachangna	Taxusbaccata	-	Forest	NA	Rare	-do-	Some of the villager
Herb	Kongreihan	Centellaasiatica	-	Field, Wet places	NA	Abundant	-do-	Whole village
Herb	Hanvanthan	Plantagoerosa	-	Field and shady places	NA	Abundant	Reduced	Whole village
Herb	Shaithur	Oxalis corniculata	-	Fallow, cultivated, dry land, roadside etc.	NA	Abundant	Reduced	Most of the village elders
Herb	Nagana	Eupatorium odaoratum	-		NA	Rare	Abundant	Most of the village elders

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Crop	Scientific Name	Local Name	Variety	Landscape/Habitat	Approx Area Shown	Local Status		Community/ Kowledge Holder
						Past	Present	
Herb	Chongkha	-	-		NA	Abundant	Reduced	Village elders
Herb	Japan Kaho	Gynura cusimba	-		NA	Abundant	-do-	Most of the village elders
Tree	Khashumthei	Elacocarpafloribundus	-		NA	Rare	-do-	Most of the village elders

TIMBER PLANTS/ TREES

Plant Type	Scientific Name	Local Name	Habitat	Local Status		Wild/Home Garden	Community/ Kowledge Holder
				Past	Present		
Tree	Albizialebbeck	Uil	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Alnusnepalensis	Pareng-Nagavaithing	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Bauhinia purpurrea	ChingthraoAngangba	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Bauhinia variegate	ChingthraoAngouba	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Casatanopsishystrix	Shahi	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Cedrella serrate	Chingtairel	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Chukrassiatabularis	Taimareng	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Cinnamomumzeylanicum	Ushingsha	Forest	Abundant	Abundant	Wild	Manipuri

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Plant Type	Scientific Name	Local Name	Habitat	Local Status		Wild/Home Garden	Community/ Kowledge Holder
				Past	Present		
Tree	Emblicaofficinalis	Heikru-Shakshathei	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Erythrinaindica	Kuraoangangba	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Ficuscunii	Hei-rit	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Ficusreligiosa	Khongnang(sana)	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Juglansregia	Heijuga-Shilangthei	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Magnolia grandiflora	U-thambal	Forest	Abundant	Insufficient	Wild	Manipuri
Tree	Microcospaniculata	Heitup-Theitupthei	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Micheliachampaca	Leihao	Forest	Abundant	Insufficient	Wild	Manipuri
Tree	Micheliadoltsopa	Leihao-leishang	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Nephaliumlongana	Nonganghei	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Parkiajavanica	Yongchak	Cultivated	Abundant	Rare	Home Garden	Manipuri
Tree	Pinuskesiya	Uchan-Matang	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Phoebe hainesiana	Uningthou-Mafathing	Forest	Abundant	Rare	Wild	Manipuri
Tree	Prunusdomestica	Heikha	Forest	Abundant	Abundant	Home Garden	Manipuri
Tree	Quercus spp.	Uyung-Shilimthing	Forest	Abundant	Abundant	Wild	Manipuri

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Plant Type	Scientific Name	Local Name	Habitat	Local Status		Wild/Home Garden	Community/ Kowledge Holder
				Past	Present		
Tree	Rhdodendron arboretum	Chingleihao-Kokliwon	Forest	Abundant	Rare	Wild	Manipuri
Tree	Rhus succedanea	Heimang-Khamkhuithei	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Schimawallichii	Usoi-Masuithing	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Cedrellatoona	Tairel	Forest	Abundant	Abundant	Wild	Manipuri
Tree	Taxusbaccata	Kachangna	Forest	Abundant	Rare	Wild	Manipuri

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1.4.2 Fauna

The limited bio-diversity found in the forests of Shiroi National Park comprises of tigers, leopards, wild boar, deer and antelopes. The Park is also famous for some unique species of birds such as Blyth's tragopan, Mrs. Hume's bar backed pheasant, owls, vultures, warblers, pheasants, tits and eagles. The Park provides an undisturbed ecosystem to the wildlife of the region. The animals and birds dwell in the small forests at the Indo-Myanmar border, within the Park.

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Table 5: Habitat Use in the National Park

DOMESTIC ANIMALS

Animal Type	Common/Local Name	Scientific Name	Breed	Features	Method of Keeping	Local Status		Uses	Community Knowledge Holders
						Past	Present		
Cattle	Cow/Sei/Shan	Bostaurus	Local	Medium	Cowshed	Abundant	Less	Meat & milk	Tangkhul
Cattle	Jersey/ Jersey Sei/ Jersey Shan	Bosindicus	Improved variety	Big	Cowshed	NO	Few	Milk	Tangkhul
Cattle	Buffalo/ Silui/Eroi	Babulis	Local	Big	Buffalo Bath	Abundant	Less	Meat & ploughing Paddy fields	Tangkhul
Dog	Dog/Fa/Hui	CanisDomesticus	Local	Medium	Inside & Outside the house	Abundant	Less	Meat & guarding the house	Tangkhul
Goat	Goat/Meh/Hameng	Capra hircus			Kept at farm	Less	Less	Meat	Tangkhul
Cat	Cat/Lami/Haodong	Feliscatus	Local	Medium	In the house	Common	Less	To keep away mice	Tangkhul
Poultry	Common/Fowl/Har/Yen	Gallus Gallus		Medium	Bamboo & wood enclosure	Common	Less	Meat	Tangkhul

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Animal Type	Common/Local Name	Scientific Name	Breed	Features	Method of Keeping	Local Status		Uses	Community Knowledge Holders
						Past	Present		
Poultry	Chicken Broiler/Har	Gallus domesticus	Improved variety	Big	Properly set up close by the house	No	Few	-do-	Tangkhul
Poultry	Chicken Coiler/Har	Gallus spp.		Big	-do-	NO	Few	-do-	Tangkhul

CULTURE FISHERIES

Animal Type	Common/Local Name	Scientific Name	Variety	Features	Method of Keeping	Local Status		Uses	Community Knowledge Holders
						Past	Present		
Carps	Common carp/Puklaobi	Cyprinuscaprio	Supplied by Fishery Deptt.	Medium	Paddy field & pond	Many	Less	Edible	Tangkhul
Carps	Grass carp/ Napichabi	Ctenopharyngodonidella	-do-	Medium	-do-	Many	Less	Edible	Tangkhul

WILD ANIMALS

Animal Type	Common/Local Name	Scientific Name	Habitat	Descripton	Season when seen	Local Status		Mode of Hunting	Community Knowledge Holders
						Past	Present		
Carnivore	Wild Boar/ Siva	Sus scrofa	Forest	Looks like Pig with	Winter	Abundant	Rare	Weapon & Traps	Tangkhul

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Animal Type	Common/Local Name	Scientific Name	Habitat	Descripton	Season when seen	Local Status		Mode of Hunting	Community Knowledge Holders
						Past	Present		
				tapering snout					
Insectivore	Porcupine/ Rikra/ Shabou	Hyrix	Earth Hole	Body covered with spines	Winter	Abundant	Rare	Traps	Tangkhul
Primate	Monkey/ Nayong	Macacamullata	Tree	Body covered with hair	Whole Year	Abundant	Rare	Weapons	Tangkhul
Primate	Hoolock/ Farifara/ Yongmu	HylobatesHoolock	Tree	Body elongated covered with hair	Whole Year	Abundant	Rare	Weopons	Tangkhul
Insectivore	Wild Rat/ Kafa	Rattus spp.	Earth Hole	Big	Whole Year	Abundant	Rare	Traps	Tangkhul
Herbivore	Red Deer/ Chao	Cervus app.	Forest	Big	Whole Year	Rare	Rare	Weapon & Traps	Tangkhul
Carnivore	Wolf/ Ramfa	Canislupis	Forest	Medium size	Whole Year	Rare	Rare	Weapon	Tangkhul
Omnivore	Squirrel/ Siluk	Funambulus spp.	Forest	Medium size	Whole Year	Rare	Rare	Weapon	Tangkhul
Bird	Mrs. Hume's Pheasant/	Syrmaticushu	Shiroi	Medium colourful	Whole	Endanger	Rare	Weapon/Trap	Tangkhul

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Animal Type	Common/Local Name	Scientific Name	Habitat	Descripton	Season when seen	Local Status		Mode of Hunting	Community Knowledge Holders
						Past	Present		
	Nongin/Rikshira	miae	Peak	Bird	Year	ed			
Bird	Jungle Fowl/ Ramhar	Gallus spp.	Forest	Big	Whole Year	Abundant	Rare	Weapon & Traps	Tangkhul
Bird	Bulbul/Rumok	Pycnonotusjocosusmonticols	Forest	Medium	Whole Year	Abundant	Rare	Catapult/Indigenous glue	Tangkhul
Bird	Hornbill	Dichoceros	Forest	Big	Seasonal	Rare	Rare	Weapon	Tangkhul
Reptile	Python/Rarei	Python molurus	Forest	Big	Whole Year	Rare	Rare	Weapon	Tangkhul
Reptile	Tree Snake/Sinaphara	Dendrilaphis app	Forest	Long & Medium	Whole Year	Rare	Rare	Stick	Tangkhul
Reptile	Blind Snake/ Nakhok	Typhlopsvermicularis	Forest	-do-	Whole Year	Rare	Rare	Stick	Tangkhul
Primates	Slow Loris/ Khanongsa/ Yonglkaithibi	Nycticebuscoucang	Forest	Medium	Whole Year	Rare	Rare	Weapon	Tangkhul
Carnivore	Jungle Cat/Lamhadong/Khara	Felischuas	Forest	-do-	Whole Year	Rare	Rare	Traps & Weapon	Tangkhul
Bird	Trush/ Shiri	Turdusfeae	Nearby fruit	Small	Migratory	Abundant	Rare	Catapult &	Tangkhul

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Animal Type	Common/Local Name	Scientific Name	Habitat	Descripton	Season when seen	Local Status		Mode of Hunting	Community Knowledge Holders
						Past	Present		
			trees					indigenous glue	

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MITIGATION MEASURES

CHAPTER 2: MITIGATION MEASURES

2.1 GENERAL

Roads and traffic impact wildlife in a variety of ways. In some animal populations, they enhance mortality, limit mobility, fragment populations, and decrease habitat amount and quality, resulting in a limitation on food, shelter, and space availability, all fundamental to species' survival. Those impacts and associated mitigations are becoming a major focus of research in conservation, namely in significant and emerging fields such as landscape and road ecology. In this chapter, we describe the main effects of roads on terrestrial vertebrates as well as a variety of mitigation measures that have been widely used for different topography: crossing structures, dry ledges, fencing, right-of-way escape ramps and noise barriers.

A very few section i. e., 2.39 km of the road project pass through the core zone and 36.423 km comes within the ESZ boundary of the Shirui National Park. The total area affected due to the project road is 133.882 sq km.

2.2 MITIGATION MEASURES

2.2.1 For Flora

The numbers of affected species during the road construction are tabulated below

Table 6: Detail of trees within formation width of the proposed alignment

Section	Chainage (km)		Side		Total
	From	To	Left	Right	
Hungpung-LongpiKajui	43.129	79.552	8057	7335	15392

To minimise negative impacts on the vegetative cover the contract documents should specify that:

- all wood building material for workers' housing should be brought from outside the project area;
- workers should be supplied with non-wood fuels such as kerosene or liquefied petroleum gas for the duration of the contract;
- all contract equipment and plants should be cleaned to the satisfaction of the project engineer in charge prior to their relocation to project sites;
- during site clearance, care should be taken to ensure that the minimum area of vegetation area is affected; and

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- water sprinkling of trucks used as construction vehicles should be properly and regularly undertaken, so that dust deposition problem on vegetation are minimised.

2.2.2. For Fauna

The project stretch near to the core zone of the national park is close to habitant area. So, the wildlife movements are negligible in the stretch. So, it is expected no wildlife is to be encountered during the road construction. Still the safety of the fauna in and around the stretch is to be taken care of. The following points should be taken care of during and after construction of the project road:

- Enough road signs should be provided for safety of both road users and animals
- Protection measures should be taken care of during construction process to avoid trapping of animals in the construction area
- Barriers and CUP must be provided for safe passage of the animals
- Hunting or poaching should be restricted and should be punishable by any person involved in the construction process

2.3 COST ESTIMATE

2.3.1 Cost of Environmental Mitigation Measures during Construction Phase

The estimated cost for implementing the mitigation measures and monitoring during the construction phase are provided in Table below.

Table 7: Environmental Mitigation & Monitoring Cost (During Construction Period)

Item	Unit	Qty	Unit Cost MRU	Total MRU (crores).
Environmental Costs - Civil Works (included in contractor's civil work contract)				
Dust suppression measures	Lump sum			**0.1**
Control of muddy runoffs from site	Lump sum			**0.2**
Environmental Monitoring Costs during Construction – Assignment of Environmental Health and Safety Manager (EHS)				
Assignment of an EHS	month	12		**0.1**
Noise Mitigation & Management	Lump sum			**0.2**
Habitat improvement (447.52 ha)	**Covered under EMP BUDGET**			
Afforestation				**101.43**
Pasture/ Nursery Development				**-**
Habitat Improvement for Wildlife	Lump sum			**0.1**
Anti-poaching measures	Lump sum			**0.02**
Engagement of part-time informers & Engagement of contractual staff	Lump sum			**0.05**
Purchase of anti-poaching kits	Lump sum			**0.02**
Construction of watch towers & quarters	Lump sum			**0.15**
Purchase of survey equipment, vehicle & communication system	Lump sum			**0.15**

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Construction of check posts	Lump sum			**0.05**
			Total	**102.57**

2.3.2 Monitoring Costs

During the Operation Phase, the project proponent will liaise with competent authorities for environmental monitoring. The project proponent will provide INR 10 lakh per annum for such monitoring.

2.3.3 Implementation Schedule

The following Table 8 presents the schedule for implementation of various environmental requirements during different phases of the Project.

Table 8: Implementation Schedule Environmental Measures

Project Phase	Issue	Schedule
Detailed Design	Inclusion of EMP provisions to improve environmental performance of the Project and to assure compliance with relevant environmental policy and standards	**once**
Prior to commencement of construction activities	Project Proponent to review and approve contractor's method statements and required licenses and permits	**once**
During construction	Monitoring	**Continuous**
During construction	Reporting: *Contractor to Project Proponent / Supervising Engineer*	**monthly**
During Operation	**Monitoring**	**On & Off (as per authorities requirements)**

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