



# Initial Environmental Examination

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## **Kamidanda-Taldhunga Section of Khopasi Taldhunga Rural Road, Kavre**

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## NEP: Rural Reconstruction and Rehabilitation Sector Development Program

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**Asian Development Bank**

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## **LIST OF ABBREVIATIONS AND ACRONYMS**

ADB	Asian Development Bank
ADB-TA	Asian Development Bank- Technical Assistant
BG	Building groups
BoQ	Bill of Quantity
CBO	Community Based Organization
CBS	Central Bureau of Statistics
CDMA	Code Division Multiple Access
CDO	Chief District Office
CDR	Central Development Region
CF	Community Forest
CFUG	Community Forest User Group
CH	Chainage
CISC	Central Implementation Support Consultant
CITES	Convention on International Trade of Endangered Species of Wild Fauna and Flora
DDC	District Development Committee
DDCO	District Development Committee Office
DFID	Department for International Development
DFO	District Forest Office
DHM	Department of Hydrology and Meteorology
DISC	District Implementation Support Consultant
DSCO	District Soil Conservation Office
DIT	District Implementation Team
DTO	District Technical Office
DOR	Department Of Road
DOLIDAR	Department of Local Infrastructure Development and Agricultural Roads
DPO	District Program Office
DTMP	District Transport Master Plan
EIA	Environmental Impact Assessment
EMMP	Environmental Mitigation and Monitoring Plan
EMP	Environmental Monitoring Plan
EPA	Environment Protection Act
EPR	Environment Protection Rules
ESD	Environment Screening Document
GON	Government of Nepal
GTZ	German Technical Co-operation
Ha	Hectare
HH	Household
IEE	Initial Environmental Examination

IUCN	World Conservation Union
Km	Kilometer
kW	Kilowatt
LDO	Local Development Officer
LDCP	Local Development Construction Program
LEP	Labor-Based, Environmentally Friendly, and Participatory Approaches
LRMP	Land Resource Management Project
MOLD	Ministry of Local Development
MoFSC	Ministry of Forest And Soil Conservation
m	Meter
NGO	Non-Governmental Organization
Nrs.	Nepalese Rupees
NTFPs	Non-Timber Forest Products
PCU	Project Coordination Unit
PMU	Project Manager Unit
RAP	Rural Access Program
RES	Rapid Environmental Screening
RIDP	Rural Infrastructure Development Program
RoW	Right of Way
RRA	Rural Road Approach
RRRSDP	Rural, Reconstruction, Rehabilitation Sector Development Program
SDC	Swiss Agency for Development and Cooperation
TA	Technical Assistance
ToR	Terms of Reference
VDC	Village Development Committee
ZOI	Zone of Influence

## A. INTRODUCTION

1. Government of Nepal is going to receive a loan from Asian Development Bank (ADB) for implementation of Rural Reconstruction and Rehabilitation Sector Development Programme (RRRSDP) in order to finance in the reconstruction and rehabilitation of the rural infrastructure which were damaged due to long conflict. The District Development Committee, Kavre, is the "Proponent" of this Initial Environmental Examination (IEE) study for Kamidanda-Taldhunga Section of Khopasi-Taldhunga Rural Road Project. The road will link the rural settlements of the district headquarter. This will provide access to the market and services to the people. It will contribute to reduce poverty of the poor and disadvantaged groups of people through the promotion of employment and income generation activities. Labour-based, environment friendly and participatory approaches (LEP) will ensure that the investment in construction and rehabilitation of infrastructure results in sustainable, improved access to economic and social services, and enhanced social and financial capital.

2. As per the Environment Protection Act (1997) and Environment Protection Rules (1997), GoN has made it mandatory to evaluate the possible physical, biological and socio-economic impacts of any development projects before its implementation. The Terms of Reference (ToR) has been prepared by the proponent and approval has been taken from the concerned line agency, Ministry of Local Development. The copy of ToR is given in Appendix 1.

3. Similarly, environmental considerations are fundamentals to [DOLIDAR the approach for the development of agricultural and rural roads concept](#). Each of major activities will be evaluated from the environmental perspective to match the requirement of the National Environmental Protection Legislation and ADB's environmental guidelines. Following this, an Initial Environment Examination (IEE) of Kamidanda Taldhunga Section of Khopasi-Taldhunga Rural Road has been prepared.

4. The goal of the project is to provide financial support to the rural people by providing them with local employment and better access to social service thereby reducing rural poverty in all the districts.

### **Purpose of the Study**

5. The purpose of this study is:
- to identify the beneficial and adverse impacts on bio-physical, socio-economic, cultural, religious environmental resources due to natural phenomenon and road induced human activities during and after construction of the proposed road
  - to formulate a monitoring plan and mitigation measures necessary to minimise the adverse impacts and enhance the beneficial impacts
  - to formulate an environmental management and action plan ensuring implementation of mitigation measures with proposed monitoring provisions;, and
  - to recommend whether the IEE is sufficient for the proposed road or if full EIA will be required as a result of the environmental issues that may arise due to the environmental impacts of the proposed project activities.

## B. PROJECT DESCRIPTION

### Location

6. Kavre district is one of the largest district lies in the Middle Mountain region in Bagamati zone of Central Development Region (CDR) of Nepal. The district is surrounded by Sindhupalchowk, Bhaktapur, Sindhuli and Makawanpur districts. Approximate latitude and longitudes of the road alignment are 27o22'30"N to 27o34'07" and 85o30'00 E to 85o32'00" E respectively.

### Type and Size

7. The proposed road has been initiated with assistance from ADB under the Rural Reconstruction and Rehabilitation Sector Development Programme (RRRSDP). Ministry of Local Development (MOLD) is the executing agency at central level and District Development Committee, Kavre is the implementing agency at district level. The proposed road falls under the category "Rural Road". The total length proposed Khopasi-Taldhunga Rural Road Project in Kavre district is estimated to be about 41 kms. The starting point of Khopasi-Taldhunga Rural Road Project is Khopasi of Khopasi Village Development Committee in Kavre district and ends at Sikre Dovan at Taldhunga of Salme Chakal VDC of Kavre district. The location of the project is shown in Fig B-1. The section from Khopasi to Kamidanda Bhanjyang is already motorable and it requires only minor repair work and some routine maintainance.

### Design Standards and Specifications:

8. In general [terms, though not exclusively](#), Nepal road standard, 2045, District road Standard of DOLIDAR, and Nepal Rural Road Standard, 2055 of MOLD will be followed for the geometric design parameters. As the proposed road is constructed under environmental friendly and in green road concept, the design parameters may be adapted to be within the limitation of District and Green road standard. The salient features of proposed proposal are given in Appendix 2.

### Technical Features and Construction Technology

9. The main technical features of the LEP approach are:

- (i) Road alignment: RRRSDP will give emphasis to the careful selection of the horizontal and longitudinal alignment prior to the start of the construction phase. As a rule of thumb, the alignment of the road should be chosen such that the centre line is close to the surface of the hill slope resulting in low cut slope.
- (ii) Balancing cut and fill: RRRSDP will encourage and emphasise planning and design of sub-projects aiming to have cut and fill balanced. A complete balance of cut and fill may not always be practical or possible in which case excess spoils will be placed in pre-identified and approved safe tipping sites. The proposed road is designed to balance cut and fill and also to protect slope failure, maximum embankment slope (fill) 1:1 with plantation and cut height is kept to minimum as possible and preferably limit to 15m in low hazard or susceptible to fail areas and 8m in medium hazard areas.
- (iii) Blasting: As a general rule, blasting will not be allowed. As much as possible rocky portions need to be avoided by choosing an alternative alignment. If rocky areas

cannot be avoided, then technologies other than blasting can be used (i.e. heating and cooling, rock cutting). In exceptional cases only, when there is no other option controlled blasting may be permitted.

- (iv) **Appropriate structures:** Structures will be built on the basis of actual need determined on site, rather than on prepared designs. Standard drawings are used as the basis for choice of structure type, which should always be the lowest cost option that will serve the function required. For example dry stone walls are favoured over gabions and gabions over concrete masonry and scuppers are favoured over Hume pipe culvers.

10. Provision of adequate drainage structures is considered critical for long-term viability of road being constructed. The monsoonal rain in Nepal and the hill roads that are constructed on a very steep mountain slopes, with large exposed batters, steep gradients and gravel or earth pavements are very susceptible to erosion, scour and slope instability.

11. A fundamental technique applied in water management is to ensure that rain water is evenly distributed off the road surface, towards the valley side. Since the road is designed as a low cost, side-drain construction is discouraged in the design as these drains often get blocked and the water finds its way to the road surface, causing major damage to the road. Drains have been proposed only at the sections with excess water from the hillside, or at the sections with steep gradient (>5%) or switchbacks. Drains have also been proposed along sections where settlement exists. However, if deemed necessary from an environmental and or technological standpoint that side drains are required, these will be considered.

12. **Bioengineering:** RRRSDP will integrate the use of vegetation in combination with simple civil engineering structures such as gabion walls and simple drains to give the best overall slope protection and shallow stabilization. The bioengineering requirements have also been discussed in the detail design report. As the road is being constructed in the mountainous topography, it will involve ~~minor~~ earth works during the construction. This will lead the erosion and sedimentation activities in the surrounding environment. Mitigation measures must be considered during design and construction to minimize impact in the surrounding environment. Design should be such that it minimizes the cutting of hillside slopes as much as possible. New cut slopes should be planted with grasses prescribing the correct planting configuration to suit the material drainage condition of slope. An uncontrolled disposal of the cut materials creates the major hazards; safe disposal of excess materials should strictly be enforced during the road construction. So far the construction concerns, labour-based participatory and environment-friendly approach of road construction is adopted. Consideration should be taken to safe discharge of the drainage outlet in the natural gullies. The bioengineering techniques adopted by the Department of Roads are found to be suitable for slope stabilization on fresh cut slopes and landslides that are considered to be stabilized by bio-engineering techniques. Under the LEP approach, unskilled and semi-skilled works such as earthworks, simple retaining structures, minor cross-drainage structures and side drainage will be carried out by local people formed into Building Groups (BGs). Other works requiring skilled inputs and/or use of specialized equipment will be carried out by local contractors.

13. The significant benefits of labour-based road construction method are that the work can be carried out at several sections of alignment at a time to speed-up work and that they generate massive local employment opportunities as well recycle financial resources at local level. This approach can be integrated into poverty alleviation programme. The researches suggest that almost 12,000 person days per kilometre are required for building road and

consequently about 200 person days per kilometre is required for maintenance work per year (GTZ, 1999).

14. This approach will eventually benefit the people living within the Zone of Influence (ZOI) with large off-farm employment opportunities during agricultural slack period. As the proposed road is planned to be constructed during agricultural slack season, there will be ample opportunities of off-farm employment generation.

### **Brief Description of Road Alignment**

15. This road will connect the Khopasi (Khopasi VDC) and Taldhunga (VDC). The total length is 63.738 km. Out of this, 22 km from Khopasi to Bhanjyang of Bhugdev Mahankal VDC is already motorable road of rural road standard and require rehabilitation only. The section of the road under study has a total length of 41.7 km and out of which approximately 35.74 is partially opened track and approximately 6 km, new road to be opened. The vertical alignment of the existing road seems to be very poor. There are too many sections of the longitudinal gradient greater than 12% and in few cases; it is more than 25%. Due to the poor condition of the road, it is finally decided to improve or rehabilitate Kamidanda-Taldhunga section (approximately 35.74 km) and remaining portion approximately 6 km for its new construction. The alignment initially vertically descends with a number of hairpin bends then gradually ascends and descends to reach Sikre Dovan at an elevation of 388.30m a.m.s.l. There is 2 km opening of road from Bhanjyang towards Taldhunga more than 4m width and then opening of road width 1.5m to 2.0m from that point to Phalate of Phalametar VDC then starts forest area where new alignment is to be set out upto Sarkidanda. Then from Sarkidanda to Taldhunga, there is again road opening of width 1.5 m to 2m up to Chitre. The road passes through forest and bari land between Chitre and Lapche of Salme Chakal VDC. There is road opening of more than 4m width from Salme, Salme Chakal VDC, ward no.1 to Sikre Dobhan at Taldhunga. The alignment passes through Bhanjyang, (Bhugdeo Mahankal VDC), Thali and Pahirochheu of Chyasinkharka VDC ward no 4 and 5, Phalate of Phalametar VDC ward no 3 and Sarkidanda, Jure, of Phalametar VDC, Saurya of Dandagaun VDC ward no 2., Chitre. On the basis of this definition, this road is classified as a district road Class A type. As mentioned in the Terms of Reference (ToR) and the detail survey report the total road alignment could be divided into following four sections:

- i) Bhanjyang to Syaule Phalametar (Mahankal Chaur, Chyasingkharka, and Phalametar VDCs)

The total length of this section of the road is approximately 18km and passes through forest land and no settlements in this section of the road. The area forested and rocky area so is rather stable.

- ii) Syaule Phalametar-Sarkidanda-Jure-Saurya to Lapche (Phalametar, Dandagaun Chakal, Salme Chakal VDCs)

The total length of this section of road is approximately 16km. The alignment descends from Syaule Phalametar to Sarkidanda and ascends upto Jure and then descends upto Lapche through the cultivated and vegetated slopes of Jure, Saurya and Chitre Villages. The colluvial slopes are rather unstable due to high drainage density and high slope gradient.

- iii) Salmegaun to Sikre Dobhan or Taldhunga (Salme Chakal VDC)

The total length of this section of road is approximately 8km. The track of more than 5m is being opened and only minor rehabilitation is required. The road passes through agricultural and hill sal forest areas. The forests are mostly community forests.

The road alignment is shown in Fig B.2.

## C. DESCRIPTION OF THE ENVIRONMENT

### Physical Environment

#### Topography and Soils

16. Out of five physiographic regions of Nepal, the road alignment passes through three physiographic regions namely, Middle Mountain or Mahabharat Range, Siwalik or Churia and Inner Bhabar region. Each Physiographic region has their unique geology, elevations and slope characteristic giving an indication of general climatic conditions, slope stability and vegetation types. Topographically the road passes through middle and lower parts of the valley slope. The aspect of the road varies through the alignment. The altitude of the road varies from 2100 m amsl near Kamidanda to 388m at Taldhunga.

17. The road passes through the colluvial and residual soils. General category of soil varies from light to medium texture on sloping level terraces and heavy textured soil in the river valley. Geologically the rock types such as shists, quartzites and phyllites characterize the area along the road corridor. The residual soil is used as cropland and saturated with ground water, resulting water seepage from numerous springs. The land is assessed as being stable and thus there may be no need for specific ~~does not require~~ mitigation measures to be applied. However these will be reassessed during the time of the proposed works and if areas are found to be prone to land-slides, necessary mitigation measures including structures will be out into place. The geological problems and land use along the road corridor is given in Appendix 3.

#### Land use type

18. The land use pattern of the area can be classified as cultivated land forest land and grazing land. The length of road under each category has been estimated using 1:25000 scale topographic map and survey data, which is presented in table C-1;

**Table C-1 Land use along the road corridor**

<b>Forest Land</b>						
From Ch	To Ch	Length	Existing Width	Area (sqm)	Additional Width	Additional Area (Sqm)
23+000	38+500	15,500	3.4	52,700	1.10	17,050
38+500	40+000	1,500	2.8	4,125	1.75	2,625
41+000	41+500	500	0.5	250	4.00	2,000
43+000	45+000	2,000	0.0	-	4.50	9,000
46+500	48+500	2,000	0.0	-	4.50	9,000
49+000	50+000	1,000	2.5	2,500	2.00	2,000
50+500	52+500	2,000	3.0	6,000	1.50	3,000
53+000	55+000	2,000	3.0	6,000	1.50	3,000
58+000	59+000	1,000	3.0	3,000	1.50	1,500
		Total Built Area (Sqm)		74,575.00	Total Add. Area (Sqm)	49,175
<b>Grazing Land</b>		Total Built Area (Ha)		7.46	Total Add. Area (Sqm)	4.92
22+000	23+000	1,000.000	2	2,000	2.50	2,500.0
40+500	41+000	500.000	0.5	250	4.00	2,000.0
41+500	43+000	1,500.000	0.5	750	4.00	6,000.0
45+500	46+500	1,000.000	0	-	4.50	4,500.0
50+000	50+500	500.000	3	1,500	1.50	750.0
57+500	58+000	500.000	3	1,500	1.50	750.0
59+000	63+653	4,652.970	3	13,959	1.50	6,979.5
		Total Built Area (Sqm)		19,958.91	Total Add. Area (Sqm)	23,479
<b>Cultivated Land</b>		Total Built Area (Ha)		19.60	Total Add. Area (Sqm)	2.35
40+000	40+500	500.000	1.8	900	2.70	1,350.0
45+000	45+500	500.000	0	-	4.50	2,250.0
48+500	49+000	500.000	1.5	750	3.00	1,500.0
52+500	53+000	500.000	3	1,500	1.50	750.0
55+000	57+500	2,500.000	3	7,500	1.50	3,750.0
		Total Built Area (Sqm)		10,650.00	Total Add. Area (Sqm)	9,600
		Total Built Area (Ha)		10.65	Total Add. Area (Sqm)	0.96

Source: Field Survey, 2007

### **Air Quality and Climate**

19. According to temperature records available at nearest place of the project area, maximum daily is reported to be 36.6 degree and minimum is 2 degree at Hetauda Industrial District station. The temperatures at higher elevation will be different depending upon the

normal seasonal variation, with higher temperature during the hot and rainy seasons, and lower in the winter season. In the winter, the weather is characterised in the beginning by warm and moist weather, becoming colder later. Temperature is critical factor in determining biological diversity, and so has a direct environment effect. The annual average rainfall recorded at Khopasi (Panauti) station in 1983 was 1433mm and 1522mm in 1984 and similarly, rainfall at Hetauda Industrial District in 1984 was 2252 mm. The climate of the district varies from subtropical to temperate.

### **Hydrology**

20. The road alignment is drained by the rivers namely Ladku Khola, Chagali Khola, Simsim Khola and Khahare Khola. There are no major Kholas and streams along road alignment from Kamidanda Bhanjyang to Taldhunga.

### **Water Quality**

21. The project area, at present does not experience any water pollution. No noticeable defecation problem was encountered around sources of drinking water. Although the quality of water was not analysed, again it is presumed that it is within an acceptable range and only natural pollution occurs. However, during the monsoon season the quality of water may be more polluted due to high flood and accumulation of silt. Due to soil erosion, landslide and gully erosion streams are polluted during the rainy reason (June to September). Water quality data of the project area are not available.

### **Noise and Vibration**

22. The project area at present does not experience noise pollution. Noise levels are insignificant and they are only generated by natural sources such as streams, animals, birds and winds.

### **Biological Environment**

#### **Vegetation/Forest Resources**

23. Vegetation of the project area falls under subtropical to temperate category. The major forest types in the project area include Sal forest in the lower altitude in Salme Chakal VDC, Schima castanopsis forest, Pinus roxburthii forest, Alnus nepalensis forest, Upper slope coniferous forest or Pinus wallichii forest at higher altitude in Mahabharat Range, Upper slope mixed hardwood forest and Oak-Rodhodendron forest again in the Mahabharat Range. Most of these are found along road way in thin patches. Vegetation of the project area is mostly distributed along the ridges of the hill slope. Most of the forest of the region is government forest. There are community forests in Baltdhali VDC and Salme VDC road zone of influence. Besides, there are some patches of private forests in the project impact zone. The table below shows the local and scientific name of the species available in the project area.

#### **Community forest**

24. Community Forests (CF) of the project area have been successfully managed by users groups to meet their fuel wood and fodder requirement. The community forest through which the road alignment passes is Sola Ban Community Forest and other community forests in the project area are Golme Community Forest, Khadde Bagar Community Forest, Gadgade Community Forest and Kuyalghari Ghattedanda Community Forest. The forest type along the road alignment includes Schima castanopsis forest, Pinus roxburghii (pine) forest, Alnus nepalensis forest, Upper slope coniferous forest, Upper slope mixed hardwood forest and Oak-Rodhodendron forest.

25. Forests are a source of firewood, fodder, animal bedding materials, timber, medicines as well as primary source of income. Local people confirmed that forests in the project area have improved over the last 10-15 years as a result of the implementation of community forestry programmes in the district and this has resulted in an increasing source of economic income. More than 70 percent of the households within the project site depend upon forest products as the primary energy source for cooking.

#### **Private Forests**

26. There are few patches of private forests along the road corridor which are not registered. In other words, the patches of government forests managed and used by individuals. Such forests are found from CH22+000 to CH24+000 and other chainages as well.

#### **Trees on Farm land**

27. Trees have been planted on farm land. The species are mainly fodder species and common species are Gogan, Nimaro, Dudhilo, Chuletro, Hattipaila, Khanayo, Mauwa, Kutmero, Tanki, Painyu, Bakaino and Gedulo. The detail survey of the trees on farm land is provided in separate report of Acquisition, Compensation, and Rehabilitation Program.

#### **Wildlife**

28. With the increase of community forests, the number and types of wildlife are increasing day by day. Therefore, community forests are playing a vital role in this regard. Many denuded lands and shrub lands have been turned into the green ones due to this endeavour. According to the local people, the most commonly available species are Jackal (*Canis aureus*), Porcupine (*Hystrix indica*), Wild bore (*Sus scrofa*) monkey (*Macaca mulatta*) and Indian fox (*Vulpes spp.*) langur (*Presbytis entellus*), Indian hare (*Lepus migriclis*), wild dog (*Cuon alpinus*), small Indian civet (*Viverricula indica*). Similarly, Barking deer (*Muntiacus muntjac*), Ghoral (*Naemorhedus goral*), Bear, Dhawase Chituwa (*Neofelis nebulosa*) are also available.

29. The most commonly available birds in the forest are Jungle fowl (*Gallus gallus*). Presence of crow (*Corvus splendens*), Parakeet (*Psittacula kramen*) oriental turtledove (*Streptopelia orientalis*), common myna (*Acridotheres tristis*), Cuckoo (*Cuculus mactropterus*) Lampuchhre, Rani Chara, Korali, Bhyakuro, Nyauli, Kalij, Dhukur and Indian Treepie (*Dendrocitta vagabunda*) was noted during the field visit.

30. Khani Khola is the main source of fish the local use. The most commonly found species are Katla (*Catla catla*), Buduna (*Garra annandalei*; *Chrossochelus latus*), Kapra and Tite (*Psilorrhynchus pseudo chensis*).

#### **Endemic and Protected Species**

31. GoN has categorised 27 mammals, 9 birds and 3 species of reptiles as endangered ones. During the last few decades many plant species have become seriously threatened due to habitat destruction and over exploitation. Consequently many of the endemic and useful species are now threatened or endangered and are facing extinction. On the basis of their overuse, poor regeneration, habitat destruction and other socio-economic factors, species are considered as endangered, rare, or several protected species. Among the plant species present in the forest area in the road alignment, Sal, Champ, Semal are the protected plant species, and is legally protected as per Forest Act 1992 and Forest Rule 1995.

32. Among the fauna present in the forest area along the road alignment, Langur (*Presbytis entellus*) and Dhase Chituwa (*Neofelis nebulosa*) are listed in CITES Appendix-I and Jangali kukur (*Cuon alpinus*), Ban biralo (*Felis Chaus*) Bandar (*Macaca mulata*), are listed in CITES Appendix II.

## **Socio-economic and Cultural Environment**

### **Population and Settlements**

33. The total population of road corridor, which is considered as settlements through which the proposed road alignment passes, is reported to be about 2000. There are about 280 households in these settlements. Average Household size in the project area is 6.5. The sex ratio (total number of males divided by total number of female) is 0.942. The population distribution within the settlements affected by the project along with the number of households as given in the Appendix 4.

### **Ethnicity**

34. The main ethnic community living within the road corridor includes Tamang, Brahmin, Chhetri, Newar and other disadvantaged groups. Kami and Damai are dalits living in the project affected settlements. Tamang is main ethnic group live in the project affected area.

### **Livelihoods and Local Economy**

35. The occupation of the people living within the project area is mainly agriculture and livestock (more than 90%). Besides agriculture and livestock other occupations included, Business, Civil Service, teaching, daily wages labour. The percentage of people involved in various occupations settlement wise is given in Appendix 5.

### **Electricity, Transportation and Communication**

36. There is electricity in some parts of the project area. Micro-hydro at Phalametar and Taldhunga and Salme villages of Salme Chakal VDC area of has distributed electricity to households in the VDC. The charge for the electricity is Rs. 30 per bulb per month. Kerosene is the main source of lighting in the area and kerosene wick lamps are the technologies employed for the purpose. There is solar energy in Saurya settlement.

37. The main means of transportation in the area is animal back and some times porters are employed for the transportation of daily goods from the nearest market.

There are no communication facilities along the road corridor from Kamidanda Bhanjyang to Taldhunga. Local people have set up CDMA telephone in Taldhunga but is not reliable. The people from Salme Chakal VDC have to come to Phaparbari of Makawanpur district for telecommunication.

### **Education**

38. In the direct impact zones, there are two primary, one lower secondary and two secondary schools. The number of schools and its level in the project area is given in the Appendix 6.

### **Health and Sanitation**

39. There are two health posts in the project area one at Phalametar, and another at Taldhunga.

There are toilets in few (less than 10%) houses of Saurya, Chitre, Lapche, Salme gaun and Taldhunga settlements. Most common diseases reported in the district are worms (tape, hook etc), diarrhoea, gastric infection, skin diseases, eye and stomach related disease etc. The situation of health facility in the project area is given in the Appendix 7.

#### **Drinking Water Facilities**

40. Most of the local people depend on traditional source for drinking water. They are mainly aquifers, springs and stone spouts. Also local people have developed several community water pipelines by trapping water from nearby spring and locally distributed waters. The area is rich for water sources and abundant availability of water. There is drinking water supply pipe line at CH 23+ .The drinking water pipelines along the road alignment are given Appendix 8.

#### **Irrigation**

41. As the livelihood of population in the district depends on agriculture, there has been developed some irrigation system. The irrigation channel and their location are given in Appendix 8.

#### **Cultural values and archaeological sites**

42. There are no cultural and archaeological sites in the project area.

#### **Migration**

43. The field survey indicates that significant out-migration has been taking place within the zone of influence over last few decades. The locals are going out to find jobs especially in foreign nation and also for education. But no in-migration to the zone of influence has been reported in last decade.

#### **Agriculture System**

44. Agriculture production and livestock farming is the main source of livelihood in the proposed project areas. The economy of the area is predominantly agriculture and livestock based. Most of the common crops grown in the areas are maize, wheat, millet and buckwheat. The cropping pattern in the Bari or upland is maize followed by millet or buckwheat or mustard or wheat depending upon fertility of land and people's need. Paddy is grown in the irrigated and lowland area such as Lapche, Salme and Taldhunga area followed by wheat or barren. Besides these there is also the species of fruit trees viz, Naspati, Suntala, Kera, Aaru, Bhogate, Nibuwa, etc. scattered on the farm land.

## **D. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS & MITIGATION MEASURES**

45. The development of infrastructure necessarily brings the changes in local environment in terms of physical, biological and socio-economic aspects. The impacts generated are both beneficial as well as adverse.

46. As in all development activities, Kamidanda-Taldhunga section of Khopasi-Taldhunga road development is likely to bring environmental impacts as a result of changes in physical, biological and socio-cultural environment. During the course of this Study, the environmental impacts have been identified for a number of issues based on the analysis of existing environmental condition and activities that are to be undertaken by the Project. Most of the identified impacts have been quantified to the extent possible on the value judgement. Each of the potential environmental impacts has been examined in terms of their current condition, likely impacts during construction and subsequent operation phases. The impacts have been predicted in terms of their magnitude, extent and duration.

47. The development efforts, particularly the development of transportation network will have multifold beneficial impacts. The project will also enhance economic growth and reducing unemployment to local people of the region.

### **Route Selection**

48. The route of the alignment has been selected as per the road network approach. Attempts were made to avoid agricultural land, protected forests, religious sites and other cultural values as far as possible. The chainage close to the geologically weak and environmentally vulnerable areas has been avoided during route selection.

### **Land acquisition**

49. Land under different uses will be used to construct road. The DDC should acquire necessary land for road construction and maintain RoW as per DOLIDAR standard. The District Development Committee (DDC) should consider the issues of land acquisition and compensation with due consideration to affected local populations.

### **Physical Environment**

#### **Land Use Change**

50. Land uses changes are likely to occur in different form from the project activities. These include spoil disposal, and material storage yards. Some areas are changed permanently and some are changed temporarily. The main impact to the existing land use system is the loss of forest, shrub and agricultural land. The total land use types that will be lost during construction of road are 0.96 ha of cultivated land, 4.91 ha of forest and 2.34 ha of grazing land. The road has followed the same track as envisaged and partially opened out under ADB assisted RIDP as far as possible looking into engineering standards. About 35.652 km length was partially opened, width ranging from 0.5m to 3.4m at different chainages. These sections require geometric improvements including widening of road width. These opened tracks were constructed three years ago. Only the remaining 6 km length was new alignment. The new clearance of forests at various places will be less than 5ha.

Phase wise site clearance will be done. Lands under various uses will be used during the construction of the road. Before cutting the trees the usual procedures will be followed that include notification to the Ministry of Forest and Soil Conservation (MoFSC) so that the MoFSC can issue an order the DFO for numbering of trees to be cleared. The DDC should acquire the land for road construction and maintain RoW as per the standard. The lost vegetation on work site and material storage yards should be re-vegetated after the completion of road construction. During re-vegetation, local species identified during the survey should be used. The spoil sites should be stabilised with bio-engineering technologies.

### **Erosions and Landslides**

51. Physical conditions of Mahabharat Range and slope stability are likely to be affected adversely during the construction phase. Major activities with likely negative impacts on slope stability include road cutting, and excavation. Slope failures in the form of landslides and rock falls will occur due to slope cutting. Flow path of natural runoff is diverted and concentrated increasing the energy of existing gullies and rivulets. Increase in the energy of gullies and rivulets would increase the lateral and down cutting work causing sever soil erosion and landslides. However, as mentioned in the project description, the construction methods likely to control surface erosion and sedimentation. The impact will be low, local, short term and direct/indirect. There is only one big landslide along the road alignment near pahirogaun. The proposed road construction method and approach is to minimize the soil erosion and landslides. The chainage wise unstable and geologically fragile hill slopes are given in Appendix-3 and landslides will be low, local, long term and direct.

52. Slope stabilisation: The construction activities will be carried out as per the "Labour based Environment friendly and Participatory (LEP) Approach" which uses a simple labour-based technology. There is no provision for the use of equipment and machinery. Blasting will not be used as far as possible. The construction activities will be carried out in four phases. Cut and fill mass management methods will be applied. Bio-engineering activities will be carried out. Thus, there is little chance to invite slope instability. Environmental awareness raising activities will be implemented. Local people will need to make aware about how to protect instable slope. Protective measures such as construction of gabion walls, catch drains and plantation should be adopted in those areas where serious problem of landslides exist however the project has avoided the significant areas with problems of land slides. All small drainage will be joined with the natural drainage system in order to avoid possible gully formation at different location, particularly on hill slopes.

### **Air quality and Climate**

53. The impacts to air pollution will be observed during the construction period. The construction activities like earthwork in excavation and filling will generate dust and pollute the air. Degradation in the air quality due to air-borne dusts will be experienced during the construction period. The impact will be direct, low, local and short term during the construction. In long term operation period the air pollution will be increased by the emission from the vehicles, and also dust from the road due to the traffic. The pollution from dust will increase, as the road will not be paved. The settlements Bhanjyang, Phalate, Jure, Saurya, Chitre, Salme gaun and Talshunga will be affected due to air pollution. Because of the low volume of traffic, the impact on air will be low, long term, local and direct. Vehicle conforming to acceptable emission standards should only be allowed and use of horns should be restricted near dense forest, health posts, schools and settlements. To reduce noise and air pollution in nearby settlements a buffer zone by planting trees on right of way should be developed. Vehicle conforming to acceptable emission standards should only be allowed and use of horns should be restricted near dense forest between CH 25+000 to CH 34+000, health post at Taldhunga, schools at Kamidanda, Sarkidanda, Jure, Saurya and Taldhunga

and settlements especially, Sarkidanka, Jure, Saurya, Chitre, Lapche, Salme gaun and Taldhunga. To reduce noise and air pollution in nearby settlements a buffer zone by planting trees on right of way should be developed.

### **Noise Pollution and Vibration Impact**

54. Noise pollution will be very low during the first phase of construction and low during second and third phases of the construction. In long term operation period the noise pollution will be increased by the vehicles due to the traffic. The settlements Bhanjyang, Phalate, Jure, Saurya, Chitre, Salme gaun and Taldhunga will be affected due to noise pollution. Because of the low volume of traffic, the impact on air and noise will be low, long term, local and direct.

### **Water Pollution**

55. Water pollution occurs during the construction phases in the streams and rivers namely Simsim Khola, Khola and Khahare Khola where the proposed road crosses them. Water pollution occurs due to disposal lubricants and vehicle washing during the operation phases in the streams and rivers namely Ladku Khola, Simsim Khola, Chagal Khola and Khahare Khola where the proposed road crosses them. Because of the low traffic, the impact will be direct, low, local and short term. Water outlets should be protected using check dams and bio-engineering works to dissipate energy and avoid erosion. The extent and intensity of dust may be minimised through the careful use of spot measures such as speed bumps in the settlements along the road. The local traffic regulating agencies should take responsibility for encouraging the use of good condition vehicles. For control of water quality the VDCs or NGOs along the roadside can be mobilize in controlling cleaning of vehicles and the leakage of fuels and lubricants into these water channels. User committees for drinking water and irrigation may be mobilizing in this aspect.

### **Impacts due to Spoil Management**

56. Spoil will be minimum in proposed road construction technology and spoil will be used in construction for filling. The impact will be low, local, short term and direct.

57. Construction material quarries and burrow pit management: Where quarries are required they should be limited to the areas which are not geologically or ecologically weak. After completion of construction activities the quarries should be filled or otherwise altered by forming gentle slopes and applying bioengineering wherever necessary.

58. Construction debris management: As the project is adopting green road approach, there will be minimum generation of debris. However to manage construction debris, any excess mass should be re-used by constructing small breast wall in the valley side of the road.

### **Biological Environment**

#### **Vegetation and Forest Resources**

59. The ecological condition of the local area will be affected negatively. The existing land use type will be changed by the road construction activities and hence, its impact will be adversely affected on both biotic and abiotic components of the ecosystem. 4.91 ha of forest and 2.35 ha of grazing land will be lost during road construction. The most of forest along the road alignment are government managed forests. The impact on vegetation and forest resources is mainly patches of Sal forest, Sal mixed with pine other species, Chilaune and Katus forest, Uttis mixed with chilaune and katus forests, Gobre salla forests and Oak and

rhododendron forest. The canopy covers of these forests are between 40 to 70 % and stockings are pole size along the corridor.

60. Loss of forest should be minimised through minimal site clearance and protection. Temporary loss of vegetation on work site and material storage yards should be re-vegetated after the completion of road construction. The directives of the Ministry of Forests and Soil Conservation should be followed while estimating compensatory plantation estimates. During re-vegetation, local species identified during the survey should be used. Within the corridor most forests are under government managed forest. Range Post, Ilaka Forest Office and DFO should support the implementation of rules and regulations with regard to control of indiscriminate felling and smuggling of trees and forest products, and poaching of wildlife. Impacts on threatened plant species should be minimised through translocation, in homologous habitat of nearby vicinity.

### **Impacts on wildlife**

61 Most of the mammals found in the project area are residential in the stretch of CH 22+000 km to CH 35+000 km. The important wildlife species found in the project area are Dhwanse chituwa, Langur and therefore; the proposed construction would have impact on their habitat. Entrance of the outsiders and activity of the local people in the forest may increase during construction of road. This may accelerate poaching of wildlife mainly Ratuwa, Ghoral and Kalij, Jungli Kuthura found in the project areas, especially between CH 22+000 to CH34+000. Vehicular flow, horn in the forest may frighten wildlife in their habitat. Sometimes collision of birds and other wildlife species may also increase during the road operation. There will be restaurants or hotels on road side and like in other parts of country, mainly in highways. There will be market of wildlife product mainly; meat of Kalij and Ratuwa and poaching of this wildlife will be increased. Therefore there will be impact on population of these species. However, the road is rural road and demand may not be high like in highways. Hence, the impact will be low, local, long term and direct.

62. Poaching of wildlife should be controlled during construction stage. Since the Road Building Groups are local people and some are users of the community forests, the poaching will be controlled by the construction workers themselves. Poaching should be controlled enforcing acts and regulations strictly. Regular monitoring or checking of wildlife products (meat of Kalij and Ratuwa) should be conducted in local restaurants and vehicles during operation stage. This should be minimised through the construction of speed hurdles and barriers in the sensitive areas for checking the vehicular speed. Horn in dense forests should be strictly discouraged.

### **Aquatic Ecosystem**

63. The road construction is likely to increase impact on water resources. The most common activities that may increase pollution are cleaning of construction equipments, leakage of fuels and lubricants into water channels. Besides, the soil works in and around the above mentioned kholas and streams will increase water pollution and will affect aquatic ecosystem. The road operation is likely to increase impact on water resources. The most common activities that may increase pollution are cleaning of vehicles, leakage of fuels and lubricants into water channels. Disposal of soil or other pollutant in kholas and streams should be controlled strictly during the construction.

## **Social, Economic and Cultural Environment**

### **Loss of Agricultural Land and Property**

64. Altogether, 0.96 ha of cultivated land will be lost during road construction.. The 7 cow shades and two houses including one under construction will also be affected by the road construction..The details of the loss of agricultural land and property are provided in separate report on socioeconomic and Acquisition, Compensation, Rehabilitation Program.

### **Compensation to affected family**

65. Since the road is rural road and the proponent is District Development Committee, the compensation should be given to affected families according to DDC guidelines. Details of the affected families and compensation are provided in Acquisition, Compensation, and Rehabilitation Program report separately.

66. The annual loss of agricultural production due to irreversible loss of the agricultural land has to be given due consideration while setting the price of agricultural land for land acquisition. It has to be taken particular attention, since the land areas are being used for green vegetables production, which yield good cash income for the farmers. The project will provide compensation to agricultural products with negotiation with the owners of a particular crop of that season, only if the farmer is unable to harvest due to land acquisition process.

67. One of the major direct beneficial impacts of the road during the construction stage is the creation of employment opportunity. Large number of skilled, semi-skilled and unskilled manpower will be required for construction of the road. The approach of LEP is to construct the road mobilizing local people or Road Building Groups from local people. Therefore, there will be employment for large number of local people.

### **Infrastructures**

68. Road construction activities may affect drinking water supply system located between chainage 23+000 Km and 24+000 Km. The road construction also affects 4 drinking water pipes between CH 61+000 – CH 62+000 alignments as mentioned in the baseline section of the report. No other infrastructures will be affected by the construction of the road. The drinking water supply pipelines between CH 23+000 and CH 24+000 along the road alignment should be realigned or rehabilitate and other four individual pipelines should also be rehabilitate if damaged during the construction activities. Otherwise, compensation should be provided at prevailing cost at local market including labour costs.

### **Health and Sanitation**

69. The adverse impact on local health will be due to air pollution during road construction. The impact will also be very low in "LEP" approach of construction of road and also there will be very low impact on sanitation. Basic first aid should be provided to construction workers during construction of the project.

### **Occupational Safety**

70. During the construction stage, a large number of work forces will be employed. They are likely to be affected by the dust only because no other machinery will be used in this project during construction. In a road construction project, there is always a possibility of occupational health and safety problems. However, this risk shall be minimised by properly adopting necessary safety measures. In order to minimise such problems, road safety measures should be an integral part of the detail design and also there should be provision of masks, boots etc for labour worker for safety. Besides, the project should provide

insurance facility for injuries or death of workers, if any, and the compensation will be based on the existing legal regime.

#### **Road Accident**

71. Construction and operation of roads invite road accidents. When the road is opened, the traffic will increase chances of accidents. To minimise the impacts proper road safety measures should be adopted during operation. It is recommended to follow road safety guidelines and codes set by Road Safety Unit of Department of Road.

#### **Loss of Agricultural Production**

72. Since the proposed road alignment passes through agricultural land, total area of 0.96 ha of cultivated land will be lost during the road formation. The project area is food deficit area and loss of agricultural production will have adverse impact on the food security of local people.

#### **Impact on Local Economy**

73. There will be no adverse effects on the local economy. However, the market will be competitive and the urbanisation and semi-urbanisation effect may lead to the high cost of living. Like in other road projects, the new settlement or expansion of existing settlements may take place. There will both beneficial and adverse due to such activities

#### **Trade and Business**

74. Easier access to market will promote opportunities for the development of small-scale cottage industries. Cultivation of high value crops such as turmeric, green vegetables and NTFPs will be increased due to increase access to markets. Similarly, production and supply of Khuwa (dairy product) and other traditional products will also be increased, as the area is popular for dairy products.

#### **Increase in Land Value**

75. The expected increase in economic opportunities will certainly increase the value of land by a considerable magnitude. Land value of land adjoining to road will be increased significantly.

#### **Encroachment into forests**

76. Ribbon like settlement growth is a common along the roadside in Nepal. The tendency of encroachment the right of way is also pronounced in other roads. The chances of expansion of settlement along road corridor between CH 25+000 to CH 34+000 is low because of terrain and government forest land and currently no settlements in and around the area. The DDC, VDC should make local communities aware of the importance of the road RoW. The DDC and VDCs must develop strategies for controlling encroachment along the road corridor and these efforts should help to reduce environmental impacts due the encroachment of RoW.

#### **Growth of Unplanned Settlement**

77. Like in other roads, there is a chance of growth of unplanned settlement along the road side. The Bhanjyang area, area from the Jure to Chitre and area between Lapche and Taldhunga potential area for such growth. There may be adverse impact due to such settlement growth along the roadside. The adverse impacts due the growth of unplanned settlements are mainly pollution.

### **Encroachment of Cultural Sites**

78. The proposed road will not damage any cultural and historical sites. Hence, there is no negative impact on historical and cultural sites.

### **Water and Drainage Management**

79. As part of road construction side and cross drain will also be constructed. The concentrated water discharged from side and cross drain can cause potential impacts to existing area by accelerating erosion. During the detail design phase, the project will design the drainage system by considering water collection, conveyance, disposal of surface water runoff from the road and motorist safety as well. The drainage system will also be designed with drainage width, depth, slopes, road alignment and protective treatment. All drainage will be joined with the natural drainage system in order to avoid possible gully formation at different location, particularly on hill slopes. The major drainage required is at Ladku Khola, Chagal Khola, Simsim Khola and Khahare Khola. There are a number of streams crossing over road alignments where different types of drainage are required.

### **Loss of Agricultural Production**

80. Loss of agricultural production during maintenance and operation should be compensated at prevailing market price of the crop loss. Loss of agricultural production due conversion of bari land into road should be mitigated either increasing productivity of the remaining agricultural land or buying rice from the nearest bazaar. However, the area is deficit in rice and wheat and people buy these crops from the nearest bazaar. Other possible mitigation measure is to introduce high yielding varieties of crops mainly maize, wheat and millet.

### **Impact on Local Economy**

81. The adverse impact on local economy can be mitigated by generating income generating activities. Like in other road projects, local people explore potential of the area after access to market on one hand and there will be expansion of potential existing business, trade and cottage industries. There is potential for bamboo based cottage industries, agro forestry (Uttis and cardamom), vegetables and horticultural farming. Besides, there is potential for Non-Timber Forest Products other than bamboo such as Chiraito, Lokta or Kagate in upper hills.

## **E. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLAN**

82. The policy to involve local community through road user group from the initial phase to the maintenance and operation phase, will be an opportunity during implementation of the project.. Users committees in different tiers are to be formed in order to channelize the whole process of implementation, operation and maintenance of the project.

83. DDC and respective VDCs are responsible for managing the construction and maintenance of the proposed road. Other institutions directly involved are DOLIDAR and Environmental Management Section of Ministry of Local Development. Similarly, involvement of DFO and CFUGs are also very important for protection of flora and fauna. Capacity of the DDC and VDCs to undertake the environmental appraisal and monitoring is very low. There is a need to support these institutions in carrying out their environmental tasks.

84. Monitoring is necessary prior to construction to see that all preparatory works have been done to implement the mitigation measures as mentioned for labour-based and environment friendly construction practices. Adequate technical supervision and guidance to the Road Building Groups is necessary during the construction period. Regular monitoring by the DDC, ADB-TA team, and ADB-Environmental Specialist to ensure proper construction practices and implementation of the mitigation measures is very essential.

85. Thus, it is recommended that an external team hired by DDC takes responsibility for periodic monitoring of the environmental performance, in addition to the regular supervision and guidance provided by the project technicians at the site. The external team should consist of experts of various disciplines such as forestry expert, geologist, geo-technician, civil engineer etc. Project's district management team (DDC and TA) should be responsible for forming the monitoring team, financing the monitoring works, providing logistics and other necessary support.

86. Road User committees at district level and sub project level is already exists. Furthermore, Municipality and DDC level committees have to be formed in order to get huge involvement of local people, which will further help to minimise any conflict on project regard.

87. This Environmental Management Plan (EMP) identifies key issues likely to arise from project implementation, and purposes mitigation measures, including monitoring schedule and responsibility. The EPR suggest inclusion of mitigation measures and a proposal for monitoring in the IEE study. The EMP outlines project description and aims of EMP, environmental management roles and responsibilities, road design, road construction management of different activities, site supervision, monitoring and reporting, records, and corrective measures, improvement proposals, bio-engineering techniques, and cost estimates for mitigation measures (DoR, 1999).

The basic purposes of the EMP are to:

- to ensure that all mitigation measures and monitoring requirements will actually be carried out at different stages of project implementation and operation - pre-construction, construction and operation and maintenance;
  - recommend a plan of action and a means of testing the plan to meet existing and projected environmental problems;
  - establish the roles and responsibilities of all parties involved in project environmental management;
  - describe mitigation measures that shall be implemented to avoid or mitigate adverse environmental impacts and maximizing the positive ones;
  - ensure implementation of recommended actions aimed at environmental management and its enhancement; and
  - ensure that the environment of the proposed site and its surrounding area are protected and developed to meet the needs of the local people, other stakeholders and safeguard and interest of common people.
88. Taking into account these considerations, the EMP of this project follow the basic concept of management. This concept focuses on the inclusion of planning, organisation staffing, directives, co-ordination, reporting within this broad framework.
- Environmental Management Plan according to ADB guidelines has been prepared and presented in Appendix 13.

#### **Report preparation including frequency and distribution**

89. As part of EMP, reports should be produced at regular time intervals depending upon type and size of project by the EMP team or unit. Since, the project is only reconstruction or rehabilitation of 41 km rural road and construction period is less than 3 years, the three monthly reports will be prepared and submitted to the proponent and relevant sections of the report will be sent to the concerned line agencies by the proponent.
90. The Contract will need to state that the DDC/DTO must approve the Contractor's arrangements for environmental protection, health and safety, waste management and other environmentally related actions identified during the Detailed Design Phase and these must be written into the Contract Document.
91. The environmental consultant will inform the DDC/DTO in case of non-compliance and of any other environmental issues that require immediate attention. The contract will detail the remedies for non-compliance by the Contractor(s) (such as delay of payments or execution of corrective measures by the client through other Contractors).
92. The monthly reports will be based on recurrent site inspections and will report on the effectiveness of the mitigation measures; the Contractor's compliance with the environmental specifications; measures recommended in the events of non-compliance and recommendations for any other remedial actions, etc.

#### **Environmental Monitoring**

93. Environmental monitoring involves the systematic collection of data to determine the actual environmental effect of the project, compliance of the project with regulatory standards, and the degree of implementation and effectiveness of the environmental protection. Monitoring must be an integral part of the implementation of the mitigation measures during project construction, and will generate important information and at the same time should improve the quality of project implementation.

94. Although, the environmental monitoring is not the responsibility of the proponent, based on the provisions of the existing environmental laws, the project has planned to monitor the compliance of the technical specification as an in-built practice. The agencies responsible for monitoring should ensure compliance of the activities such as; inclusion of mitigation measures in the design and tender documents, budget allocation for mitigation measures and monitoring, compensation arrangements, etc.

#### **Monitoring Parameters**

95. Based on the level of site-specific information or existing data series and potential impacts, efforts are made to make the indicators measurable and diagnostic with low natural variability and broad applicability. In this context, the following indicators will be monitored during the project construction and operational stages of the Project.

96. **Physical Parameters:** Construction sites should be monitored with special attention to sites of unstable slope and soil erosion. Regular supervision on materials handling at earthworks and stockpiling of construction materials in co-operation with environmental protection measures in the detail design, contract documents and tender documents.

97. **Biological Parameters:** The use of fuel wood, construction materials in mesh, and tea stalls should be monitored regularly. Similarly, unstable land and steep fragile slopes should be maintained through bioengineering. This needs the serious consideration of the species types, and survivability of the planted species thus should have monitoring of this activity.

98. **Social, Economic and Cultural Parameters:** Employment or number of male, female and children (below 10Yrs), health, sanitation and other facilities in the labour camp, compensation and use of compensation for acquired or damaged houses, land or other properties, and type and extent of damage to local infrastructures such as drinking water pipes, irrigation schemes, and rehabilitation of such facilities, in-migration and out-migration along the roadside. Furthermore, the Project will monitor the type and number of accident, availability of first aid and emergency services and awareness of the workers and roadside people on occupational health and safety. The project will also monitor the events of social disharmony and related disputes, prostitution and liquor drinking, if any, and related disputes during the construction stage. During the operational stage, the Project will monitor intermittently the air and noise pollution and its effect on roadside settlers, and changes in socio-economic conditions of the local people.

99. The monitoring parameter, indicator, methods, schedule and responsibility of the monitoring of different institutions are given in Appendix 10.

#### **Cost for Mitigation Measures**

100. The design and cost estimate for most of the suggested mitigation measures such as slope stabilisation, quarrying management, reinstatement of community infrastructure, cultural and religious sites, spoil disposal, bioengineering and others shall be incorporated in the design and cost estimates. The estimated cost of mitigation measures for RRRSDP is given in Appendix 11.

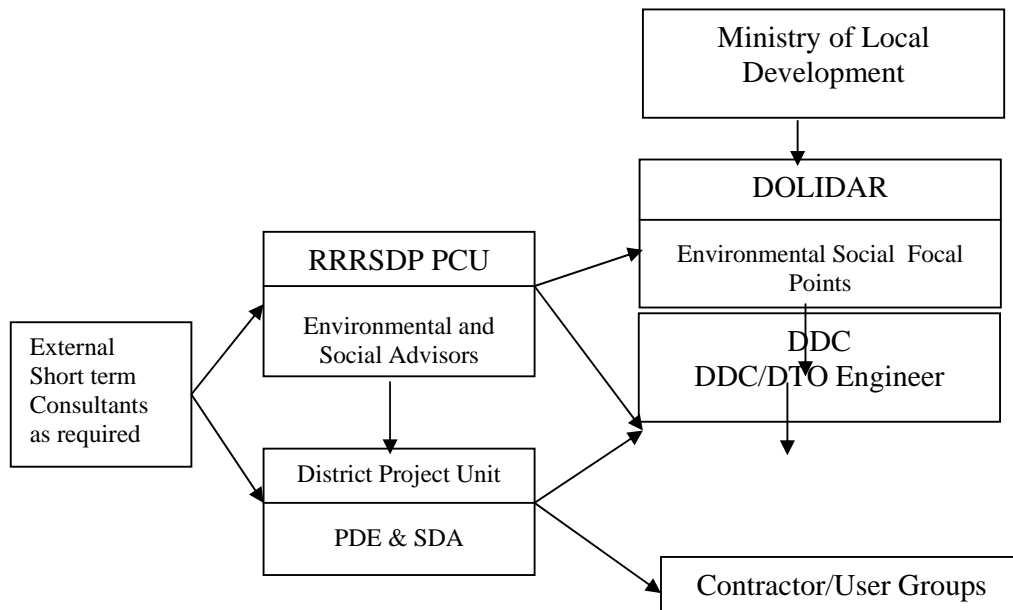
## Institutions Involved for Project Implementation

101. The DDC shall be mainly responsible for preparing and implementing the project. However, the detailed maintenance plan will be presented and approved by the consulting firm, NGOs in consultation with the DOLIDAR and the Project Coordination Unit (PCU). The concerned DDC and VDC shall be the partners for periodic regular maintenance of the road giving utmost priority in using the locally available resources. As far as possible, the community shall also be involved in the maintenance of the road since peoples' participation is vital for any development project these days. The proposed institutional set-up of EMP implementation is shown in diagram below.

102. Road User committee in VDC and DDC, and village level are to be formed in order to get huge involvement of local people, which will further help to minimise any conflict on project regard.

## Organisation and Staffing for EMP Implementation

Figure E-1 EMP Implementation



## Monitoring cost

103. The estimated cost for the environmental monitoring for pre-construction, construction and operation stages will be worked out during the project construction phase. Number of environment experts and estimated man months for the RRRSDP is given in Appendix 11.

## F. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

104. Public consultation is an integral part of Environmental Assessment Process. In Nepalese context, the EPR, 1997 and first amendment in 1999 has clearly mentioned

about the public involvement in EA of both IEE and EIA process. Similarly, it is suggested in ADB's Environmental Assessment Guidelines that public consultation should be conducted at least two times, one at project planning or desk study level and another after the preparation of draft report, for category A and B type of projects.

105. Public or project affected people were informed and consulted as per EPR and the guidelines. Prior to submission to Terms of Reference (ToR) to Ministry of Local Development (MOLD), a 15 days public notice was published in a national daily newspaper "Gorakhapatra" on 24th April, 2007, seeking written opinion from concerned people and local institutions regarding the probable impacts of the Project, as per the requirement for IEE Study, EPR, 1997 (first amendment, 1999). The copy of the notice is given in Appendix 13. A copy of the public notice was forwarded to all affected VDCs for public posting, and preparing a deed of public inquires (Muchulka). These and letters of recommendation for the implementation of the Project were collected from the VDCs and together with the public notice are included in the Appendix 13 of this report.
106. All the concerned DDC VDC, school, health post or other stakeholders were requested to send their comments and suggestion regarding possible beneficial and adverse issues/impacts of the Khopasi-Taldhunga Rural Road Sub-project on physical, biological, socio-economic and cultural environment of the project influenced area, within 15 days from the first date of publication of the notice. During the desk review process the IEE team discussed with concerned officials line agencies at district level and the proponent District Development Committee To conduct consultation with the local communities Group Discussions were organized at different places along the proposed rural road alignment corridor such as Kamidanda, Mahankal Chaur-3, Saurya, Salme gaun, Taldhunga, Bhangal and Khopasi. In the Group discussion and consultation meetings, environmental sensitivity, importance of rural road and its environmental features, present status, present problems or difficulties, potential solutions, and consequences of the proposed rehabilitation and reconstruction activities of the road area were discussed and issues raised were documented. During walkover survey, public consultations were conducted for comments and suggestions. Public notice information was pasted on the notice board of respective VDCs/ DDC i.e Chyasingkharka, Mahankal Chaur, Phalometar, Dandagaun and Salme Chakal VDCs, Chowk or Junctions /Schools/ Health post in the settlements in and along the road corridor. The group meetings were organized at 4 places and discussed upon environmental issues such as compensation, environmental pollution, loss of forests and their possible mitigation measures. The date, place, type of participants, number of participants and issues raised or suggestions are presented in Appendix 14.
107. The issues and suggestions raised or received during the consultation meetings were mainly mitigation measures. The local people, during the consultation were found to be are positive about the project and have shown full support and also given low priority for compensation of loss of their property.
108. The mitigation measures such as protection of drinking water sources have been included in mitigation measures of the IEE of the project. The participation of the local people and local bodies are obvious in this project.

### **Information Dissemination**

109. Due to non availability of most of the concerned offices and other local stakeholders in the villages, information was disseminated through person to person contacts and interviews and group discussions. However, available institutions at the local level were informed through notice distribution or posting at concerned VDCs, school, health posts within the road alignment corridors.
110. In the walkover survey along the road alignment, site specific or significant environmental features in the probable influence corridor were recorded. Suggested necessary measurements were observed and were discussed with the local stakeholders.

### **G. FINDINGS AND RECOMMENDATIONS**

111. The proposed road passes mainly through agricultural and forest area and hence there will be some impact on land use change due to road formation. About 4.9 ha of forest land will be converted into road formation, similarly, 0.96 ha of cultivated land will also be converted into road formation.
112. The proposed road passes through steep slopes and also from unstable hills, so soil erosion could be one of the major impacts of the project. However, there are no major landslides along the road alignment because of geological condition or rocky and stable land in the Mahabharat Rang or Middle Mountain region. The soil erosion impacts can be mitigated.
112. Several trees or saplings of various species used for fuelwood, fodder, animal bedding and small poles will be cleared for road formation. The impact due to loss of these fodders and other tree species will be inconvenient to local people or farmer as their livelihood depends upon agriculture and livestock. The livestock plays a vital role in hill farming system. The mitigation measures for loss of the trees on private land or farm land should be adequately compensated.
112. Only one family will be displaced and need to be relocated and other losses such as land, cow sheds, crop, fodder trees, fruit trees will be compensated. Overall, socioeconomic and cultural impacts due to implementation of the project are minor and could be mitigated.
115. The project will have some adverse impact on biophysical environment of project area. The mitigation measures, framework of Environmental Management Plan (EMP) and Environmental Monitoring Plan are given in this report. It is recommended that all mitigation measures should be considered and detailed mitigation measures should be prepared before implementation or construction of the project. The road project will have beneficial impacts on local people and local economy. Transportation or road is considered as backbone for development of the area.

## **H. CONCLUSIONS**

116. The proposed Kamidanda Taldhunga Section of Khopasi-Taldhunga Rural Road Project will have some adverse environmental impacts on biophysical environment and natural resources. Most of the potential adverse impacts are low and of short term duration and can be mitigated. The beneficial impacts due to the increase in accessibility to market centres and enhancement of productivity are more significant and long term in nature. These benefits will have positive impact on well beings of the population in the project area. Hence, the proposed Project is recommended for implementation with incorporation of mitigation measures or implementation of Environmental Management Plan including Environmental Monitoring Plan. The project is categorized under category B as per the EPR 1997 and hence no further EIA is required.

## REFERENCES

- Agriculture Marketing Information Bulletin SPECIAL ISSUE-1999, Department of Agriculture, Marketing Development Division.
- CBS, 2005, Four Monthly Statistical Bulletin
- DFID (UK) and HMG, RAP Nepal, Feb 2003, Initial Environmental Examination Guidelines (Draft).
- DOLIDAR, 1998, Proposed Social and Environmental Monitoring and Evaluation System for Agricultural and Rural Roads, GON, MOLD, Technical Division.
- DOLIDAR, 1999, Approach for Agricultural and Rural Roads.
- Environmental Guidelines for Selected Industrial and Power Development Projects, Office of Environment, ADB, 1993.
- Environmental Impact Assessment Requirement of Asian Development Bank, Environment Division, Office of Environment and Social Development, March 1998.
- GON, 1973 National Parks and Wildlife Conservation Act, 1973 and Conservation Area Management Rules, 1996, MoFSC, GON.
- GON, 1995 Forest Act, 1992, and its Rules, 1995. MoFSC, GON.
- GON, 2000, Environmental Protection Act, 1997 and environmental Protection Rules, 1997 (amended in 1999), GON Ministry of Law, Justice and Parliamentary Affairs, Law Books Management Board for MoPE.
- GON, 2002. Guide to Environmental Assessment in Nepal Sector. PWD: Public Works Directives Part II Procedural Directives Volume B Sector Procedures.
- GON, Land Act, 2031 (1974).
- GON, Public Roads Act, 2031 (1974), amended in 2046 (1990).
- GON, 1997, Environmental Management Guidelines, MOWT, DOR, Geo-Environmental Unit.
- Howland A.K. and Howland P, 1984. A Dictionary of the Common Forest and Farm plants of Nepal
- IUCN/Nepal, 1995 b- Nepal's Flora and Fauna in current CITES lists
- IUCN/Nepal, 1996, Glossary of Environmental Terms. Kavre District Profile, DDC, 2005
- NCST, Study of trace element distribution I soil and rock of various geological formations of central Nepal Mahabharat Rang, NCST, Research Paper Series 3, Kathmandu.
- Softwel (P) Ltd., 2007, Detailed Engineering survey and Detailed Design of Khopasi-Taldhunga Rural Road, Kamidanda-Taldhunga Section, Vol: Technical Report, May 2007.