

Environmental Assessment Document

Initial Environmental Examination

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NEP: Earthquake Emergency Assistance
Project (EEAP),
Initial Environment Examination (IEE) Document
Dolakha- Singati Road

Prepared by the Government of Nepal

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Municipality/ VDC	Total	Caste/Ethnicity wise population														
		Chhetri	Newar	Brahman-Hill	Tamang	Thami	Magar	Kami	Sarki	Sherpa	Gharti/Bhujel	Sanyasi/ Dashnami	Damal/Dholi	Majhi	Thakuri	Others
Suspa Kshyamawati	3437	356	36	346	27	2407	24	166	-	42	18			-	-	14
Sundrawati	2766	291		989		1321		35	23	-	-		21	-	61	25
Sunkhani	4675	2308	145	1269	58	187	33	125	237	-	24		129	127	-	33
Lamidanda	4232	2300	193	625	184	551		132	-	31	-		175	-	-	41
Total	37647	12863	4674	6229	3076	5823	211	1252	833	456	466	107	666	127	162	702
Percent (%)	100	34.17	12.41	18.54	8.17	15.47	0.56	3.32	2.22	1.22	1.24	0.28	1.77	0.34	0.43	1.86

Source: CBS Nepal, 2011

In the project area, language wise, 73.07% of total population speak Nepali and 12.71% people speak Thami, 6.82% people speak Tamang. Newari language is spoken by 4.97%, and Sherpa 1.06%. Along with these languages there are also various languages having users less than 1% as shown in Table 3.15.

Table 3.15: Population by mother tongue and sex

Municipality/VDC & Mother Tongue	All Mother Tongue	Nepali	Tamang	Newar	Thami	Sunuwar	Magar	Sherpa	Gurung	Maithili	Others
Bhimeshwor Municipality	22,537	16,615	2,358	1,844	955	35	22	318	16	193	181
Suspa Kshyamawati	3,437	1,121	-	28	2,221	-	-	62	-	-	5
Sundrawati	2,766	1,517	-	-	1,238	-	-	-	-	-	11
Sunkhani	4,675	4,553	44	-	51	-	-	-	-	14	13

Municipality/VDC & Mother Tongue	All Mother Tongue	Nepali	Tamang	Newar	Thami	Sunuwar	Magar	Sherpa	Gurung	Maithili	Others
Lamidanda	4,232	3,703	166	-	320	-	-	21	-	-	22
Total	37,647	27,509	2,568	1,872	4,785	35	22	401	16	207	232
Percent (%)	100.00	73.07	6.82	4.97	12.71	0.10	0.60	1.06	0.04	0.55	0.62

Source: CBS Nepal, 2011

c. Literacy Rate and Education Level

As per Census report 2011, about 63% population aged five and above are literate and can read and write. Only 73.3% of boys and men aged five and above and 53.7% of women and girls in Dolakha can read and write. 3.3% of men aged above five can read only whereas the similar percentage for women is 3.7. About 7.5% populations have passed School Leaving Certificate. Following figure shows completed level of education of Dolakha District and project affected municipality and VDCs as per 2011 Census.

Table 3.16: Literacy status and sex

VDC/Municipality and sex	Population aged 5 years & above	Population who are			Literacy not stated	Literacy rate
		Can read & write	Can read only	Can't read & write		
Dolakha District	170,820	107,238	5,979	57,447	156	62.78
Bhimeshwor Municipality	20,873	14,999	963	4,894	17	71.86
Suspa Kshyamawati	3,113	2,043	107	961	2	65.63
Sundrawati	2,558	1,743	56	751	8	68.14
Sunkhani	4,308	2,791	134	1,306	77	64.79
Lamidanda	3,858	2,469	89	1,298	2	64.00
Total	34,710	24,045	1,349	9,210	106	66.88

Source: CBS Nepal, 2011

Table 3.17: Population aged 5 years and above by educational attainment

VDC/Municipality	Total	Population that have completed the educational level of								Non-formal	Level not stated
		Baglmar	Primary (1-5)	Lower secondary (6-8)	Secondary (9-10)	S.L.C. & equivalent	Intermediate & equiv.	Graduate & equiv.	Post Graduate equiv. & above	Others	
Bhimeshwor Municipality	15,183	701	4,869	3,087	1,632	2,055	1,207	494	152	18	51

VDC/Municipality	Total	Population that have completed the educational level of								Non-formal	Level not stated
		Beginner	Primary (1-5)	Lower secondary (6-8)	Secondary (9-10)	S.L.C. & equivalent	Intermediate & equiv.	Graduate & equiv.	Post Graduate equiv. & above		
Suspa Kshyamawati	2,088	121	932	419	172	122	48	15	10	0	1
Sundrawati	1,804	159	754	329	174	101	74	28	3	1	3
Sunkhani	2,836	160	1,239	810	229	250	143	38	11	3	7
Lamidanda	2,544	176	1,025	570	239	171	120	19	15	6	4
Total	24,465	1317	8819	4995	2446	2699	1592	584	191	27	66
Percent (%)	100.00	5.38	36.06	20.42	10.00	11.04	6.51	2.39	0.78	0.11	0.27

Source: CBS Nepal, 2011

d. Health facilities

In health sector, there are 5 health posts along the alignment. Major health problems associated with local people are gastric, water borne diseases, gaeneco related diseases, bath, respiratory diseases, skin, malnutrition, typhoid, worm etc. Sanitation awareness among local people is on the rise and many of them have toilets in their home.

There are different health institutions such as government hospital, health centre, private clinics which are providing health services to the people of the project influence area. With regards to type of health institutions they visited, when fell sick about 41% of the households reported that they have visited to the government hospital. Similarly, about 23 % of the household also visited the private clinic or nursing home for the diagnosis and treatment.

e. Sanitation

In the project influence area 87.82 % of the households have toilet facilities. Those who have toilet mostly possess either pan or pit type toilet with flush system.

Table 3.18: Type of Toilets Available in the project area

V.D.C. / Municipality	Total HHs	HHs without toilet facility	HHs with toilet facility of		Toilet facility not stated
			Flush toilet	Ordinary toilet	
Bhimeshwor Municipality	6,076	604	3,112	2,345	15
Suspa Kshyamawati	864	144	407	311	2
Sundrawati	677	115	257	304	1
Sunkhani	1,194	139	645	404	6
Lamidanda	1,045	173	642	229	1

V.D.C. / Municipality	Total HHs	HHs without toilet facility	HHs with toilet facility of		Toilet facility not stated
			Flush toilet	Ordinary toilet	
Total	9,856	1,175	5,063	3,593	25
Percent (%)	100	11.92	51.37	36.45	0.26

Source: CBS Nepal, 2011

f. Drinking Water

A major (86.31%) source of drinking water was found to be from piped water supplied through community made water tanks. About 11.56 % of the household also use spout water as a source of drinking water. Other source of drinking water is river/stream. About 1.18 % of the households use uncovered well and 0.40% use river/stream for the purpose of drinking water. The use of underground water for drinking water is none.

Table 3.19: Households by main source of drinking water

Municipality/ VDC	Total households	Main source of drinking water							
		Tap/piped water	Tubewell	Covered well/kuwa	Uncovered well/kuwa	Spout water	River/ stream	Others	Not Stated
Bhimeshwor Municipality	6,076	5,247	0	3	54	724	12	21	15
Suspa Kshyamawati	864	796	0	1	0	57	6	2	2
Sundrawati	677	512	0	2	29	128	3	1	2
Sunkhani	1,194	1,077	0	0	8	101	3	0	5
Lamidanda	1,045	875	0	0	25	129	15	0	1
Total	9,856	8,507	0	6	116	1,139	39	24	25
Percent (%)	100	86.31	0	0.06	1.18	11.56	0.40	0.24	0.25

Source: CBS Nepal, 2011

g. Occupational Status

Households in the project area are found to depend on more than one occupation. However, the majority of population are students. The major occupation of the households is agriculture which comprises 28.37% of the total household's members. Similarly, 9.6% depend on trade and business where 6.88% are service holders and 5.87% population is engaged in foreign employment. It is observed that about 4.30% population are unemployed. Table 3.20 below presents the main occupation of the households in the project area.

Table 3.20: Occupation Status of the Households in Project Area

S.N.	Occupation	Sex			Percent (%)
		Male	Female	Total	
1	Agriculture	69	129	198	28.37
2	Service	35	13	48	6.88
3	Trade & Business	55	12	67	9.60
4	Agricultural Labour	7	23	30	4.30
5	Non Agricultural Labour	21	2	23	3.30
6	Students	124	111	235	33.67

S.N.	Occupation	Sex			Percent (%)
		Male	Female	Total	
7	Foreign Employment	28	12	41	5.87
8	Housewife	0	26	26	3.72
9	No job	12	18	30	4.30
	Total	352	346	698	100.00

Source: Baseline Survey, September 2015

h. Physical or Cultural Heritage

The project district hosts to several religious and cultural structures. People in the project area have different cultural values amongst the different ethnic groups. Major religious places of the district are Dolakha Bhimsen, Kalinchowk Bhagwati, Shailungeshwor Mahadev, Deulangeswor Mahadev temples, Tasi Gumba, Rolwaling valley, Ksho Rolpa glacier lake, Gaurishanker Mountain, Veding Gaun (village), Jiri valley, Jataa pokhari, Bahula pokhari etc.

The major festivals of project area are Dashain, Tihar, Buddha Jayanti, Krishna Ashtami, Maha Shiva Ratri, Basant Panchami, Holi, Lhoshar, Chaite Dashain, Bhumiraja festival, Bhimeshwor Jatra, Gaai Jatra, Indra Jatra and Machchhindra Rath Yatra etc. Most of the ethnic groups celebrate the major festivals such as Dashain and Tihar, although these are Hindu festivals.

3.14.4 Profile of the Affected Households (DIA)

a. Demographic Information

As revealed by the census data, estimated number of 47 persons from 9 households will be affected from the implementation of the project. The details of affected households and their demographic structures is given below.

Table 3.21: Demographic information

S.N	VDC	HHs	Male	Female	Total	Family Size
1	Lamidada	1	4	3	7	7.0
2	Sundrawati	1	3	2	5	5.0
3	Sunkhani	7	19	16	35	5.0
Total		9	26	21	47	5.22

Source: Census Survey, December 2015

b. Age of Affected Persons

The total population of the census households is 47 with average household size of 4.7 people per household. Of the total population of displaced households, the proportion of economically active age group is 55.3% followed by 45 – 60 years persons (17%), age group of 6-16 years (15%), and under five children (6.4%). Details of displaced persons by gender and age group are summarized in Table 3.22.

Table 3.22: Displaced Persons by Gender and Age Group

Age Group	Gender			%
	Male	Female	Total	
<5 Years	2	1	3	6.4
6-16 Year	5	2	7	14.9

Age Group	Gender			%
	Male	Female	Total	
16-45 Year	13	13	26	55.3
45-60 Year	4	4	8	17.0
>60 Year	2	1	3	6.4
Total	26	21	47	100.0

Source: Census Survey, December 2015

c. Caste/ethnicity composition of Displaced Households

Table below show that Brahmin/Chhetri comprise 66.67% and IP (22.22%) followed by Yadav (11.11%).

Table 3.23: Caste/Ethnic Composition of the Displaced Households

S.N.	Caste/Ethnicity	No of HHs	Percent
1	Brahmin, Chhetri	6	66.67
2	Indigenous People (Thami)	2	22.22
3	Yadav (Terai caste)	1	11.11
Total		9	100.00

Source: Census Survey December 2015

d. Literacy Status

The overall literacy status of displaced household reveals that 10% population are illiterate, and 25% are just able to read and write. However, the highest percent (20.5%) population of displaced households have been found within education level of class 6-10. The proportion of people obtaining higher education or above bachelor's level has been found none. Women literacy status is comparatively low in comparison to male literacy status.

Table 3.24: Literacy Status of Affected Population

S.N	Education	Gender			%
		Male	Female	Total	
1	Literate	4	7	11	25.0
2	Primary	4	1	5	11.4
3	Lower Secondary	6	2	8	18.2
4	Secondary	3	6	9	20.5
5	Higher Secondary	5	1	6	13.6
6	Bachelor level			0	0.0
7	Illiterate	2	3	5	11.4
Total		24	20	44	100.0

Source: Census Survey, December 2015

e. Occupational Status

Among the affected population majority of them are students. Besides them, 21.28% are involved in agriculture, 14.9% in business, 12.8% in foreign employment, 10.6% labour and 10.64% in service sector.

Table 3.25: Occupation of Displaced Population by Sex

S.N.	Occupation	Number	Percentage
1	Agriculture	10	21.28
2	Service	5	10.64

S.N.	Occupation	Number	Percentage
3	Business	7	14.89
4	Student	14	29.79
5	Foreign Employment	6	12.77
6	Labour	5	10.64
7	Total	47	100.00

Source: Census Survey, December 2015

f. Food Sufficiency of Affected Households

Among the affected households, about 44% have sufficient production for their household consumption. Table 3.26 shows the food sufficiency level among affected households.

Table 3.26: Food Sufficiency Level

S.No.	Food Sufficiency Level	HH	Percent (%)
1	Less than 3 Months	1	11.11
2	3 to 6 Months	2	22.22
3	6 to 9 Months	2	22.22
4	9 to 12 Months	2	22.22
5	Saving	2	22.22
	Total	9	100

g. Vulnerable Households

Of the total households interviewed 9 having effect on their assets, 4 households have been reported to be vulnerable of different categories. Among them, 50.0% falls on below poverty level and Janajati. Tables 3.27 provides the breakdown of affected vulnerable households by type of vulnerable categories.

Table 3.27: Affected Vulnerable Households

S.N.	Vulnerable Category	No. of HHs	Percentage
1	Below Poverty Line	2	50.00
3	Janajati	2	50.00
Total		4	100.00

Source: Census Survey, December 2015

h. Average Annual Income and Poverty Status of Affected Households

In line with the CBS criteria, average annual household income of the census households has been assessed in order to estimate the number of BPL households. Foreign Employment and trade/business has been reported as the main source of earning of census households. The other sources of income of the census households are service; followed by labor, rent/pension, livestock selling, agricultural products.

Table 3.28: Average Annual Household Income

Income Range	No of HHs	%
<50000	0	0.00
50000- 130500	2	22.22
130500- 200000	3	33.33
200000- 300000	3	33.33
300000- 400000	0	0.00

Income Range	No of HHs	%
400000- 500000	0	0.00
>500000	1	11.11
Total	9	100.00

Source: Census Survey, December 2015

Based on the CBS criteria of consumption requirement for minimum subsistence, out of 9 census households, 2 fall under the below poverty line.⁴



⁴ The poverty status was calculated based on the national poverty line estimated by the CBS Nepal. While calculating the poverty status, first, the average annual household income was calculated. After this, the poverty line was measured by converting the average household income into per capita income required for BPL based on the average family size. Then the households are having less than NRs 10,875 per households monthly income is determined as below poverty households.

CHAPTER 4

4. IMPACT OF THE IMPLEMENTATION OF THE PROPOSAL ON THE ENVIRONMENT

The identification and assessment of impacts has been carried out by considering the proposed proposal activities in terms of construction and operation phases.

The possible impacts from the proposal during the construction and operation phases are presented as following:

4.1 Beneficial Impacts

4.1.1 Construction Phase

Following beneficial impacts are anticipated during construction phase:

i. Employment opportunities and income generation

The road upgrading works offers a wide range of employment opportunity for approximately 160,000 unskilled and 38,000 skilled labours throughout the project construction period of 24 months. The amount of money flowing into the rural economy in the form of wage earnings will directly enhance the initiation of various ancillary economic activities and enterprise development.

The impact is direct, high significance, local but short term in nature.

ii. Upgrading of local labor skills in road construction

The underlying policy of the labour intensive approach is to employ local (unskilled) labour force for works that can be carried out manually. This strategy provides employment opportunities for the local poor people but also supports the transfer of skills and technical know-how while working in construction work such as masonry, gabion works, and bio-engineering and roadside plantation.

This impact will be indirect, of high significance, local and long-term in nature.

iii. Local scale enterprises establishment and enhancement

During construction period, different types of commercial activities will come into operation in order to meet the demand of construction crews. Since they will have good purchasing power, they will regularly demand for different types of food, beverage and other daily necessary items. To meet these demands, many local and outside people can operate a number of small shops and restaurants around the vicinity of the construction sites. Various farm based enterprises including wide range of agricultural and livestock products will also gain momentum as a result of increased demand by labours during construction period. This will increase local trade and business in the area and provides opportunities for new income generating activities as well.

The impact is indirect, medium significance, local but short term in nature.



iv. Enterprise Development and Commercialization

During the road construction period, different types of commercial activities will emerge in the subproject area in order to meet the demand of labour groups, construction crew and project team. For meeting these needs, enterprises like food and tea shops, groceries, lodges and restaurants will be developed for serving large numbers of people. It also exerts demand on the local production like pulses, milk, meat, vegetables, fruits etc. which may provide added impetus for local production and marketing. Such benefits may contribute to enterprise development which often continues to entrench beyond construction period. *This impact will be indirect, of moderate significance, local and long-term in nature.*

v. Market for local commodities like local agricultural products

During construction there will be need for local commodities like food, road construction materials e.g. stones and their related products, sand, gravel etc. Already there are few people involved in excavating these local materials for sale to whoever is in the building industry. The project is likely to create markets for some of these products as well as food produce hence improving the income level of the individuals involved during construction. However, this positive impact will cease (short term) when construction ends. *This impact will be indirect, of moderate significance, local and short-term in nature.*

vi. Better access to markets for local products

The sub-project is likely to create markets for local products especially food produce hence improving the income level of the individuals involved during construction. However, this positive impact will cease (short term) when construction ends. *Thus this impact will be indirect, of moderate significance, local and short-term in nature.*

vii. Improved access to social services

This impact is more relevant to operation phase.

4.1.2 Operation Phase

A number of beneficial impacts of the Proposal are anticipated during the operation phase, some of them are as indicated below.

i. Improved access facility

Upgrading of road will enhance the access of people to social services, and quick transportation of goods. Once the road upgrading is completed, the people living within the road corridor will have easy access to cities and markets. It will save more than 50% of travel time and transportation cost too.

This impact will be direct, high significance, regional and long-term in nature.

ii. Appreciation of value of land and other property

The upgrading of road leads to appreciation of land values particularly near the market and settlement areas. The land price would increase due to the availability of reliable transportation facilities. There will be rapid increase in the commercial production of agricultural crops due to road accessibility which is also a major factor to raise the land value. This activity would likely uplift the economic condition of the local people.

This impact will be indirect, moderate significance, regional and long term in nature.

iii. Increase in crop productivity and sale of farm products

The operation of road will benefit local communities in terms of increased productivity and diversification of crops including cereals as well as cash crops. Due to easy and cheaper availability of agricultural inputs and technologies, productivity will be increased along the road.

Such impacts are indirect, moderate significance, regional in extent and long term in nature

iv. Enhancement of social services

With the improved access to inputs and better transport services upon completion of proposed road upgrading, other social services will also open up in the areas including education, health, communication, market, banking etc. With these services available and given its reliability assured, local stakeholders may look for and stick to locally available services rather than seeking it to elsewhere. *This impact is indirect, high significance, local and long-term impact of the proposed Project.*

v. Women Empowerment

All the people will benefit from the road construction and upgrading. However, women in particular may benefit more from improved access to the market centers and various service providing agencies like health centers, banks, training institutions, community development offices etc. Frequency of visit to such agencies will increase awareness level and empower the women. *The impacts are indirect, moderate significance, local and long-term.*

vi. Improved Trade and business

After construction, the condition of the road will improve and transportation of commodities to and from the project area will be easier. For instance, farming communities will be easily accessed to evacuate farm produce will easily and quickly be transported to different destinations. More traders will prefer to buy directly from farmers compared to markets at trading centers hence creating "a pull effect" that will encourage farmers in the remote areas to produce more for the market. *The impact is indirect, medium significance, local and long-term.*

vii. Better accessibility to health facilities

With upgrading to bituminous standards, there will be quick means of transport and reduced time taken to health facilities for the communities along the project area. *The impact is indirect, moderate significance, local and long-term.*

viii. Support for Hydropower Projects In the region

With upgrading of project road to bituminous standards, there will be quick means of transport and reduced time taken for the transportation of goods and services for many hydropower projects under construction in the project region. Upgrading of project road will help in timely completion of hydropower projects in the region. *The impact is indirect, high significance, local and long-term.*

4.2 Adverse Impacts/Issues

4.2.1 Physical Environment

A. Pre- Construction Phase



i. Relocation of utilities

Proposed road upgrading may also cause disruption in the services of existing public utilities. These services includes: power supply lines (electric poles, cables etc.); water supply lines, telephone, and irrigation channels by the road side, drainage structures (cross, side etc.). It is estimated that about 50 electric poles (8 with transformer), 1 telecommunication pole, 7 tapstands and 1 water supply pipeline (Ch. 31+810) will be required to be relocated due to the project implementation.

ii. Clearance of land

Construction of materials processing plants, storage yards, vehicle parks, disposal sites and labour camps for temporary use will require additional lands within subproject affected areas. These activities can create social and environmental impacts such as conflicts between workforce and surrounding communities, soil erosion, impact on natural ecology due to removal of green cover vegetation and trees etc.

iii. Location of storage yards, labor camps, and construction sites

There will be the need to identify and use (temporary basis) work sites and area or compound for storage of materials and equipment. The presence of camps, site offices and works yards/compounds within a rural community can cause an adverse impact through the increased disturbance, noise and waste generated by camps and work sites, especially if the sites are located close to settlement areas and houses. The temporary sites/compounds can also be the cause of conflict, especially if many workers are brought in from outside of the local area.

iv. Procurement of equipment and machinery

Road upgrading works requires different type of equipment and machinery. The contractor needs to make necessary arrangement for the procurement of equipment and machineries during pre-construction phase.

v. Identification and selection of material sources

Extraction of materials can disrupt natural land contours and vegetation situated on proposed site resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution.

vi. Identification of designated waste disposal locations

Unmanaged or improper disposal of spoil generated during road construction may cause blockage of natural drainage systems, loss of organic fertile top soil and farmlands, crops and forest, water logging. During pre-construction phase, identification of designated waste disposal locations needs to be identified.

vii. Stockpiling of Construction Materials

It is general tendency of the contractors to stockpile the constructions materials like gravels, rock aggregates, bricks, cement, etc. nearest to the site, which could be in agricultural land, forest land or other private property. Similarly, surrounding crops and ground vegetation

may be damaged due to haphazard disposal of these materials. Construction material storage site pose adverse impact during construction stage. Appropriate sites for stockpiling of construction materials shall be selected during pre-construction phase by the contractor.

B. Construction Phase

i. Impact due to establishment and demolition of construction camps

Impacts anticipated from construction camp establishment and operation include disposal of solid waste (organic waste, plastic and metal scrap, domestic effluent, etc.), competition on public facilities (drinking water sources, health facilities, schoolings, etc.), impairment of aesthetic value of the landscape (loss of vegetation, compaction and contamination of soil and land), poor sanitation (unhygienic latrine, poor drainage facility), transmission of communicable diseases (sexually transmitted diseases, vector borne diseases, etc.), poor water supply, use of alcohols, gambling and conflict with local communities.

However, contractor will establish camp if he brings labors from outside of the area. Siting of camp may cause encroachment of forest, agriculture land, and alteration of drainage, solid waste and waste water problems. Probable sites for campsites are Ch. 4+650 to 4+900, 8+750 to 10+550, 15+950 to 16+640, 21+500 to 22+150, 23+000 to 23+500, 30+200 to 31+000 and 34+150 to 34+450. *Impact will be direct, moderate significance, site specific and short-term.*

ii. Impact due to operation and location of different types of borrow pits and quarries

Large amount of construction materials such as the boulders, sand and aggregates material are required for pavement, retaining wall, breast wall, gabion wall and other structures. These materials are obtained from borrow pits and quarry sites. Extraction of materials from inappropriate places or in excessive amount can seriously damage the local environment. For example, quarrying from a high slope and fragile area can result slope instability, extraction of sand and gravel in excessive amount from river can cause riverbank cutting and erosion and changes in river regime. It may cause landslide, erosion or box cutting of agriculture land, impact on sensitive environmental areas etc. *Impacts from quarrying and borrowing will be of direct, moderate significance, site-specific and long-term in nature.*

iii. Impact due to spoil disposal and location of disposal sites

Unmanaged or improper disposal of spoil generated during road construction may cause blockage of natural drainage systems, loss of organic fertile top soil and farmlands, crops and forest, water logging. During site clearance, excavation in slope, foundation of structures will be generated huge debris. If this debris is not properly disposed significant negative impacts are anticipated on public health and safety and scenic beauty of the project area. *The impact from spoil disposal will be direct, of moderate significance, site-specific and short-term in nature.*

iv. Impact due to stockpiling of construction material and locations

Proposed road upgrading also needs a substantial quantity of construction materials including rock, sand, aggregate of sub base and base course materials, chips, fines etc., requiring its proper stockpiling maintaining its specifications quality – including free of mixing up with deleterious materials. Similarly these materials may be washed away by monsoon rain causing water pollution. The haphazard piling of construction materials would disturb



the scenic beauty and topography of the local environment. Similarly, surrounding crops and ground vegetation may be damaged due to haphazard disposal of these materials. Construction material storage site poses adverse impact during construction phase. Erosion from stockpiled material will cause water pollution, land degradation, loss of agricultural productivity, and nuisance.

The impact is direct, low significance, site specific and short term in nature.

v. Loss of top soil

Topsoil is a valuable resource for the revegetation of cut and fill banks. Accordingly it shall be saved from all RoW sites that will be disturbed during road construction. Topsoil shall be stripped from each site prior to any associated filling or sub-surface excavation. *Impact is predicted as direct, of low significance, site-specific and short term in nature.*

vi. Impact on irrigation channels

There are six (6) irrigation canal crossings along the road alignment (Ch. 13+990, 16+670, 16+800, 28+015, 28+770 and 28+950). Road upgrading work will impact these canal crossings. *Impact is predicted as direct, of moderate significance, site-specific and short term in nature.*

vii. Obstruction to natural drainage pattern

Proposed road upgrading crosses few number of natural drainages along its alignment. These drainages are of various magnitudes according to its catchment area. The existing natural drainage system's seasonal flow paths will be obstructed due to dumping of soil and metal etc. This can happen especially during the construction of embankments, shoulders, reconstruction/repairing of culverts etc. The main impact of this is creation of temporary inundation areas closer to the above locations during rainy season. These inundated areas may become good breeding sites for disease causing mosquitoes and directly impact to public health. *The impact due to this will be indirect, of moderate significance, site specific, and short-term in nature.*

viii. Air, Noise and Water Pollution

Various construction activities that will cause air pollution are earth works (excavation and dredging), quarry operations, crushers, asphalt plants etc. These activities generate dust and noise, which directly affect the air quality. In addition vehicles and machinery emit smoke and fine particles. These substances will increase the local air pollution significantly during the construction phase. Air pollution will cause inconvenience to local people who reside closer to the proposed road or quarries etc. Asphalt plants would also create problems of ash disposal and thermal pollution. Combustion of fossil fuels is considered to be the largest contributing factor to the release of greenhouse gases into the atmosphere.

Noise impacts will be significant during construction period due to increase in vehicular movements and machinery, blasting and crushing operations, construction material transport etc. Increased noise will affect the nearby communities and wild animals as well.

During construction, exposed soil, excavated soil and excess soil can be washed off into nearby water bodies or canals causing siltation. Emissions from machinery, equipment, vehicles, quarries, crushers and asphalt plants can be dispersed with the wind and deposited in nearby water bodies. Contaminated top soil due to oil, liquid and other chemicals from construction vehicles /equipment, sewerage, garbage and waste water from

worker camps will washed out to nearby water sources causing water pollution and consequently affecting aquatic fauna and flora, farmlands and creating health hazards. *The anticipated impacts on air, noise and water pollution will be direct, moderate significance, local and short term in nature.*

ix. Decline in Aesthetic Value

Landscape degradation relates particularly to poorly designed or monitored activities resulting from quarrying operations and from indiscriminate dumping of spoil material. Road induced activities may lead to the generation and mismanagement of wastes in the roadsides and create scars on the landscape. *The likely impact will be direct, low in magnitude, local nature and short term in duration.*

x. Damage to ancient monuments, temples, religious chautaris, burial sites and cemeteries

There will be no impact on ancient monuments, religious chautaris, burial sites and cemeteries. But there are two temples which lies within 7.5 m distance of the center line of the road and these are not of any historical importance.

xi. Impact on cultural, religious and historical sites

The road upgrading work will not impact any cultural, religious and historical sites.

C. Post construction phase

i. Dismantling of camp site and Camp site restoration

Change of land use will occur due to setting up of construction camp and there will be waste generation at the camp site as well. The contractor is required to properly remove all temporary structures built for operation of construction and workers camps. While doing so, the land shall be brought back to original state. *The impact is predicted to be direct, of medium significance, site specific, and short-term.*

ii. Clearing of water channels, side drains and culverts

During construction, water channels, side drains and culverts will be disturbed or filled with construction debris. Contractor shall ensure that these will be cleared after the construction activities are over. *The impact is predicted as direct, of low significance, site specific, and short-term.*

iii. Rehabilitation of borrow areas

Borrow areas safe closure is also another concern once its operation is no longer required, and thus properly rehabilitated respecting local stakeholders concern. *The impact is direct, low significance, site specific and short term in nature.*

D. Operation Phase

i. Stability of the road corridor

Proposed road upgrading works will result in the stability of road corridor as a result of provision of bituminous sealed road surface and side drains of adequate capacity, extension of existing minor cross drainage structures, slope stabilization structures and landslide protection structures. *The impact is direct, high significance, local and long-term in nature.*

ii. Stability of longitudinal and cross-drainage structures

One of the objective of proposed road upgrading work is to extend and/or upgrade existing longitudinal and cross-drainage structures (excluding bridges). Therefore, after the

implementation of the upgrading works, the stability of longitudinal and cross-drainage structures along the Dolakha-Singati road section will be ensured provided regular maintenance of these structures are carried out by DoR. *This impact is direct, moderate significance, local and long-term in nature.*

iii. Right of Way encroachment

Encroachment of RoW of roads can take place any time after completion of construction works and this practice is common all over the country; mainly for income generation activities. The permanent or temporary structures built by encroachers within existing RoW cause impact to the pavements and road side drains. They also obstruct maintenance activities of the road, view range of travelers and impact to the movement of pedestrian. Parking of vehicles opposite to these locations for buying foods (vegetable, fruits), as well as for other services will increase risk of accidental damage to vehicles and other road users. *The impact will be direct, local and long term in nature with high significance.*

iv. Impacts to Cultural Heritages

There will be no impact on cultural heritages as the sub-project area does not have cultural heritage sites.

v. Impacts due to Slope Instability

The destabilization of road slope may be expedited due to human activities in the road neighborhood such as quarrying stones or soil, animal grazing, irrigated cultivation. This can cause damage to road section, disruption to transportation and other social impacts in the nearby areas. The inadequate maintenance of the road due to the blockage of drains damages the road surface that can lead to slides and slope failure.

The impact will be direct, local and long term in nature with moderate significance.

vi. Impacts due to Poor Drainage

While upgrading the road and providing the cross drainage structures and roadside drains, the existing natural flow path of water will be altered. Discharge of concentrated flow of water from roadside drains through cross-drainage structures can erode downstream slope and fields. Likewise, alteration of natural drainage can also disrupt local irrigation practices by diverting flowing water into agriculture fields. Water source can dry-up, and water holes of cattle or wildlife can get affected.

Impacts will be indirect, of moderate significance, local and long-term in nature.

vii. Change in Land use pattern

After the road improvement, it will induce the change in land use pattern along the road corridor. The agricultural lands in the area will be converted into residential and commercial land. Considering the population pressure, access to social services and other facilities, the impact can be predicted as indirect, moderate magnitude, local in extent and long term in duration.

viii. Air and Noise Pollution

The source of air pollution in this area will be the exhaust from the vehicles using fossil fuels and vehicle fumes from any other fuel powered mechanical equipment. This will result in the degradation of air quality. It is common practice in Nepal for pressure horns to be used. This is likely to increase the noise level and it may affect human beings and livestock. *The*

impacts associated with this will be of direct nature, moderate in magnitude, locally confined and long term in nature.

E. Beneficial Impacts/Operation Phase

i. Improved aesthetic scenery

In the road design, provision of bio-engineering works, road side facilities (passenger waiting shades), tree plantation, slope stabilization works have been proposed. Completion of the proposed road improvement activities will result in the improved aesthetic scenery in the sub-project area. *The impact will be of direct nature, moderate in magnitude, local and long term in nature.*

ii. Preservation of sub grade, sub base and base material

With the provision of a good bituminous sealed road surface, adequate drainage facilities and proper road side slope protection structures, the sub grade, sub base and base material of the road cross-section will be preserved. *The impact will be of indirect nature, moderate in magnitude, local and long term in nature.*

iii. Control in inundation/flooding

With the provision of adequate drainage facilities and proper road side slope protection structures, inundation/flooding phenomena in the road corridor will be controlled. *The impact will be of indirect nature, moderate in magnitude, site-specific and long term in nature.*

4.2.2 Biological Environment

A. Pre-construction Phase

i. Tree felling

Around 150 numbers of trees from community forests may be required to be felled during the sub-project implementation including the clearing of bushes and shrubs.

The anticipated impact will be direct, of moderate magnitude, site specific and long-term in nature.

ii. Diversion of forest land

No diversion of forest land is planned in the Sub-project road. Hence no impact in forest is anticipated.

iii. Loss of forest and vegetation

There will be minimum impact due to loss of forest and vegetation during the implementation of the proposed road upgrading works.

iv. Disturbances in wildlife activities

Although the wildlife population is reported low in the sub-project area, however, they may be disturbed due to the frequent movement of the vehicles. Vehicular flow, horn blowing in the forest area will have impact on the wildlife and bird species. *The impact will be indirect, low, local and short term in nature.*

v. Impacts on Forest Resources

There will not be significant impact on forest resources during the pre-construction phase of the proposed road upgrading works including the clearing of bushes and shrubs.

The anticipated impact will be direct, of low magnitude, site specific and short-term in nature.

B. Construction Phase

i. Clearing of shrubs and herbs of the forest areas

The existing road has a width of about 4-5 m which will be extended to about 6.5 m within a RoW of 30 m. It will be inevitable that during the upgrading/improvement of the proposed road, establishment of the campsite, opening up of borrow pit/quarry areas and construction of access routes to the borrow pit/quarry there will be need to clear all vegetation within the designed sub-project area along the entire stretch of the proposed road.

There will be clearing of vegetation on either side of the road to make room for the construction works. *The anticipated impact will be direct, of moderate magnitude, local and medium-term in nature.*

ii. Disturbance, Hunting and Poaching of wildlife

Although the wildlife population is reported low in the sub-project area, as and where the road site crosses the natural forests harbouring various species of wildlife – flora and fauna, it often becomes local people's good ground for hunting and poaching. Where the proposed road upgrading activities takes place, it again becomes contractors' and his labor forces' illegal hunting ground given they are let loose and no restriction is imposed on them during road upgrading. *The impact will be confined to the road alignment and thus is indirect, low magnitude, local, short-term in nature.*

iii. Use of forest product by the construction workers and construction activities

Labor force and workforce unless their energy needs for their meal cooking is met from fossil fuel, may exert pressure on the local forests of the surrounding areas. *The impact will be indirect, of low significance, local and short term in nature.*

iv. Disturbances on aquatic lives and fishing activities

Disposal of excavated materials on water bodies may increase turbidity of water and result in reduction in dissolved oxygen content. During construction, more construction vehicles will be moving on the road section. So it is common to see the inappropriate driver practices connected with vehicle washing in streams and rivers which can cause local water pollution by leakage of fuel, lubricants and hydrocarbons that may not only affect the aesthetic value of the water body, but also put hazards on aquatic lives. Streams along the road alignment are not renowned for fish population. So, possibility of fishing activity on these streams are minimal.

Such impact on aquatic life and fishes along the road alignment will be indirect, of low significance, site-specific and short term in nature.

v. Disturbances on the corridor of the wildlife movement

The wildlife population is reported low in the sub-project area, however, due to the frequent movement of the vehicles there will be minor disturbances on the corridor of movement of wildlife. *The impact will be indirect, low, local and short term in nature.*

C. Operation Phase

i. Possible extraction of firewood and timber

Road opening to public transportation and others following its upgrading works completion may exert indirect pressure on forests and forest resources through illegal extraction of firewood and timber. Timber mafia may surface up and become active as and when they

find demand from outside. Good trafficable road condition may motivate/intimidate them to take advantage of opportunity and earn money illegally. *Impact is indirect, high significance, local, and medium to long-term in nature.*

ii. Increased wildlife disturbance, hunting and poaching

Where the road stretch is crossed by forests harbouring wildlife including game value, it may become a good ground for the locals for hunting and poaching of wildlife of game value. The reason behind it being demand surfaced up for it following the proposed road upgraded and put it into open for public transportation. *Impact is indirect, low significance, local, and long-term in nature.*

iii. Impact on forest resources

Majority of the forests along the road corridor are community managed forests and some private forests. So, being an already operational road impact on local forest resources will be minimal.

The impact will be indirect, of low significance, local and long term in nature.

iv. Disturbances on the corridor of the wildlife movement

Upon proposed road upgraded and open to public transportation and others, increased traffic flow may cause disturbance to wildlife and their movements on road stretch crossed by natural forests. This in combination with fast driving (especially during night time) and or in combination with relentless horn honking over the stretch harbouring wildlife may pose further risks to their natural succession. These may have far-reaching consequences leading to its population decimation and at worst to its extinction. Given effective regulations *Impact is indirect, low magnitude, local, and long-term in nature.*

4.2.3 Socio-economic and Cultural Environment

A. Pre- Construction Phase

i. Impacts due to loss of land, standing crops, and farm trees

The improvement/upgrading works of road formation and side drain construction will not require additional land. Based on the inventory of affected assets, there is likelihood of 50 number of private trees being affected.

ii. Population displacement

The upgrading works will be conducted along the existing alignment and limited to existing road width. However, there will be population displacement of 47 people living in nine (9) households within the road corridor in Sundrawati, Sunkhani and Lamidanda VDCs.

iii. Land and Property acquisition and transfer of land ownership

There will not be any impacts related to land acquisition as the existing road width is clear. However, it is estimated that about 10 (4 residential, 5 residential cum commercial and 1 kitchen shed) private structures (temporary sheds) needs to be acquired.

iv. Resettlement issues, if any

The upgrading works will be conducted along the existing alignment and limited to existing road width only. However, there will be population displacement issue on nine (9) households in the sub-project area.

v. Social Conflicts due to change in community structures

This impact is not foreseeable during pre-construction phase.

vi. Impairment of Cultural and Historical Monuments/Areas

The subproject area does not have any historical monuments or areas within the COL.

B. Construction Phase

i. Land use change

Proposed road upgrading work will be carried out only within the existing road width. So possibility of permanent land use change is not envisaged.

ii. Occupational Health and Safety, STDs and Nuisance from construction camps

Road construction exposes workers to various physical hazards that may result to minor, disabling, catastrophic, or fatal injuries. Working close to rotating and moving equipment like hot mix plant operation, materials handling, motor pool repairs/machining and the like create trap hazards putting extremities at risk. Exposure to loud noise can cause temporary or permanent hearing impairment. Hand-arm vibration, electrical, welding/works, and working close to moving vehicles also expose workers to injuries.

Health risks are commonly associated with poor labour camp conditions. Unsafe water sources and unhygienic conditions (lack of latrines and washing facilities) bear the risk of additional and often endemic diseases, such as dysentery, diarrhea, and cholera. Increase in Sexually Transmitted Diseases (STDs) such as HIV/AIDS, caused among others by the influx of outside and migrant labourers might pose health risks to the public.

Impact is direct, high significance, local and short term in nature.

iii. Pressure on Social Service Facilities

Influx of labor force exerts pressure and competes on existing essential services including telephone, water supply, solid waste management, health services, transportation, school etc if its magnitude is not upgraded to suit and cater additional needs. *This impact is indirect, low significance, short-term and local in nature.*

iv. Social and cultural conflicts due to influx of construction workers

Improved road accessibility and connectivity following construction completion, may trigger socially unacceptable activities including illegal drug peddling, human trafficking, sex life etc. Public life associated with alcohol, gambling etc also may cause social conflict especially among the local people and in-migrant labor force. *Impact is indirect, low significance, local, and short-term in nature.*

v. Loss of private properties (building and land)

The Right of Way (RoW) is in general clear as the land within the proposed formation width has already been acquired by GoN. Thus, the subproject will not require any acquisition of land for the upgrading purpose. However, based on resettlement study data, it is estimated that about 10 private structures (temporary sheds) needs to be acquired. *Impact is direct, low significance, site-specific, and long-term in nature.*

vi. Loss of agricultural product (types and quantity) and land

The improvement/upgrading works of road formation and side drain construction will not require additional land. So, no impact is envisaged during the construction phase due to loss of agricultural land and products.

vii. Loss of public properties/infrastructures and their locations

Two (2) public infrastructures (Temple) will be impacted during the proposed road improvement works. They are located at Ch. 14+210 and Ch. 23+735. These temples are not of any historical and archaeological importance.

viii. Accidents related to construction activities

Proposed road upgrading deploys a large number of labour forces for undertaking its activities of various natures. These activities amongst others include risk prone ones – quarry, rock break up works, hot bitumen handling, surface sealing etc. These activities are highly risk prone ones especially when it is undertaken without safety gadgets. Gravity of risks is extremely high and irreparable – death in extreme. *The impact is direct, high significance, local and short term in nature.*

ix. Social security and related issues

Cash flow into the area as labor forces' wage may escalate price of essential commodities, causing market inflation during road construction. Concentration of large number of people with varied social and cultural backgrounds and cash inflow at the same time may lead to anti-social activities such as alcoholism, gambling, and prostitution etc., and may become a source of conflict between local people and in-migrant work force. *Impact is indirect, moderate significance, local, and short-term in nature.*

C. Operation Phase

i. Population pressure and impact due to new settlement along the road alignment

Settlements, shops, food stalls' emergence along the road-side soon after road construction or upgrading work completion is common practice in Nepal. It surfaces up as the economic opportunities for the local people and to some in-migrant labor force. This leads to both appreciation in land value especially of those along and by the road side and encroachment of public land by them, causing to becoming source of social conflicts associated with road accidents – road blockage, delays etc. *Impact is indirect, low significance, local, and long-term in nature.*

ii. Increased accidents

Fast driving temptation especially among the public transports drivers' following road up gradation to smooth road surface, may cause road accidents. These accidents are generally of frequent occurring nature, which is associated with non-respect to speed limit and safety signs posted on the road stretches. *Impact is indirect, high significance, local, and long-term in nature.*

iii. Breakdown of social fabrics - Change in social behavior

Improvement of road conditions would result in increased number of persons using the road. There would be an increase in the number of vehicles carrying goods and farm produce from various communities. This increase in the number of visitors in the area may influence the changes in the social behaviour. This will cause impact on social aspects including family breakdown and disease spread and ultimately affecting the traditional bonds, norms and functions of the community. *Impact is indirect, high significance, local, and long-term in nature.*

iv. Encroachment of road assets

Ribbon development, i.e. the establishment of settlements, shops and food stalls along the road-side soon after construction of road is common feature in Nepal. The existing trend is to settle along the road for economic opportunities. Apart from conventional convenience,

Increase in value of land adjoining road and land speculation are important drivers for such undesired and uncontrolled development. Negative consequences of ribbon settlements are: encroachment of right of way, road blockage, delays in private and public transports, increase of local accidents, and hindrance for maintenance works, undesired landscape aesthetics, and reduction of the overall road capacity.

RoW encroachment can cause indirect, moderate significance, local and long-term adverse impacts.

4.2.4 Chemical Environment

A. Pre- Construction Phase

i. Use and storage of fuel, lubricants, oils, acids, and other chemicals for construction

Putting mechanical workshop, gas station etc. into operation at contractor's camp in order to ensure upkeep of all vehicles, operating machines including heavy ones deployed in proposed road upgrading requires use of substantial quantity of lubricants, vehicles refueling etc. Acids used in battery recharging, other chemicals etc used at workshop are another type of workshop wastes. Fossil fuel is also required in operating crusher plant on road site where electric power supply is not available. Whilst its safe storage and usage is required and ensured, workshops wastes are potential source of environmental hazards unless it is handled correctly. *Impact is indirect, moderate significance, site specific, and short-term in nature.*

• Construction Phase

i. Use of fuel, lubricants, oils, acids, and other chemicals for construction

During construction period, large number of vehicles, crusher plants and several other equipment will be operating in the field. Due to significant number of vehicles, there is likely of accidental leakage of fossil fuel, lubricants, oil, acid and other chemical used in vehicles, crusher plants, and equipment if all these are not properly maintained and repaired from time to time. It could bring malefic effects to the environment. If it is exposed to the human being, aquatic animal, it even brings carcinogenic effects (Cancer induced effect) to the human being. *The impact will be direct, moderate significance, local and short-term.*

ii. Use and Storage of chemicals like bitumen etc.

Bitumen, which is to be used in sealing of proposed road upgrading, is highly combustible and risky of fire hazards unless it is kept away from the fire igniting source as well as from the public insecurity. Hence its storage prior to usage in sealing works is of key concern during road sealing works, and need to be of adequately safe condition in storage. It causes severe burns if handlers skin get in touch with it, and is also severely toxic to naked eyes. *Impact is indirect, moderate significance, local, and short-term in nature.*

B. Operation Phase

Effect on water quality

The practices connected with car/truck washing in streams and near wells and springs has the potential to cause local water pollution by leakage of fuel, lubricants and hydrocarbons that may not only affect the aesthetic value of water bodies but also have detrimental effects on the health of people and animals relying on these sources.

The impacts associated with this will be of low in magnitude, locally confined and long-term.

Table 4.1: Beneficial and Adverse environmental impacts

Beneficial Impacts

Aspect	Impacts	Nature	Magnitude	Extent	Duration
Construction Phase					
Socio-economic	Employment opportunities and income generation	Direct	H	L	ST
	Upgrading of local labor skills in road construction	Indirect	H	L	LT
	Local scale enterprises establishment and enhancement	Indirect	M	L	ST
	Enterprise development and commercialization	Indirect	M	L	LT
	Market for local commodities like local agricultural products	Indirect	M	L	ST
	Better access to markets for local products	Indirect	M	L	ST
	Improved access to social services	NA			
Operation Phase					
Socio-economic	Improved access facility	Direct	H	R	LT
	Appreciation of value of land and other property	Indirect	M	R	LT
	Increased crop productivity and sale of farm products	Indirect	M	R	LT
	Enhancement of social services	Indirect	H	L	LT
	Women Empowerment	Indirect	M	L	LT
	Improved Trade and business	Indirect	M	L	LT
	Better accessibility to health facilities	Indirect	M	L	LT
Physical	Improved aesthetic scenery	Direct	M	L	LT
	Preservation of sub grade, sub base and base material	Indirect	M	L	LT
	Control in inundation/flooding	Indirect	M	SS	LT

Adverse Impacts

Aspect	Impacts	Nature	Magnitude	Extent	Duration
Physical Environment					
Construction Phase					
	Impact due to establishment and demolition of construction camps	Direct	M	SS	ST
	Impact due to operation and location of different types of borrow pits and quarries	Direct	M	SS	ST
	Impact due to spoil disposal and location of disposal sites	Direct	M	SS	ST
	Impact due to stockpiling of construction material and locations	Direct	L	SS	ST
	Loss of top soil	Direct	L	SS	ST
	Impact on irrigation channels	Direct	M	SS	ST
	Obstruction to natural drainage pattern	Indirect	M	SS	ST
	Air, Noise and Water Pollution	Direct	L	L	ST
	Decline in Aesthetic Value	Direct	L	L	ST

Aspect	Impacts	Nature	Magnitude	Extent	Duration
Post Construction Phase					
	Dismantling of camp site and Camp site restoration	Direct	M	SS	ST
	Clearing of water channels, side drains and culverts	Direct	L	SS	ST
	Rehabilitation of borrow areas	Direct	L	SS	LT
Operation Phase					
	Stability of the road corridor	Direct	H	L	LT
	Stability of longitudinal and cross-drainage structures	Direct	M	L	LT
	Right of Way encroachment	Direct	H	L	LT
	Impacts due to Slope Instability	Direct	M	L	LT
	Impacts due to Poor Drainage	Indirect	M	L	LT
	Change in Land use pattern	Indirect	M	L	LT
	Air and Noise Pollution	Direct	M	L	LT
Biological Environment					
Construct ion Phase	Clearing of trees, shrubs and herbs of the forest areas	Direct	M	L	LT
	Disturbance, Hunting and Poaching of wildlife	Indirect	L	L	ST
	Use of forest product by the construction workers and construction activities	Indirect	L	L	ST
	Disturbances on aquatic lives and fishing activities	Indirect	L	SS	ST
	Disturbances on the corridor of the wildlife movement	Indirect	L	L	ST
Operation Phase					
	Possible extraction of firewood and timber	Indirect	M	L	LT
	Increased wildlife disturbance, hunting and Poaching	Indirect	L	L	LT
	Impacts on forest resources	Indirect	L	L	LT
	Disturbances on the corridor of the wildlife movement	Indirect	L	LT	LT
Socio-economic and Cultural Environment					
Construct ion Phase	Land use change	No Impact			
	Occupational Health and Safety, STDs and Nuisance from construction camps	Direct	H	L	ST
	Pressure on Social Service Facilities	Indirect	L	L	ST
	Social and cultural conflicts due to influx of construction workers	Indirect	M	L	ST
	Loss of private properties (building and land)	Direct	L	SS	LT
	Loss of agricultural product (types and quantity) and land	No Impact			
	Loss of public properties/infrastructures and their locations	Indirect	L	SS	ST
	Accidents related to construction activities	Direct	H	L	ST
	Social security and related issues	Indirect	M	L	ST
	Damage to ancient monuments, temples, religious chautaris, burial sites and cemeteries	No Impact			
	Impact on cultural, religious and historical sites	No Impact			
Operation Phase	Population pressure and impact due to new settlement along the road alignment	Indirect	L	L	LT
	Increased accidents	Indirect	H	L	LT
	Breakdown of social fabrics - Change in social	Indirect	H	L	LT

Aspect	Impacts	Nature	Magnitude	Extent	Duration
	behaviour				
	Encroachment of road assets	Indirect	M	L	LT
	Impacts to Cultural Heritages	No Impact			
Chemical Environment					
Pre-Constructi on Phase	Use and storage of fuel, lubricants, oils, acids, and other chemicals for construction	Indirect	M	SS	ST
Constructi on Phase	Use of fuel, lubricants, oils, acids, and other chemicals for construction	Indirect	M	L	ST
	Use and Storage of chemicals like bitumen etc.	Indirect	M	L	ST
Operation Phase	Effect on water quality	Indirect	L	L	LT

4.3 Enhancement issues

Following enhancement issues were considered during the preparation of IEE report:

- Orientation of EMP for implementing authority and contractor groups (Pre-construction phase)
Orientation program has been included in EMP and necessary budget has been allocated for the activity
- Plantation along the road
This issue has been found not relevant as the sub-project road is in hilly region.
- Orientation to workers about Occupational Health and Safety
Orientation shall be given to contractor's workforce regarding occupational health and safety by the contractor's Health and Safety Officer
- Provision of cattle crossing at normal crossing routes for safety of cattle and road user
Being a hill road, this issue is not relevant for the sub-project road
- Provision of ramp for access to and from agriculture lands for cross traffic
Being a hill road, this issue is not relevant for the sub-project road
- Provision of paved shoulders at destination/roadside settlements/villages
- Provision of bus bays to avoid traffic obstruction
Provision of three (3) bus bays have been made in the design estimate.
- Where possible, the road embankment should be widened to provide a platform for stacking materials for road maintenance and to ensure the shoulders are kept free for traffic movement

Being a hill road, this issue is not relevant for the sub-project road.

4.4 Other Issues raised by Public during IEE study

Apart from the above mentioned impacts/issues, following issues were encountered during the study period and has been included in the report:

i. Minimum loss of forest area and resources

This issue has been considered during finalizing the design. So, road width has been limited to existing formation width (6.5 m) so as to minimize the forest area loss.

ii. Compensatory plantation for trees required to be cut

A budget of NRs. 391,875.00 for compensatory plantation has been allocated in the sub-project's cost estimate for the compensatory plantation.

iii. To consider the possible landslides, soil erosion issues into consideration

This issue has been taken care of in the design of sub-project road. Adequate bio-engineering and civil engineering measures have been provided in the road design.

iv. Provide adequate drainage facility in the road section around Suspa Kshemawati area

To address this issue, adequate minor cross drainage and side drains are included in the overall design of road structures.

v. To Implement the project as soon as possible

The sub-project is going to be implemented very soon so as to complete the project by the end of 2018 AD.



CHAPTER 5

5. ALTERNATIVE FOR IMPLEMENTATION OF THE PROPOSAL (ALTERNATIVE ANALYSIS)

Alternative analysis has been considered as an integral part of IEE study, which involves an examination of alternative ways of achieving objectives of the proposed subproject. The aim of alternative analysis is to arrive at a development option, which maximizes the benefits while minimizing the adverse impacts. As the scope of the proposed activity is limited to the upgrading of the existing road, there is not much room for alternatives at the Subproject level. There could be alternatives in the implementation stage which could be selected to suit local conditions and given situations. The various alternatives considered to achieve the subproject objectives with minimum environmental degradation are discussed below:

5.1 Alternative Design and Construction Approach

The conventional road construction approach uses contractors with heavy machineries and equipment, explosives, heavy concrete structures for retaining slopes, and bituminous surfacing. Green road approach is normally referred as labour based, environment friendly and participatory (LEP) method which focuses on producing least disturbance to local topographical settings and conserve the delicate local ecology. Under this approach, construction work is done manually by the local labour without using heavy machinery and explosives. Spoil disposal is minimized through maintaining balance in cut and fill as far as possible. Soft engineering structures are used as far as possible. Vegetation cover is maintained through application of re-plantation and stabilization of slopes is achieved through bio-engineering. Using local manual labor helps to inject money in local economy through the wages earned by the people. There will also be ownership feeling among the community towards the road.

5.2 Alternative Alignment (Route)

The alignment of the road is an existing motorable and fair weather with 4.5 to 5 m width. Since this is an existing road, the proposed upgrading/improvement measures do not need to acquire additional land and clearing of trees. Hence, new alternative alignment is not feasible and the proposed existing alignment can be the best option.

As the alignment of the road was finalized and constructed as earthen road long time back, the analysis relating to alternate route with the consideration of environment, upgrading cost, serviceability etc. is not relevant.

This alternative is therefore not relevant.

5.3 Time Schedule

The upgrading of Dolakha-Singati road under EEAP will be implemented over 2 years commencing in the fourth quarter of 2016 and is expected to be completed in the fourth quarter of 2019. The soil work or excavation activities of the Subproject should be avoided during the monsoon period. The construction activities will be carried out during the day time only. During the rainy season, the upgrading work has to be stopped to allow the

natural compaction of the road. Rehabilitation and upgrading work will be carried out during the remaining months. The upgrading work is more appropriate from October to June as the local people are more or less free from farming activities.

5.4 Raw Materials (Resource) to be used

The physical resources consumed for the upgrading of the proposed road will mainly include boulders for gabions and stone for dry masonry wall, gabion boxes, aggregates of different sizes for sub-base, base course, surface dressing and concreting. Other local resources will be sand retrieved from local river beds and banks. Moreover, Reinforcement bars and cement will also be used in upgrading activities. The proposed upgrading will emphasize on the use of local materials as far as possible.

Alternatives to the selected materials will not be considered.

5.5 Others

No Action Option

The subproject road lies in Dolakha district, which is one of the worst affected district from the Earthquake 2015. This road has been damaged by the earthquake. In the absence of the road improvement, the potential socio-economic development of the Subproject area will be affected in the medium and long term. The present road condition is bad and the average traffic speed is less than 15 Kph thus causing high fuel consumption, wasted time (man-hour loss), and high vehicle maintenance. In addition, arrangements for better and safer travel of road users, which is grossly lacking in present condition, will be made. The surface improvements would improve the riding quality, allow fast movement, and safer journeys. Under the 'no action' alternative the current poor road condition will worsened and will further erode the quality of life in the Subproject area.

Proposal alternatives

The people living in the sub-project area require an efficient and safe mode of transportation to have the access to the market and other service centers. At the same time, there is need to conserve the physical, biological and socio-economic and cultural environment. As the road has not much adverse impacts on the environment due to road upgrading, and DoR has decided to upgrade the existing road, and this could be best option for better access. Therefore, proposal alternative is irrelevant in this road.



CHAPTER 6

6. MEASURES TO REDUCE OR CONTROL THE IMPACT OF IMPLEMENTATION OF PROPOSAL ON THE ENVIRONMENT

An effective implementation of benefit augmentation measures and adverse impacts mitigation measures would optimize the benefits expected from the sub-project and avoid/minimize the adverse impacts from the sub-project. Based on the impact assessment and identification, beneficial augmentation and adverse impact mitigation measures are presented in this chapter.

6.1 Benefit Augmentation Measures

6.1.1 Construction Phase

a. Employment opportunities and income generation

The Subproject will give emphasis in obtaining labour from the road influence area. The Subproject will employ local poor, vulnerable and socially excluded people (Janajati, Dalit) and women to the possible extent, without gender discrimination. Contractor will employ local people if, and where they are available and willing to work giving more emphasis to women (at least 40%), ethnic minority and dalit (occupational caste). The Sub-project will ensure that disadvantaged persons will be adequately considered in this process and that everyone receives fair and timely remuneration. The Subproject will ascertain that they will receive adequate training beforehand to carry out the required tasks and to ensure that further livelihood and income generation programs will be jointly undertaken to improve overall economic situation.

b. Upgrading of local labor skills in road construction

During the road upgrading works, the local labours will receive manifold skill training in construction techniques, small engineering structures and bio-engineering works. They also will receive additional knowledge in waste management, material handling and general application of environmental health and social precautionary measures. By augmenting their capacity, local people being involved in the Subproject will find it easier to find skilled manpower jobs in the future, thus securing their livelihood as an alternative/additional occupation to agriculture.

c. Local scale enterprises establishment and enhancement

The benefit augmentation measures will include awareness raising programme, providing support to local entrepreneurs, promotion of cooperatives and linkage with bank and other financial institutions.

d. Enterprise development and commercialization

The benefit augmentation measures will include awareness raising programme, providing support to local entrepreneurs, promotion of cooperatives and linkage with bank and other financial institutions.

e. Market for local commodities like local agricultural products

In the road upgrading area, there is need to develop key settlements established along the road as it being the ideal point for bringing out rural productions especially farm products. As its development, proposed upgrading where possible need to develop and establish road transport infrastructure e.g. shed house, as a 'buy' and 'sale' centre of rural productions.

6.1.2 Operation Phase

a. Improved access facility

Proponent will undertake regular maintenance of the road.

b. Appreciation of value of land and other property

Benefit enhancement measures will be promotion of land development activities and control of encroachment within RoW. The local people will be made aware of the fact that high value lands are easily acceptable to the banks and microfinance institutions to provide loans. Local people can start their own business.

c. Increase in crop productivity and sale of farm products to bigger markets

- Provide easier and cheaper agricultural inputs to farmers.
- Enhance the market facilities to local farmers and entrepreneurs.
- Promotion of market linkages and networking for better market price will increase sale of farm and livestock products in the settlements along the road corridor. Farmers will be more interested to increase agricultural production because of improved market accessibility. For this, market linkages shall be developed.

d. Enhancement of social services

Educate local farmers about the importance of cash crop farming and modern farming techniques.

e. Women Empowerment

For the empowerment of women and especially from indigenous people including Thami people, Mobile and television repairing training, Promotion of poultry farming and marketing training, Training on promotion of horticulture (citrus and other fruits), Promotion of lokta farming and processing, Rural agriculture volunteer, Reproductive health training, Health and sanitation training and Leadership development training have been proposed.

f. Improved Trade and business

This beneficial impact could be augmented by increasing production of local products such as cereals and cash crops like vegetables and fruits. Periodic and routine maintenance of the road should be properly streamlined.

g. Better accessibility to health facilities

Periodic and routine maintenance of the road should be properly streamlined.

6.2 Adverse Impact Mitigation Measures

The mitigation measures adopted during construction phase are of preventive nature with two basic objectives: (i) avoiding costly mitigation, and (ii) increasing awareness among the stakeholders for environment protection while constructing and operating infrastructure services.

6.2.1 Physical Environment

(i) Pre- Construction Phase

Following activities shall be carried out during pre-construction phase by the Contractor in co-ordination of executing agency and their representative after getting the letter to proceed with the work execution.

Table 6.1: Environmental Issues during pre-construction phase

Sl. No.	Activity and Sub Activity	Mitigation Measure/s
1.	Relocation of utilities	(i) Identification of relocation sites in advance in coordination with concerned authorities (ii) Scheduling the activity in consonance with the community usage pattern
2.	Tree felling	(i) Compliance with Forest Act, 1993 if trees are on forest land and co-ordinate with DFO and CFUGs (ii) Number of trees required to be felled down shall be confirmed (iii) Prior clearance shall be taken from DFO (iv) Compensatory plantation shall be done at a ratio of 1:25
3.	Clearance of land	(i) As per project provisions (ii) Scheduling of activity and coordination (iii) Modification of alignment or Relocation of the cultural Properties (iv) Avoidance of natural habitats
4.	Diversion of forest land	(i) Activity scheduling to avoid delays, confirmation to legal requirement (ii) Precautionary measures shall be taken during construction in forests (iii) Precautions shall be taken while operating equipment machinery
5.	Location of storage yards, labor camps, and construction sites	(i) Location criteria to be adopted (ii) Obtain required clearances from concerned authorities (iii) Infrastructure arrangements to be as per guidelines (iv) Residential areas shall not be considered in order to protect the communities (i.e., to curb accident risks, health risks due to air and water pollution and dust, and noise, and to prevent social conflicts, shortages of amenities, and crime). (v) All locations shall be included in the design specifications and on plan drawings.
6.	Procurement of equipment and machinery	(i) Machinery to be procured shall be in conformance with noise and emission standards of GoN. (ii) Adequate and proper safety equipment shall be arranged for workers
7.	Identification and selection of material sources	(i) Consultations and arrangements at contractor-individual levels, documentation of agreement (ii) The contractor shall identify the borrow area locations in consultation with the individual owners in case of private lands and the local government bodies like Municipality/VDC in case of their lands, after assessing the suitability of the material. The suitable sites shall be selected and finalised in

Sl. No.	Activity and Sub Activity	Mitigation Measure/s
		consultation with the PIU. (iii) Precautionary measures during siting of borrow areas and quarry areas (iv) Avoidance of location of material sources in Natural Habitats (v) It will be the construction contractor's responsibility to verify the suitability of all material sources and to obtain the approval of Local Body. If additional quarries will be required after construction is started, then the construction contractor shall use the mentioned criteria to select new quarry sites, with written approval of concerned District Development Committee (DDC) or other concerned government agency.
8.	Identification of designated waste disposal locations	Site selection in conformance to criteria provided

(ii) Construction Phase**(a) Impact due to establishment and demolition of construction camps**

Following mitigation measures shall be adopted:

- Efforts shall be made to establish construction camp at such sites so as to utilise the existing houses/ infrastructure as far as possible.
- The Contractor shall be required to prepare detailed plan for construction camp including location (distance from settlements, drainage facility, outdoor facilities, and surrounding areas), housing facilities (site roads, drainage, waste management and other facilities) and need to get approval from the Supervision Consultant.
- Basic facilities such as fire precaution, lavatories and showers, potable water supply, clean eating area, lighting, safe access, air supply, LPG /kerosene, and others shall be provided.
- Appropriate facilities for women and children shall be provided in the construction campsites.
- First aid facilities shall be made available at camp sites. In addition to this, collaboration with VDC level health/sub-health posts for major injury cases including a contingency plan for emergency cases shall be prepared.
- The Contractor shall ensure that all workers, drivers, delivery crew, as well as the communities are aware of the risk of communicable diseases such as HIV virus, STD and AIDS. In order to prevent the risk of transmission of such diseases, awareness raising programmes such as information education, posters, and consultation and communication campaigns about primary health care shall be organized regularly.
- The Contractor shall be responsible to control open space defecation and pollution of stream sites and public places by workers.
- The Contractor shall ensure that sufficient and good quality of food stuff at reasonable price including adequate and safe drinking water has been supplied to the workers.

(b) Impact due to operation and location of different types of borrow pits and quarries

The Contractor shall restore all haul roads used for transporting the material from the quarry to construction site to their original state. The rehabilitation of the quarry site shall be completed as per the approved plan in case the Contractor has opened-up a new quarry for the sub-project purpose.

Following mitigation measures shall be adopted:

- Borrow pits and quarry sites shall be selected avoiding protected and sensitive areas, nearby settlements, water sources, and in forest areas and fertile agriculture lands. The potential sites will be the waste and low quality of barren lands.
- Approval from authorities of government and land owners shall be taken.
- Suitable size of borrow pits and quarry sites shall be operated as per required volume of materials.
- Top soil shall be stockpiled and preserved to spread during reinstatement of sites. In turn, preserved top soil shall be spread and grasses seeding with long mulch and tree planting shall be carried out as a part of bioengineering. Leguminous plant species shall be planted in order to restore nitrogen in the soil.
- Contractor shall prepare and submit for approval from Engineer a borrow pits and quarry sites restoration plan after completion of the work
- After the extraction is completed, the borrow pits and quarry site shall be rehabilitated to suit the local landscape.

(c) Impact due to spoil disposal and location of disposal sites

Careful management of construction spoils/wastes is essential. Spoils generated through excavation of existing roads constitute bitumen and other pavement materials with various chemicals, oils, grease, etc. pose hazards to human health. Safe and careful management of such wastes generated through road excavation is vital.

Probable location of spoil disposal with available area is presented in the table 6.2 below.

Table 6.2: Probable Locations for Spoil Disposal

SN	Location/Chainage	Geomorphology	Stability condition	Approximate available area
1	00+400~00+880	Foot Hillside Slope	Stable	> 700 m ²
2	01+200~01+950	Foot Hill side Slope	Stable	> 600 m ²
3	04+690~04+910	Foot Hill side Slope	Stable	>500 m ²
4	15+700~15+960	Foot Hill side Slope	Stable	>300 m ²
5	22+150~23+100	Foot Hill side Slope	Stable	>700 m ²
6	32+500~33+100	Foot Hill side Slope	Stable	>600 m ²

Source: Field Survey, 2015

Mitigation Measures

- The Contractor shall prepare a detailed Site specific Environmental Management Plan (SEMP) including suitable disposal locations for spoils/wastes and that shall be approved by the Supervision Consultant.
- Locations for disposal shall be selected with the consent of local community, VDC representatives, and the sites shall be located at least 1 km away from the settlements, schools, hospitals, religious and cultural sites, water sources including other sensitive areas from environmental point of view.
- The Contractor shall use such spoils/wastes for construction purposes as far as possible.
- No spoils or waste is allowed to be disposed on the valley side of the road.

(d) Impact due to stockpiling of construction material and locations

Following mitigation measures shall be applied.

- The land for storing the construction material shall be far from the agriculture land and water bodies.
- Prior permission from the local stakeholder shall be taken before commencing the stockpiling of the upgrading material
- Construction materials shall be covered with tarpaulin during stockpiling to prevent rain water and dust emission generated from the stockpiling site. It should be encircled with side barriers and covered so that incidence of mix up with deleterious materials is imminent.
- Stockpiles shall be kept wet by sprinkling water or covered so that erosion by wind causing dust will not occur
- The construction materials shall be placed in barren land as far as possible to protect the ground vegetation
- Haphazard disposal of construction materials shall be strictly prohibited

(e) Loss of top soil

Top soil shall be saved by either stockpiling it adjacent to the proposed road formation batter sides, either immediately upslope or downslope of the extent of works, or by stripping it from the road section about to be excavated and re-spreading it immediately onto the previously completed adjacent section of road.

The preferred method is topsoil stripping and re-spreading immediately. This has the advantages of only single handling the material and using topsoil when it is fresh, when soil fertility and seed viability have not been reduced by stockpiling. If topsoil is to be stockpiled, it shall only be done above the excavation site to avoid mixing it with excavated sub-soil. Topsoil shall only be re-spread on batters with a grade of 1:1 (V: H) or flatter. Topsoil spread on steeper batters will not stay on the place.

(f) Impact on irrigation channels

In the project road design, provision has been made to replace all 600 mm or lesser diameter irrigation pipes by 900 mm diameter hume pipes and extend all to the required extent.

(g) Obstruction to natural drainage pattern

The following mitigation measures will be adopted:

- Avoid road-side drain water to be discharged into farmland or environmentally sensitive locations. In order to prevent damages in downstream areas, construct additional drainage channels as needed.
- Do not divert water away from natural water-course unless it is absolutely necessary. In such cases, provisions must be included to allow by-pass for migrating fish.
- Avoid any blockage or diversion of natural channels due to (intended or incidental) disposal of spoil.

(h) Air, Noise and Water Pollution

Noise Pollution

The following mitigation measures will be adopted to minimize the noise pollution:

- Prohibition of using pressure horn by vehicles and equipment near the settlement and wildlife habitat areas
- Use of silencer in vehicles and crushing plants
- Establishment of crusher plant, batching plant etc. in area away from settlement, school and sensitive ecological areas.

- Provision of wearing ear muffs during working in noisy areas.

Air Pollution

The mitigation measures to be adopted by the Proponent will include following:

- Prohibition of open storage and spillage of loose soil in and around construction site
- Covering of the stock piled spoil with an erosion control materials
- Covering of truckloads of material during transportation
- Sprinkling of water on working areas and road if dust pollution becomes nuisance
- Use of good quality of fuel
- Location of crusher plant away from settlement, school and sensitive ecological areas and they are fitted with air and noise control devices.

Water Pollution

The following mitigation measures shall be adopted in order to minimize the impact on surface water quality:

- Disposal of soil, sludge, and other wastes directly into water bodies will be avoided
- Prohibition of activities like washings – cloth, dish etc. near water bodies causing water bodies pollution, risking downstream users
- Prevention of soil slippage at toe of the stockpile areas by installing barriers at the perimeter
- Prohibition of urination and defecation in open areas and water bodies by construction workers with the installation of sanitation facilities.

(i) Decline in Aesthetic Value

Mitigation measures

- Control of clearing to the area in the construction limits and quick re-vegetation upon completion of construction.
- Planting mixtures of grass, shrubs, flowers and trees should be tailored to help re-establish the original site flora. The trees could form boundary of the road reserve.
- Discourage indiscriminate dumping of spoil material; quarry sites shall be properly closed to suit the local landscape and cover by plantation of local species trees.
- All the exposed areas should be planted with grass once construction activities are complete. This should be undertaken in phases; grassing activities should be undertaken on a section by section basis.
- After the extraction is completed, the quarry site will be rehabilitated to suit the local landscape.
- Plantation of local species along the roadside/ open space will be done.

(iii) Post construction phase

a. Dismantling of camp site and camp site restoration

At the completion of construction, all construction camp facilities shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site restoration are:

- Oil and fuel contaminated soil shall be removed and transported and buried in pre-approved waste disposal areas.



- Soak pits and septic tanks shall be covered and effectively sealed off.
- The contractor shall execute all works to restore the site and land cleared of all debris and shall hand over to the community/land owner or lesser in clean condition without any encumbrance.
- Campsite to be restored to its original condition as per the rehabilitation plan
- Restoration of top soil removed from the camp site during its establishment
- Disposal of waste at designated locations

b. Clearing of water channels, side drains and culverts

The following mitigation measures will be adopted:

- The precincts of the water body have to be left clean and tidy with the completion of construction.
- Temporary structures constructed during construction shall be removed before handing over to ensure free flow through the channels.
- Removal of debris and disposal will be done in designated location.

c. Rehabilitation of borrow areas

The Borrow Areas shall be rehabilitated as follows:

- Borrow pits shall be backfilled with rejected construction wastes (unserviceable materials) compacted and will be given a turfing or vegetative cover on the surface. If this is not possible, then excavation slope should be smoothened and depression is filled in such a way that it looks more or less like the original ground surface.
- Borrow areas might be used for aquaculture in case landowner wants such development. In that case, such borrow area will be photographed after their post-use restoration and Environment Expert of Supervision Consultant will certify the post-use redevelopment.
- The Contractor shall keep record of photographs of various stages i.e. before using materials from the location (pre-project), for the period borrowing activities (Construction Phase) and after rehabilitation (post development), to ascertain the pre and post borrowing status of the area.

(iv) Operation Phase

a. Stability of the road corridor

The following mitigation measures will be adopted:

- Correction or maintenance of the slope protection measures and drainage works
- Minor landslide and mass wasting will be immediately cleared and slope restored with appropriate technology (bioengineering)
- Soil conservation activities like community forestry will be promoted in the right of way and vulnerable areas beyond the road alignment
- Environmental awareness programs will be organized for local communities so that quarrying in road side hill slopes, grazing cattle on unstable areas will be controlled.

b. Stability of longitudinal and cross-drainage structures

Improvements to the road drainage will result in improved storm water flows and reduce the frequency of blockages from occurring. Risks to the public health caused by stagnant water bodies acting as disease vector breeding places will be reduced. By designing the drains to withstand appropriate storm events will reduce the risk of any operational failure of the drainage system and regular maintenance will further reduce the chances of failure.

c. Right of Way encroachment

Mitigation measures depend much on the local government ability for good land use planning and governance to discourage and/or remove such newly upcoming settlements along the road. Mitigation measures include:

- Establish public notes that specify the acquisition/property rights of the RoW, and that explain at the same time non-permissive uses of the RoW by non-entitled persons.
- Establish and propagate an effective land-use plan for the region; such land-use plan should clearly incorporate future visions for acquiring land for further road network expansion.
- Prepare good cadastral records that can easily be verified by land-use planners.
- Good demarcation of RoW, incorporating physical barriers and appropriate planting (through community forestry programs) of selected zones adjacent to the road.
- Incorporate physical barriers in zones of potential / prospected encroachment risks, e.g. by roadside plantation schemes;
- Initiate, by engaging local NGOs/CBOs, community awareness and assistance programs to prevent undesired land-take and roadside squatter development.
- Exert all legal and socially acceptable means to evict illegal occupants of the RoW, but take in due consideration the needs and constraints of vulnerable and indigenous groups.
- Consider long-term solutions to avert undesired growth (e.g. expanding markets along road or in different axis) by planning for road bypasses in congested areas.
- The DDC, municipality and VDCs should make local communities aware of the importance of the road RoW. The DDC, municipality and VDCs must develop strategies for controlling new settlements along the road corridor and these efforts should help to establish planned settlements only.

d. Impacts due to Slope Instability

The following mitigation measures shall be adopted:

- Correction or maintenance of the slope protection measures and drainage works
- Minor landslide and mass wasting will be immediately cleared and slope restored with appropriate technology (bio-engineering)
- Rill and gully formations should be regularly monitored and immediately fixed at critical areas;
- Soil conservation will be promoted in the right of way and vulnerable areas beyond the road alignment
- Promotion/support/assistance to community forestry programs, not only in the right of way, but also beyond in erosion-prone lands;
- Soil amelioration methods in the right of way and beyond should be promoted;

e. Impacts due to Poor Drainage

The following mitigation measures shall be adopted:

- Maintenance of smooth discharge across culverts and cross drainages by cleaning and maintaining them regularly so that water logging on adjacent land due to road do not occur.
- Roadside drain water will not be discharged into farmland or environmentally sensitive locations.



- Regular cleaning of roadside channels to avoid any blockage of drainage.

f. Change in Land use pattern

The following mitigation measures shall be adopted:

- Site selected for borrow pits must be lands where the effect will be temporary and generally involve lower value land and the sites shall be rehabilitated soon after use.
- The impact due to change in land use can be mitigated by regulating the land use.
- The RoW will be demarcated and fenced in order to avoid encroachment.
- In addition, the forest area shall be cleared only to maintain the designed formation width. Plantation shall be made in the acquired areas in order to stabilize roadsides greenery.

g. Air and Noise Pollution

Following mitigation measures shall be adopted to mitigate air pollution:

- Roadside plantation of pollution absorbent tree species like Eucalyptus species, Azadirachta indica, Melia azediarch, Grevelia robusta etc. especially nearby settlements and other public places will help to reduce pollution due to dust.
- DoR shall coordinate with relevant agencies on the implementation and enforce Nepal Vehicle Mass Emission Standard, 1999 and will stipulate vehicle owners to engage in proper and regular vehicle maintenance.
- Air pollution by dust shall be controlled with provision of paved shoulders, especially in the sensitive/built up areas.
- DoR shall partner with Development organizations (NGO, INGO and CBOs) to motivate the local communities to maintain greenery along the road apart from their houses by planting fodder, fuel wood and fruit trees including flowering plants.

Following mitigation measures shall be adopted to mitigate noise pollution:

- Effective traffic management and good riding conditions shall be maintained to reduce the noise level throughout the stretch and speed limitation and honking restrictions shall be enforced near sensitive locations such as hospitals, schools etc.,
- Effectiveness of the multi-layered plantation shall be monitored.
- Awareness shall be created amongst the residents about likely noise levels from road operation at different distances.

6.2.2 Biological Environment

i. Pre-construction Phase

a. Tree felling

- Compliance with Forest Act in case trees are on forest land
- Prior clearance will be taken from Department of Forest; coordinate with district forest officer

b. Diversion of forest land

- Compliance with Forest Act
- Activity scheduling will be done to avoid delays, confirmation to legal requirement

ii. Construction Phase

a. Clearing of shrubs and herbs of the forest areas

- Restricted movement of machinery/equipment

- Disposal/storage of grubbing waste and possible reuse

b. Disturbance, Hunting and Poaching of wildlife

Following mitigation measures shall be adopted

- Efforts shall be made to avoid disturbance to these animals to the extent possible.
- Every precaution shall be taken to minimise noise and other human activities during construction within the corridor.
- The project should closely coordinate with Forest Office, CFUGs and its outlets to control illegal poaching and trapping by the project stakeholders or other outside wildlife poachers, wildlife traders and timber smugglers.

c. Use of forest product by the construction workers and construction activities

Following mitigation measures shall be adopted:

- The Contractor documents must include provisions to restrict work forces with regard to forest product and wildlife collection and trade.
- The contract documents must include provisions to instruct contractor arrange alternate energy such as kerosene, LPG for labour by making provision in contract document.
- The Contractor must prevent illegal cutting of forest wood by labour force. He is also liable for penalties to violators.
- Equally, collection of non-timber forest products (e.g. bamboo, medicinal plants, mushrooms) by work staff must be prohibited and enforced.
- The project management should instruct the project officials, labour force, contractors, consultants and other stakeholder not to indulge in such activities and abide by the forest act and its regulation.

d. Disturbance to aquatic life and fishes

Following mitigation measures shall be adopted:

- Culvert crossings should be designed with the needs of migratory aquatic species in mind;
- Baffles might be installed to slow the flow enough to allow fish and others to swim against the current and culvert bottoms should be set below the level of stream bed.

e. Disturbances on the corridor of the wildlife movement

No mitigation measures are proposed as the road corridor is not renowned for wildlife movement.

iii. Operation Phase

a. Possible extraction of firewood and timber

The mitigation measures recommended are:

- Encourage and support local communities and authorities in controlling illegal harvesting of forest resources.
- CFUGs shall be supported to conserve and manage their CFs according to operational plans
- Encourage and support local community for controlling illegal harvesting of forest resources.

b. Increased wildlife disturbance, hunting and Poaching

The following mitigation measures shall be adopted:



- Coordination with DFO and CFUGs to control the activities like illegal hunting and poaching of wild fauna, especially listed in CITES and IUCN red data book by enforcing acts and regulations strictly.

c. Impacts on forest resources

The following mitigation measures shall be adopted:

- Encourage and support local communities and authorities, CFUGs in controlling illegal harvesting of forest resources.
- CFUGs shall be supported to conserve and manage their CFs as per operational plan

d. Disturbances on the corridor of the wildlife movement

No mitigation measures are proposed as the road corridor is not renowned for wildlife movement.

6.2.3 Socio-economic and Cultural Environment

i. Pre- Construction Phase

a. Impacts due to Loss of Land, standing crops, and farm trees

No mitigation measures are proposed as there will be no impact of loss of land, standing crops and farm trees.

b. Population displacement

Rehabilitation of displaced population (47) will be guided by the Entitlement Matrix prepared in Resettlement Plan of the sub-project. The displaced households will receive one time structure relocation allowance. Households whose houses need to be relocated will receive a housing displacement allowance. Owners of commercial enterprises requiring relocation will receive a business displacement allowance. Estimated cost for the relocation and transportation allowances is as mentioned below.

Table 6.3: Relocation and Transportation Allowances

S.N.	Allowances	Unit	Affected HHs	Amount (NRS)
1	Relocation allowance	No.	9	172,500.00
2	Material Transportation assistance	No.	9	172,500.00
Total (NRs.)				345,000.00

Source: Resettlement Plan, Dolakha Singati Road, 2016

c. Land and Property acquisition and Transfer of land ownership

The project will not provide compensation for 10 private structures (temporary sheds) to be acquired before starting construction activities. But the project will provide material transportation assistance and one time relocation assistance to the affected 9 households.

d. Resettlement issues, if any

An estimated budget of NRs. 345,000.00 has been allocated for shifting, transportation allowance for affected 9 households.



ii. Construction Phase

a. Land use change

As the upgrading works will be limited to existing road width only, no permanent land use change has been envisaged during construction phase.

b. Occupational Health and Safety, STDs and Nuisance from construction camps

- Make mandatory the use of helmets, safety belts, masks, gloves and boot by workers depending on nature of work.
- Necessary planning and safety approach shall be made for rescue during emergency.
- The supervisor shall have to check whether the provisions made in the plan are implemented according to plan.
- Workers shall be provided with first aid and health facilities.
- There shall be provision for group accidental insurance for the workers.
- First aid training shall be provided to field staffs like overseer, social mobilizers and supervisors.
- Strict rule for non-complying safety condition such as payment withholding and/or termination of contract
- Respective provisions shall be included in the contract document with contractor.

c. Pressure on Social Service Facilities

Impact on existing social service facilities can be mitigated by:

- Provide required facilities in the camp during the sub-project construction, and
- Use of local people in construction activities to reduce the extra burden on existing resources.

d. Social and cultural conflicts due to influx of construction workers

- Information signboards shall be placed at required places and safety measures installed as precautionary measures.
- Strict rules and regulation shall be maintained in the labour and work camp so that any engagement in alcoholic and other bad habits are restricted.

e. Loss of private properties (building and land)

The compensation for the loss of residential/commercial structures will be as mentioned below:

- Cash compensation for loss of structures at replacement value to be fixed by CDC.;
- Two months local agricultural wage rate for rebuilding/ rehabilitation of structures.
- Transport allowance (one month for same village and two month for villagers outside village) to cover the cost of moving structures including loading/uploading of materials based on district rate;
- Owners will be allowed to take/reuse the salvaged materials for rebuilding structures.
- An estimated budget of NRs. 345,000.00 has been allocated for shifting, transportation allowance for affected 9 households.

f. Loss of public properties/infrastructures and their locations

An estimated budget of NRs. 9250,000.00 has been allocated for relocation of services. Two (2) impacted public properties (Temple) located at Ch. 14+210 and Ch. 23+735 will be relocated at the location agreed upon with the consent of stakeholders. This issue shall be dealt with during pre-construction phase.

g. Accidents related to construction activities

Following mitigation measures are recommended:

- The Contractor shall ensure that internationally accepted and practiced safety measures are adopted during (i) road works (ii) handling of large construction equipment and machineries (iii) handling of chemicals including hazardous materials and inflammable substances (iii) welding/hot work (iv) electrical works etc.
- The occupational health and safety (OHS) Clauses established by the DoR shall be included in the work contracts. This refers basically the FIDIC rules for road construction works encompassing all accident prevention measures which can happen at work sites and in the camps.
- The Contractor shall keep at site a full time Safety and Environment Monitoring Officer and a Medical Officer. Safety Officer shall ensure proper safety measures undertaken at camps and work sites. Regular safety drill shall be conducted and safety signs shall be kept at work areas.
- The Contractor shall arrange all personal protective equipment (PPEs) for workers, including first aid facilities at construction sites. An emergency plan shall be prepared duly approved by the Supervision Consultant to respond to any instance of safety hazard.
- Entry of unauthorised persons to the construction sites and equipment storage sites shall be restricted.
- Workers shall not be allowed to enter work areas without wearing proper safety gear (hard hat, work boot, gloves, ear muffs, face mask, reflective jacket, goggles, safety belt etc. as appropriate)
- General medical centre with a bed shall be established at the campsite to treat simple/minor injuries or illness. Arrangement shall be made with the District Hospital to keep a dedicated bed for emergency treatment of project staff and workers, and a doctor of the hospital shall periodically make a visit to the site office for health check-up of workers
- The Contractor shall be responsible for erecting signs and signals on sensitive and risky areas, which should be visible from long distance.
- Use of delineators, traffic cones, empty bitumen drums, barricades, and flag men shall be used to ensure traffic management and safety.
- Regular safety audit on safety measures shall be conducted during construction. The audit shall cover manpower and their safety, machinery, temporary works, equipment and vehicles, materials storage and handling, construction procedures and environment, site safety guidelines, and miscellaneous services.

h. Social security and related issues

Following mitigation measures shall be adopted:

- Strict law and order situation shall be maintained in co-ordination with District and Local administration.
- Contractor's labour force shall comply with the code of conduct set by the contractor

iii. Operation Phase

a. Population pressure and impact due to new settlements along the road alignment

The recommended mitigation measures are:

- Plantation of trees along the RoW so that it is not encroached;

- Awareness raising programme through local organizations to plan proper settlements.
- Regulate settlement growth with proper planning

b. Increased accidents

In order to mitigate such incidents following safety measures and restriction on speed shall be adopted.

- Required delineators, safety signs, road bumps etc. shall be used as appropriate along the road.
- Road safety awareness programs shall be conducted, including the propagation of educative material in local language(s).
- The material shall be propagated in schools and be available at all VDCs.
- It is also recommended to place illustrated sign boards at accident-prone spots and bus bays.
- Footpaths should be placed at the town limits and settlement areas.

c. Breakdown of social fabrics - Change in social behavior

The recommended mitigation measures are:

- Awareness raising programme through local organizations to plan proper settlements strengthening local communities through awareness
- Opportunities to local workforce during road maintenance

d. Encroachment of road assets (RoW)

The recommended mitigation measures are:

- Awareness program,
- Enforcement of law,
- Planning of land development, and
- Plantation of road side trees.



6.2.4 Chemical Environment

i. Construction Phase

a. Use of fuel, lubricants, oil, acids and other chemicals for construction

- Chemicals such as oils, chemicals, paints, acids etc. shall be stored in leak proof container and disposed in pit safely after use.
- The vehicles shall not be washed directly into the water bodies.
- The vehicles and equipment shall be maintained from time to time to ensure any leakage from them.

b. Use and storage of chemicals like bitumen etc.

Following mitigation measures shall be adopted:

- Avoid heating of bitumen near water sources and disposal of bitumen in water bodies,
- Secure safe site for bitumen storage,

- The permission from the land owner shall be obtained before commencing the storage activities.
- The bitumen storage shall not be done on fertile land and nearby water bodies.
- If bitumen has spread over the land accidentally and in improper place then it shall be cleared immediately.
- The bitumen shall not be discharged into the drain structure while overlaying on the sub-base material.
- Bitumen related work shall not be carried out during the rainy condition.

ii. Operation Phase

a. Effect on water quality

For control of water quality, the Municipality/VDCs along the roadside shall control haphazard cleaning of vehicles and the leakage of fuels and lubricants into water channels. The effects of chemicals resulting from vehicle leakage can be minimized by preventing their draining into the adjacent water courses. The washing of cars in rivers and creeks should be strictly controlled and violators be penalized. In places where car washing habits have evolved, it is advised to erect signboards (illustrated and in local language) that explain the inherent risks for people utilizing the source for drinking and aquatic life, and also indicate penalties for violators.



CHAPTER 7

7. MATTERS TO BE MONITORED WHILE IMPLEMENTING THE PROPOSAL/ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Monitoring of the implementation of environmental protection measures provides a basis for logical comparison for the predicted and actual impacts of the subproject. Environmental monitoring involves the systematic collection of data to determine the actual environmental effects of the subproject, compliance to regulatory standards, and evaluate the implementation and effectiveness of the environmental protection measures. Monitoring must be an integral part of the implementation of the mitigation measures during construction, and will generate important information and at the same time should improve the quality of sub-project implementation. Environmental monitoring thus helps to ensure the effectiveness of environmental mitigation measures, compliance with environmental standards and to facilitate on changes required in Subproject design and operation.

The National EIA Guidelines (1993) and EPR, 1997 require monitoring plans and indicators, schedules and responsibility be identified in the IEE report. The following subsections deal with the various components of the environmental management and monitoring programme in order to promote the full integration of monitoring activities in Subproject works and implementation. The EMP as detailed in Table 7.3 shall form a part of Bidding Document.

7.1 Environmental Management Roles and Responsibility

Responsibility for environmental management associated with the proposed road upgrading involves a number of road building parties, each with specific responsibilities for particular activities. Main parties responsible for the implementation of environmental safeguards measures prior to -, during - and following - proposed road upgrading are:

- MoPIT
- DoR (including GESU)
- Asian Development Bank
- Design Consultant
- Construction Supervision Consultant
- Contractor – construction/bio-engineering works

Within the road sector, MoPIT has the overall responsibility for environmental safeguarding. The Department of Road (DoR), as the project proponent, has the ultimate responsibility for the supervision of road construction and environmental management works. Implementation of the EEAP will be the responsibility of Project Director, DoR Project Directorate (ADB). Geo-Environment and Social Unit (GESU) of DoR undertakes environmental assessment functions, as well as monitoring of Sub-projects and provision of advice relating to design of environmental mitigation and enhancement measures, and the setting of environmental quality standards.

Asian Development Bank (ADB) is responsible for overseeing DoR's project design, implementation management in accordance with their grant/loan conditions including environmental safeguards adequately addressed, and respected it during proposed road upgrading works.



The design Consultant will prepare final detailed designs and conduct necessary environmental studies including EMP design recommendations. The Supervision Consultant will supervise the day to day activities of the construction contractor on behalf of DoR and conduct technical supervision of road layout, overseeing contract implementation and certifying works for payment. The supervising consultant will ensure effective implementation and compliance of all aspects of work as specified in Environmental Management Plan (EMP) by the Contractor, with reporting direct to the Project Director, DoR Project Directorate (ADB).

The construction Contractor will be responsible for undertaking all duties and works assigned to him/her in the road construction contract, including all specified conditions in this EMP. The Contractor will work closely with the Construction Supervision Consultant to ensure that the works are constructed to specified standards.

The specific responsibility of DoR Project Directorate (ADB), Design and Supervising Consultant (DoR's representative), and construction Contractor are as follows:

DoR Project Directorate (ADB)

- Acquisition of all necessary buildings, structures and temporary shops within COI, if any.
- Review and approval of detailed road construction designs.
- Obtaining necessary permits from GoN for road construction activities including liaising with various Government Institutions (i.e. District Forest Office, District Agriculture Office, District Irrigation Office, District Administration Office, District Survey Office etc.) and Local Bodies (i.e. Municipality, DDC, VDC etc.).
- Review and approval of surveyed road alignment and road works.
- Review and approval of proposed ancillary work sites (including workforce camps, quarries, borrow pits and storage areas).
- Road maintenance and environmental monitoring and management following handover by the Contractor.

DoR

- Acquisition of all necessary private assets – land and physical structures – according to design / construction needs
- Review and approval of surveyed road alignment
- Review and approval of detailed design of proposed road upgrading
- Securing necessary permits from other line agencies of GoN including local institutions related to proposed road upgrading activities (District Forest Office, District Administration Office, District Land Survey Office, District Land Revenue Office, District Development Committees, Village Development Committee)
- Review and approval of proposed ancillary activities (workforce camps, quarry, borrow pit, crusher plants etc)
- Road maintenance, environmental monitoring and management following road handed over by the contractor

Project Design and Supervision Consultant (DoR's Representative)

- Preparation of final road construction design, required environmental studies and EMP design recommendations.
- Survey and pegging of road construction design works.
- Conduct necessary orientation training and other awareness raising programs, skills training in co-ordination with GESU/DoR

- Supervision of the Contractor to ensure work to be undertaken as per road construction contract.
- Inspection and reporting of Contractor activities to ensure effective implementation of the EMP.
- Auditing Contractor works and activities against the conditions set out in EMP.
- Issuing corrective action requests and conducting follow up inspections and evaluation of corrective actions.
- Reporting all non-conformances to the Project Director, DOR Project Directorate (ADB).
- Certifying correctly constructed road works for payment.

Construction Contractor

- Construction of detailed road design works and implementation of EMP.
- Participation in site inspections and audits undertaken by the Supervising Consultant.
- Implementation of corrective actions in response to requests made by the supervising Consultant regarding specific environmental safeguards.

7.2 Site Supervision, Monitoring and Reporting

Strict supervision of road construction activities is required prior to, during and following road construction to ensure that works are constructed in accordance with the approved designs and that environmental impacts are fully mitigated in accordance with the EMP. A standard system of site inspections, reporting and approval will be undertaken during the life of Sub-project, as described below.

7.3 Pre-construction Phase

Pre-construction Inspections of each section of the alignment and all ancillary sites will be undertaken by the supervising Consultant and Contractor. It will serve to:

- Identify site specific road construction or environmental problems.
- Identify existing services that are required to be reinstated.
- Identify construction waste disposal sites.
- Identify quarries and borrow pits site for extraction of construction materials.
- Identify labor and work force camp sites.
- Plan of phasing of construction along the alignment.

Supervision Consultant and Contractor shall discuss and agree upon the factors listed above and document accordingly. The supervising Consultant shall review the sites pegged by the Contractor and approve them for construction where appropriate, or request the Contractor to re-peg sites. The cost for inspection is included in the Sub-project implementation cost.

7.4 Construction Phase

The Contractor is wholly responsible for complying with all aspects in the construction contract pertaining to environmental protection provisions and must at all times during the contract term provide clear evidence that contract requirements are being met.

The supervising Consultant shall undertake appropriate supervisions of road works during construction, and inspections of ancillary sites during their period of use. For noncompliance

activities as per EMP contract conditions, notice will be issued for rectification accordingly and as appropriate, pay items withheld.

The supervising Consultant shall undertake appropriate inspection of all ancillary sites in use over preceding months, as well as any ancillary site activities currently in progress, at the end of each month in conjunction with the Contractor. If any activities are not being undertaken in accordance with the contract or EMP conditions, the supervising Consultant shall document these and specify corrective measures in the Monthly Report.

The supervising Consultant shall provide a copy of the Monthly Report to the Contractor of the inspection for action. The cost for supervision is included in the Sub-project implementation cost.

7.5 Post-Construction Phase

The supervising Consultant shall undertake a post-construction certification inspection of each completed section of road and each rehabilitated ancillary sites. Certification will be based upon the contract conditions and EMP conditions. The cost for post-construction certification inspection is included in the Sub-project implementation cost.

7.6 Operational and Maintenance Phase

The environmental monitoring of roads during the road operation and maintenance phase shall concentrate on the major identified potential impacts of the roads, including slope stability, drainage and sedimentation.

The DoR, GESU shall undertake a 6-monthly inspection of the road formation and related features over the initial year following the completion of road construction. The inspection will include a visual assessment of:

- Road surface condition.
- Embanked slope stability and vegetative cover
- Road side structures.
- Drains and drainage lines, their stability and drainage line erosion.
- Damage from sedimentation.

Standard report covering above features will be completed by GESU following each inspection.

7.7 Project Organization

As per EPR 1997, the Ministry of Physical Infrastructure and Transport is legally responsible for environmental monitoring works of strategic roads. The Project Implementation Unit (PIU) will carry out the monitoring of the implementation of the EMP by the Contractor through its Supervising Consultant. A safeguard desk will be established in the Subproject with a focal person to lead the desk. All safeguard (environmental and social staff) will be member of the desk. The desk will meet monthly to discuss safeguard compliance in the project, gaps, and mitigation measures. The Desk will also convene monthly meeting with technical team to discuss compliance, gaps, agree on corrective measures and do the monitoring and reporting. The Desk will also periodically report to GESU, and keep linkage with district forest office, ministry of forest and soil conservation, and ministry of environment, as required.

The DoR has also established the Geo-Environment and Social Unit (GESU) in 1991 in order to integrate environmental aspects into the road development and maintenance projects. The GESU has, inter alia, issued the Environmental Management Guidelines in 1997 and the policy document for Environmental Impact Assessment (EIA) in 2000. PIU will co-ordinate with DoR's GESU and get the additional technical assistance required for the implementation of the environmental protection measures. PIU may also seek additional technical assistance from the Ministry of Forests and Soil Conservation and the Ministry of Population and Environment as and when necessary.

The DoR and MOPIT will evaluate the monitoring results, as and when necessary. The Subproject intends to invite an independent monitoring team to safeguard its environmental performance. PIU staff will work alongside the construction and operation to ensure that the measures and requirements outlined in the EMP are carried out effectively.

The Environmental Organization Structure is presented in Figure 7.1.

During Construction, MoPIT, DoR/GESU, PIU will carry out compliance monitoring of the environmental compliance carried out by the Contractor while the Supervising Consultant and ADB will carry out external monitoring at field and higher level respectively. During operational phase, ADB will carry out external monitoring while MoPIT and DoR/GESU will carry out internal monitoring.

7.8 Monitoring and Evaluation

For road projects, MoPIT shall monitor and evaluate the impact of the implementation of the proposal on the environment. During the course of carrying out monitoring and evaluation of impact, if the actual impact is found higher than the one specified in the conditions prescribed at the time of approving the proposal, the MoPIT shall issue necessary directives to the proponent to adopt corrective measures to reduce or control such impact. Monitoring activities during subproject operation will focus on recording environmental performance and proposing remedial actions to address unexpected impacts.

7.9 Organization of Environmental Management

Figure 7.1 outlines a number of government agencies responsible for environmental management and its monitoring in line with EPR, 1997, Rule13 (Amendment). Department of Roads, ADB Project Directorate under the Ministry of Physical Infrastructure and Transport (MoPIT) is the proponent of the proposed Earthquake Emergency Assistance Project (EEAP).



Figure 7.1: Environmental Management Organization Structure

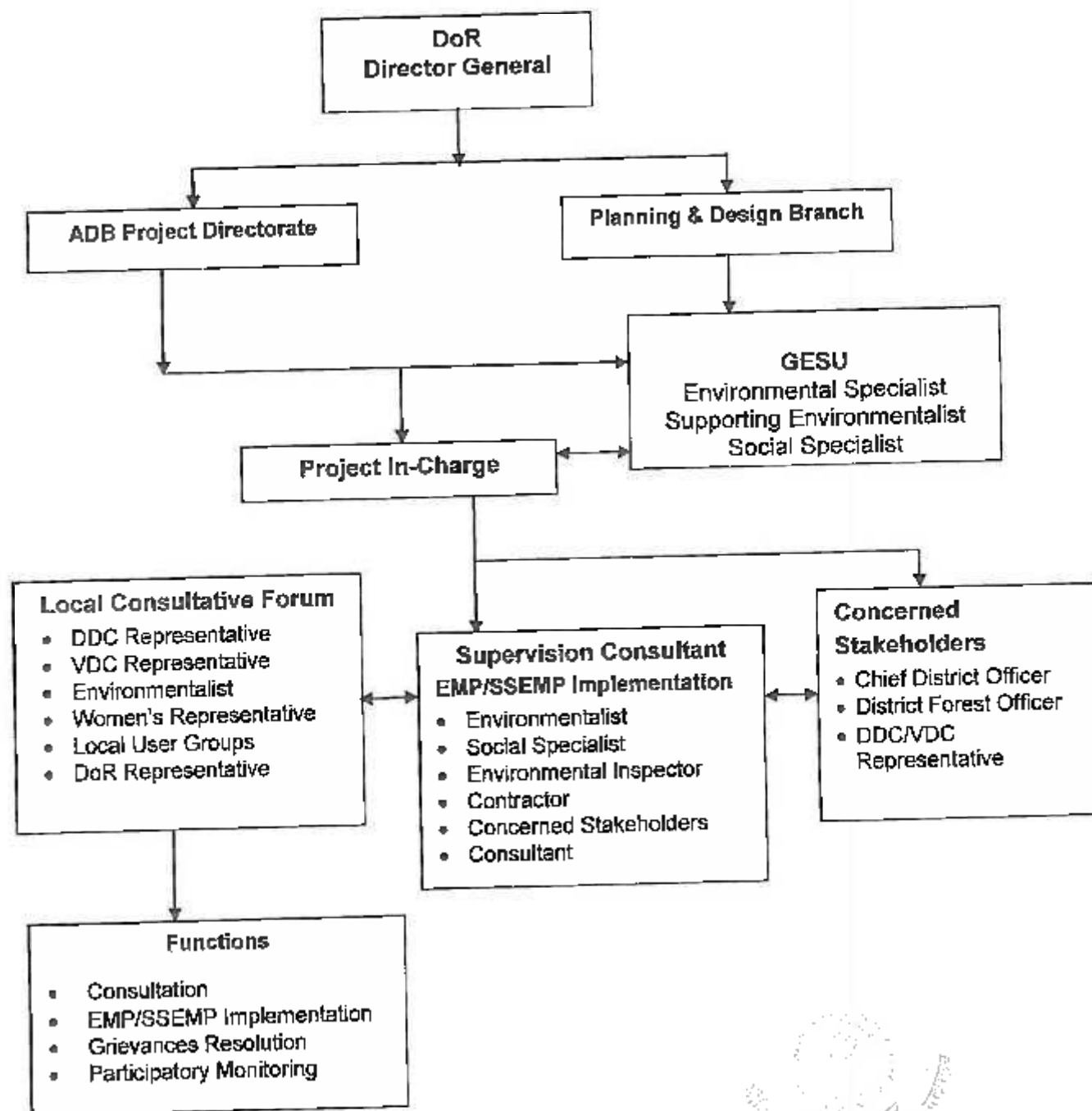


Table 7.1: Compliance Monitoring

Parameters/Issues	Responsible Implementing Agency	Verifiable Indicators	Verification Methods	Schedule	Responsible Monitoring Agency
Socio-economic Environment					
Involvement of local labors in construction activities	Contractor	Number of local labors employed in project	Inspection at construction site, Interaction with local people	Periodically during construction phase	PIU/SC/GESU/ MoPIT
Worker's sanitation, Occupational health and safety	Contractor	Incidence of communicable/non-communicable diseases in labor camp, safety gears usage by labor, medical checkup camps, shelter, drinking water and toilet facility	Site inspection, interaction with labors	Periodically during construction phase	PIU/SC/GESU/ MoPIT
Pressure on social service facilities	Contractor	Number of labors depending on local social Infrastructures like forest, water supply lines, health posts, etc	Site observation, interview with local peoples	Periodically during construction phase	PIU/SC/ GESU/ MoPIT
Social Conflict	Contractor	Number of days lost due to conflict, bandhs at project level etc.	Interview with contractor, site consultant, locals	Periodically during construction phase	PIU/SC/GESU/ MoPIT
Employment to Project affected people	Contractor	Number of project affected people employed	Interaction with project affected people, recording	Periodically during construction phase	PIU/SC/GESU/ MoPIT
Restoration, rehabilitation of infrastructures damaged by the subproject activities	Contractor	Continued services by the facilities and functional public life	Site observation; VDC/DDC records; Public Consultation Meetings; Photos	Once in a month during construction phase	PIU/SC/GESU/ MoPIT
Physical and Cultural Environment					
Slope protection	Contractor	Bioengineering methods used at recommended sites	Walk through survey	Before award of construction completion certificate	PIU/SC/ GESU/ MoPIT
Extraction of material from recommended quarry sites and borrow pits	Contractor	No cases of material extraction reported from unauthorized sites	Walk through survey, interaction with local peoples	During construction phase	PIU/SC/GESU/ MoPIT
Control of dust emission	Contractor	Dust level at construction site, water sprinkling practice observed	Use of sprinkler tank, interview local about	During construction phase	PIU/SC/ GESU/ MoPIT

Parameters/Issues	Responsible Implementing Agency	Verifiable Indicators	Verification Methods	Schedule	Responsible Monitoring Agency
			dust problem		
Spoil disposal in safe tipping sites	Contractor	Spoil dumped in sites recommended by project manager	Interaction with project manager, and local people, Walkthrough survey along road alignment	During construction phase	PIU/SC/GESU/ MoPIT
Erosion protection measures used in material stockpiling area	Contractor	Erosion protection measures used (grassing), bunds constructed, adequate drainage provided	Visit to material stockpiling area, observation	During construction phase	PIU/SC/GESU/ MoPIT
Road Safety	Contractor	Use of signal boards (speed limit, men at work, danger etc) during upgrading, safety passage provided to vehicles	Walkthrough survey observation, interaction with locals	During construction phase	PIU/SC/GESU/ MoPIT
Measures to protect environment from air & noise pollution	Contractor	Dust level and noise level at work sites, major settlements and sensitive spots like health centers and schools	Testing, Observation of good upgrading practices and discussion with residents and workers	Once in a month during construction	PIU/SC/GESU/ MoPIT
Biological Environment					
Spoil disposal in forest and water bodies	Contractor	Spoil dumped in forest, and sensitive areas	Walkthrough survey observation	During construction period	PIU/SC/GESU/ MoPIT
Compensatory plantation done	Contractor	Number of trees planted	Visit to re-plantation area	Before issuing of construction completion certificate	PIU/SC/GESU/ MoPIT
Use of firewood	Contractor	Use of firewood by labor, and bitumen heating	Inspection, interaction with local, community forestry and labors	During construction phase	PIU/SC/GESU/ MoPIT
Disturbing, illegal killing, poaching of wildlife	Contractor	Cases of disturbances, illegal and hunting and poaching	Interaction with CFUG, locals, inspection of labor camp area	During construction phase	PIU/SC/GESU/ MoPIT
Measures to avoid pressure on forest and wildlife	Contractor	Use of firewood or fossil fuel by upgrading crew, events of hunting and killing of wildlife/fishes	Inspection and interview with local people	Once in a month during construction	PIU/SC/GESU/ MoPIT

Parameters/Issues	Responsible Implementing Agency	Verifiable Indicators	Verification Methods	Schedule	Responsible Monitoring Agency
Final alignment selection as per IEE/EMP recommendation	Consultant	Incorporation of IEE/EMAP recommendations into Site and alignment selection process and design document	Walkthrough survey along final road alignment, verifying sensitive areas	Initial stage of surveying	PIU/SC/GESU/ MoPIT
Chemical Environment					
Measure to protect water bodies from pollution	Contractor	Visual observation of open defecation and waste disposal around water sources near construction sites; Parameters like pH, hardness, DO etc.	Site inspection, test of site-selected samples of water at laboratory	Once in six months during construction	PIU/SC/GESU/ MoPIT

Table 7.2: Impact monitoring

Parameter	Verifiable Indicators	Verification Methods	Location	Schedule	Responsible Agency	
					Implementa- tion	Monitoring
Landslide and Erosion	Inclination, slope failures, causes; Drainage facilities such as Cross drain, side drains, Fresh gullies and erosion Success/failure of bio-engineering solutions	Site observation, photos Discussion with people and technicians	Near steep slopes and at slide areas and sites where bio-engineering activities are failed.	Continuously during upgrading and operation	Contractor	PIU/SC/GESU/ MoPIT
Bio-engineering of Disturbed Slopes	Re-vegetation through bio-engineering application on disturbed slope Establishment of nursery	Site observation Inspection of nursery and its production rate; Photos, measurements	Cut slope area, where vegetation is cleared; Nursery	During and at the end of construction	Contractor	PIU/SC/GESU/ MoPIT
Disposal of Spoils and construction Wastes	Initiated erosion, affected aesthetic value, affected forest and agriculture, initiated land erosion by local blocked drainage, hazard to downhill slope residents and agricultural lands	Site observation and interviews, photos, geo-referencing sites	At specific locations where such sites occur	During construction	Contractor	PIU/SC/GESU/ MoPIT
Quarrying of construction Materials	Initiated erosion, landslide due to quarrying, degradation of vegetation, water logging, waterborne diseases	Site observation, photos Records from local health centres	Quarry site areas	During construction	Contractor	PIU/SC/ MoPIT

Parameter	Verifiable Indicators	Verification Methods	Location	Schedule	Responsible Agency	
					Implementation	Monitoring
Disruption of Drainage System	Status of rehabilitation Service status of irrigation channels and water supply system	Observation and interviews, photos, fisheries data, wildlife records	Disrupted aquatic system, irrigation canal	During construction	Contractor	PIU/SC/GES U/ MoPIT
Water Quality	Turbidity, Oil and Grease, Dissolved Oxygen	Water quality tests of source of drinking and irrigation water	Water bodies of importance	During construction	Contractor	PIU/SC/GES U/ MoPIT
Air Quality	Total Suspended Solid, Particulates	Visual inspection, measurement	At upgrading sites and at sensitive spots (schools, hospitals)	During construction	Contractor	PIU/SC/GES U/ MoPIT
Forest and Vegetation	Numbers of trees, presence of ground vegetation, signs of illicit logging and extraction of NTFPs	Observations, DFO records, photos, stakeholder interviews	In and around the upgrading sites	During construction and operation	Contractor	PIU/SC/GES U/ MoPIT
Wildlife	Wildlife hunting trapping and poaching by work force, Trade of wildlife	Interview with local people / DFO, photos Observations	Forest areas at roadside	Throughout project construction	-	CFLIG/ VDC, Municipality and DFO
Worker's health and sanitation	Types of diseases in the labor camp	Discussion with labors, health workers,	Project Area	Monthly during construction phase	Contractor	PIU/SC/GES U/ MoPIT
Occupational Health and Safety	Type and number of accident occurred during upgrading, Adequacy of occupational safety measured provided Compensation provided in case of fatal accidents or invalidity	Observations, photos, spot checks, Contractors' and health centre records interview with labourer	Project Area	During upgrading	Contractor	PIU/SC/GES U/ MoPIT
Ribbon Settlement	Congestions to road users Numbers of accidents, RoW encroachment	Records, observations	Project Area	During operation	Div. Road Office	DOR
Drainage blockage	Water overflow the road, damage to the drainage structure	Observation	Project area	During operation	Div. Road Office	DOR



Table 7.3: Environmental Management Plan (EMP)

Environmental Issues / Component	Remedial Measures / Actions	Approximate Location	Time Frame	Mitigation Cost (NRs.)	Institutional Responsibility	
[A] Environmental Enhancements						
1. Upgrading of road through settlement areas	<ul style="list-style-type: none">Improved side and cross drainage and improved road geometry.Blacktopping in settlement areas will be carried out as per design.	Major settlement areas	Construction	Construction contract	Contractor	SC, PD/DOR
2. Road side amenities	<ul style="list-style-type: none">Installation of bus bays as per designs.Erection of road furniture - e.g., traffic signs, speed zone signs as per design.	Throughout Subproject road corridor	Construction	Construction contract	Contractor	SC, PD/DOR
3. Slope stabilization/Preservation of Vegetation	<ul style="list-style-type: none">Carry out bioengineering as per detailed design	Throughout Subproject road corridor	Construction	7,773,712.00	Contractor	SC, PD/DOR
4. Cultural properties	<ul style="list-style-type: none">Enhancement of all cultural properties	Throughout Subproject road corridor	Construction	Construction contract	Contractor	SC, PD/DOR
[B] Pre-Construction Stage						
1. Land and property losses/acquisition	<ul style="list-style-type: none">Initiate all necessary land and property acquisition (32 private structures) procedures prior to the commencement of any related work.Adhere to the land acquisition procedures in accordance to RAP's Entitlement Framework.	Throughout Subproject road corridor	Design/Pre Construction	Subproject preparation cost	PD/DOR/SC	PD/DOR
2. Permits	<ul style="list-style-type: none">Obtain all necessary permits for commencement of roadwork and provide a copy to the Contractor.Obtain written permission from landholders, Municipality, DDC and VDC under the Local Self-Governance Act, 1998 prior to commencement of various activities related to construction work and provide copies to the Supervising Consultant.	Throughout Subproject road corridor	Pre Construction	Subproject preparation cost Construction contract	PD/DOR Contractor	PD/DOR SC, PD/DOR
3. Worksite survey, Pegging and approval	<ul style="list-style-type: none">Conduct layout survey of the proposed upgrading works.Locate, peg out and seek approval from the Supervising Consultant for each ancillary site prior to the commencement of related activities.Inspect and approve, if correct all ancillary sites.	Throughout road corridor	Pre Construction	Construction contract Subproject Cost	Contractor SC	SC, PD/DOR
[C] Construction Stage						
A. Physical Environment						

Environmental issues / Component	Remedial Measures / Actions	Approximate Location	Time Frame	Mitigation Cost (NRs.)	Institutional Responsibility	
					Implementation	Supervision
1. Operation and Closure of Quarries and Borrow Pits	<ul style="list-style-type: none"> • Locate and peg quarries and seek approval from the Supervising Consultant. • Obtain permission/license for extraction of materials from Stakeholders, Municipality, DDC or VDC as appropriate. • Locate extraction sites restricted to small areas; preferably on existing quarry sites and sites without any tree cover; away from dwellings, archeological, religious or cultural sites; sites which will not alter river flow regime and possess water logging problem in future; and sites where effects will be temporary. • Restrict all extraction activities to approved sites with operations to the hours of 7:00 – 18:00. • Prevent ponding of surface water through adequate • Re-use excess material as per detail design. • Locate disposal sites on stable ground without excessive slope; that avoids water courses and wetlands; that will not promote instability and result in destruction of property, vegetation and local services. Preferably permissible sites are abandoned quarries in order to restore original contour. • Avoid haphazard side casting and use small spoil benches to prevent slope overloading. • Identify, peg and seek approval from supervising consultant for permissible fill disposal sites. • Obtain permission from local stakeholders, DDC, VDC where required as appropriate. • Restrict disposal at approved locations with correct placement of fill. • Where required, apply bio-engineering measures for vegetative cover to prevent surface erosion. • Measures will be taken to prevent earthworks and gabion works from impeding rivers, streams, water canals, or drainage system. 	Location of selected quarries and borrow pits proposed during construction	Construction	Construction Contract	Contractor	SC, PD/DOR
2. Spoil and construction waste disposal	<ul style="list-style-type: none"> • Avoid haphazard side casting and use small spoil benches to prevent slope overloading. • Identify, peg and seek approval from supervising consultant for permissible fill disposal sites. • Obtain permission from local stakeholders, DDC, VDC where required as appropriate. • Restrict disposal at approved locations with correct placement of fill. • Where required, apply bio-engineering measures for vegetative cover to prevent surface erosion. • Measures will be taken to prevent earthworks and gabion works from impeding rivers, streams, water canals, or drainage system. 	Location of selected spoil and construction waste disposal sites. Excess cut material can use in the road as a filling if material specification permit.	Construction	Construction Contract	Contractor and SC	SC, PD/DOR
3. Cut and fill operation	<ul style="list-style-type: none"> • Survey and peg crest of cut batter and toe of earth embankments. • Bench earth embankments prior to filling to enable keying. • Fill shall be carried out in layers no deeper than 	Throughout the Subproject road corridor	Construction	Construction contract	Contractor	SC, PD/DOR

Environmental Issues / Component	Remedial Measures / Actions	Approximate Location	Time Frame	Mitigation Cost (NRs.)	Institutional Responsibility	
					Implementation	Supervision
4. Water Management (Drainage, cross-drainage, gully protection etc.)	<p>150mm and appropriately compacted before applying next layer.</p> <ul style="list-style-type: none"> Cut and fill slopes shall be protected using conventional civil engineering structures in conjunction with bio-engineering stabilization measures as per design to rehabilitate erosion prone and problem sites. Suitably sized side drains, causeways, cross-drainage structures, bridges will be constructed as per detailed design. Cascades, steps, energy dissipaters, and check dams including bio-engineering measures are to be constructed as per design for gully protection to avoid depth and side erosion of river beds. Standpipes and public water supplies should not be used to extract water for construction works, without prior permission of municipality/VDC. Public shall be consulted regarding location of drainage outfalls. Care shall be taken not to disrupt or contaminate the irrigation water supply or the supplies to the local public water supplies. 	Throughout road corridor	Construction	Construction contract	Contractor	SC, PD/DOR
5. Stockpiling of Construction Materials	<ul style="list-style-type: none"> Locate, peg and seek approval from the supervising consultant for the use of stockpile sites. Stockpile should not be located on water courses; should not be within 50m of schools, hospitals or public standpipes; and should not affect locals and their properties. Obtain written permission from landowners and local bodies for stockpiling on their land. Stockpiles should be covered with tarpaulins. For large stockpiles, it should be enclosed with side barriers and also covered when not in use. Provide intervening vegetated buffer to control any un-expected run-off. Seed topsoil stockpiles with a cover crop where they are to be retained for more than one month. Clean area properly after completion. 	Location of identified stockpiling sites	Construction	Construction contract	Contractor	SC, PD/DOR
6. Top Soil Saving and Re-use	<ul style="list-style-type: none"> Save all available top soil from ROW sites and re-use it on completed road formation batters approved by 	Throughout road corridor	Construction	Construction Contract	Contractor	SC, PD/DOR

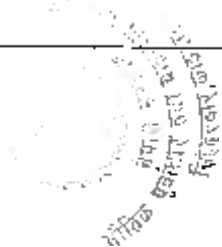
Environmental Issues / Component	Remedial Measures / Actions	Approximate Location	Time Frame	Mitigation Cost (NRs.)	Institutional Responsibility	
					Implementation	Supervision
	<p>Supervising Consultant.</p> <ul style="list-style-type: none"> Strip and stockpile topsoil from all ancillary sites that are to be disturbed. Keep stockpiled topsoil separate from sub-soil material. Sow a cover crop on each top soiled batter soon after topsoiling. 					
7. Reinstatement of Services	<ul style="list-style-type: none"> Inventory of all services / cultural sites to be reinstated. Locate and reach agreement with affected landowners and local people / end users (municipality/VDC) regarding services (i.e. irrigation canal, water supply lines, standpipes, drainage ditches and walking trails, chauraras (public resting places etc) to be maintained, temporarily cut and reinstated including timing and location of cuts and reinstatements. Obtain written permission from affected landowners / local people regarding temporary cessation of services. All community facilities likely to be impacted (i.e. temples, stupas (Buddhist temple), pali pauwa (public resting place), traditional ceremonial site etc.) be avoided, protected and re-provisioned as necessary at locations with access acceptable to the local stakeholders, end users (to satisfaction of municipality/VDC). Works shall be planned with timing to avoid/ minimize impact to cultural festivals. Moving of religious structures shall be done based on the results of public consultation. 	Subproject area	Construction	9250,000.00	Contractor	SC, PD/DOR
8. Stone Crushing Plant/Hot mix Plant/Batching Plants	<ul style="list-style-type: none"> Locate, stake out and seek approval from Design Supervision Consultant for stone crushing plant. Locate plant site away from population centers, drinking water intakes, cultivated lands and sensitive ecosystem, preferably at least 500m from settlement and habitation. Obtain permission from local stakeholders, Municipality, DDC or VDC as appropriate. Stone crushing equipment / cement batching shall be fitted with dust control devices and operated as per 	Location of selected plant sites	Construction Stage	Construction Contract	Contractor	SC, PD/DOR

Environmental Issues / Component	Remedial Measures / Actions	Approximate Location	Time Frame	Mitigation Cost (NRs.)	Institutional Responsibility	
					Implementation	Supervision
9. Air Pollution	<p>Manufacturer's Specification.</p> <ul style="list-style-type: none"> • Bitumen mixing plant should have in-built mechanisms for the absorption of gases. • The plant shall be operated during day time. • Restore the site maintaining natural contours and vegetation after use. • Stone crushing plant / Hot mix plant / Batching plant will be appropriately located at least 500m from settlement & habitation fitted with dust suppression equipment. • Road construction area will be maintained damp by periodical spray of water. • Delivery vehicles during transportation of materials will be covered so as to avoid littering of materials. • Mixing equipment will be well sealed and equipped as per existing standards. • All construction vehicles will comply with Motor Vehicles and Transportation Management Act as amended and have green sticker for operation. Will comply with vehicular emission standard for in use vehicle published by Ministry of Population and Environment. • Provide temporary hoardings where required to minimize dust impact on locations of temples and other cultural sites. • Provision of speed control measures in settlement and working areas to limit traffic speed. • Air pollutant parameters (TSPM, PM₁₀, SO_x, NO_x, CO_x) will be monitored regularly during construction. Conforming NAAQS of Nepal. 	Sub-project area, Crusher Plant site.	Construction	Construction Contract	Contractor	SC, PD/DOR
10. Noise Pollution and Vibration Effect	<ul style="list-style-type: none"> • Ensure plant and equipment used for construction conforms to best practices. • Vehicles and equipment used will be fitted with silencer and maintained to keep noise at minimum levels. • Workers will be provided with appropriate ear muffs/plugs specially at crusher site • Noise barriers will be placed in urban and sensitive locations i.e. schools, hospitals etc. 	Three sensitive locations as directed by SC.	Every six months	For air quality monitoring ~600,000.00 (3 sites x 4 times x 50,000)	Through approved monitoring agency	SC, PD/DOR
10. Noise Pollution and Vibration Effect	<ul style="list-style-type: none"> • Ensure plant and equipment used for construction conforms to best practices. • Vehicles and equipment used will be fitted with silencer and maintained to keep noise at minimum levels. • Workers will be provided with appropriate ear muffs/plugs specially at crusher site • Noise barriers will be placed in urban and sensitive locations i.e. schools, hospitals etc. 	Sub-project area, Crusher Plant site	Construction	Construction Contract	Contractor	SC, PD/DOR

Environmental Issues / Component	Remedial Measures / Actions	Approximate Location	Time Frame	Mitigation Cost (NRs.)	Institutional Responsibility	
					Implementation	Supervision
	<ul style="list-style-type: none"> Cracks caused by vibration due to construction activities need to be monitored closely and alternative be sought where problem arises. Work will be restricted to day hours specifically at urban and sensitive locations. Noise levels (1 hr Leq dB (A)) levels will be monitored regularly during construction. Conforming WHO standards. 	Four sensitive locations as directed by SC.	Every six months	For noise level monitoring ~ 240,000.00 (4 sites x 4 times x 15,000)	Through approved monitoring agency	SC, PD/DOR
11. Water Pollution (Hazardous Materials, Combustibles and Toxic Materials Management)	<ul style="list-style-type: none"> Hazardous materials shall not be stored near surface waters sources Used lubricants and oils will be collected and recycled or disposed off site. Plastic sheeting will be placed under hazardous material storage area to collect and retain leaks and spills. Contaminated runoff from storage areas will be captured in ditches or ponds with an oil trap at the outlet. Contaminated and worn plastic sheeting will be packed into drums and disposed off site. Explosives will be used as per the prevailing GON regulations. Water Quality (EC, PH, DO, TSS, Oil and Grease) Monitoring regularly during construction. Conforming Nepal Standards. 	Sub-project area	Construction	Construction Contract	Contractor	SC, PD/DOR
		Three sensitive locations as directed by SC.	Every three months	~ 98,000.00 (3 sites x 8 times x 4000)	Through approved monitoring agency.	SC, PD/DOR
C2. Biological Environment						
1. Vegetation and Forest Resources	<ul style="list-style-type: none"> Identify and seek approval from SC for felling of trees within COI. (around 150 trees) Plantation of trees as instructed on designated location. (around 4125 trees) Fuel wood will be banned for construction works. 	Through out road alignment	Construction	~391,875.00	Contractor	SC, PD/DOR
C3. Socio-economic and Cultural Environment						
1. Labour Camp Location and Management	<ul style="list-style-type: none"> Locate, peg and seek approval from SC for labor camp sites. Camps shall not be located near settlements; near water supply intakes; or sites that affect the access by local people to drinking water. Camp shall not be in the vicinity of landslide and flood plains. 	Locations of selected labour camps	Construction	Construction contract	Contractor	SC, PD/DOR

Environmental Issues / Component	Remedial Measures / Actions	Approximate Location	Time Frame	Mitigation Cost (NRs.)	Institutional Responsibility	
					Implementation	Supervision
	<ul style="list-style-type: none"> • Provide and maintain proper drinking water, sewerage and waste disposal facilities at the camps. • Ensure no wood is burnt by any worker on or off site. Camps shall be provided free of cost, with electricity and regulator & adequate fuel supplies of LPG or Kerosene. • Prohibit workforce from poaching wildlife and cutting trees. • After use, sites shall be cleared and restored to near natural or stable conditions with vegetative cover. 					
2. Work Camp Location and Operation	<ul style="list-style-type: none"> • Locate, peg and seek approval from SC for work camp sites. • Camps shall not be located near settlements and; near water supply intakes; or sites that affects locals access to drinking water. • Camp shall not be in the vicinity of landslide and flood plains. • Provide and maintain proper drinking water, sewerage, waste disposal including first aid unit medical facilities at the camps. • Used oil, lubricants shall be recovered, re-used or removed from site. • Explosives, oil, petrol, and grease shall be managed according to Provisions of this Management plan. • After use, the site shall be cleared and restored to near natural or stable conditions. 	Locations selected for work camps	Construction	Construction contract	Contractor	SC, PD/DOR
3. Occupational Health and Safety (Safety, Accident Risks and Health)	<ul style="list-style-type: none"> • Adequate lighting and safety signal devices be installed for work safety. • Adequate warning signs and safety barriers will be provided for work safety. • Protective clothing including helmets, masks, boots, gloves, ear plugs and goggles will be provided for workers safety. • At every work place, a readily available first aid unit including an adequate supply of dressing materials will be provided. • Maintain health care system at construction camps including regular visits by trained medical staff for routine check-up of workers and avoidance of 	Subproject area	Construction	720,000.00	Contractor	SC, PD/DOR

Environmental Issues / Component	Remedial Measures / Actions	Approximate Location	Time Frame	Mitigation Cost (NRs.)	Institutional Responsibility	
					Implementation	Supervision
	<ul style="list-style-type: none"> communicable disease. Strict rules and regulation be maintained in the labour and work camp to avoid alcoholic and other bad habits. Electrical Equipment will be checked and certified regularly. Provide and install all road signs as per design. Impart road safety education to all villagers, schools, clubs and drivers of construction vehicles. Restore all disturbed infrastructures to the condition before disturbance or improve where appropriate in coordination with local people 					
Impact on community infrastructure		Along the road alignment	Construction	Construction contract	Contractor	SC, PD/DOR
D. Chemical Environment						
1. Storage/handling and distribution of Bitumen	<ul style="list-style-type: none"> Secure safe site for bitumen storage The permission from the land owner must be obtained before commencing the storage activities. The bitumen storage must not be on fertile land and nearby water bodies. If bitumen has spread over the land accidentally and in improper place then it should be cleared immediately. The bitumen should not be discharged into the drain structure while overlaying on the sub-base material. Bitumen shall be melted in heaters using kerosene, diesel or gas fuel. Bitumen drums shall be stored in designated areas, not scattered along the road and any small accidental spills shall be cleared up immediately. No bituminous material shall be discharged into side drains. Bitumen shall not be applied in strong wind or rainy conditions. 	Area where storage and spreading of bitumen has to be carried out.	Pre-construction and Construction	Construction contract	Contractor	SC/DOR
2. Use of Bitumen	<ul style="list-style-type: none"> Fuelwood shall not be used for heating bitumen. Bitumen shall be melted in heaters using kerosene, diesel or gas fuel. Bitumen drums should be stored in dedicated areas, not scattered along the road and any small accidental spills should be cleared up immediately. No bituminous material shall be discharged into side drains. 	Subproject area	Construction	Construction contract	Contractor	SC, PD/DOR

Environmental Issues / Component	Remedial Measures / Actions	Approximate Location	Time Frame	Mitigation Cost (NRs.)	Institutional Responsibility	
					Implementation	Supervision
2. Combustibles and Toxic Materials Management	<ul style="list-style-type: none"> • Bitumen shall not be applied in strong wind or rainy conditions. • Hazardous materials shall not be stored near surface waters sources • Used lubricants and oils shall be collected and recycled or disposed off site. • Plastic sheeting shall be placed under hazardous material storage area to collect and retain leaks and spills. • Contaminated runoff from storage areas shall be captured in ditches or ponds with an oil trap at the outlet. • Contaminated and worn plastic sheeting shall be packed into drums and disposed off site. • Explosives shall be used as per the prevailing GON regulations. 	Subproject area	Construction	Construction contract	Contractor	SC, PD/DOR
						
[D] Operation Phase						
1. Water Management and Slope Stabilization	<ul style="list-style-type: none"> • Maintenance of drainage and cross-drainage structures. • Cattle grazing and tethered cattle along the road edge be strictly prohibited. 	Throughout road corridor	Operation	Maintenance Cost	DOR	DOR, GESU
2. Safety Measures	<ul style="list-style-type: none"> • Traffic management plan will be developed, especially along congested locations. • Traffic control measures, including speed limits with proper signboards, will be enforced strictly. • Further encroachment and squatting within the ROW will be prevented. • No school or hospital will be allowed to be established within 50m of the road without permission from the planning authorities. 	Throughout road corridor	Operation	Maintenance cost	Local Body, DOR Govt. Traffic Police	DOR, TESU

Note: COx = Oxides of Carbon, DDC = District Development Committee, GESU = Geo-environment and Social Unit, PD/DOR = Project Directorate/Department of Roads, NOx = Oxides of Nitrogen, ROW = Right of Way, SC = Supervision Consultant, SOx = Oxides of Sulfur, TESU = Traffic Engineering and Safety Unit, TSPM = Total Suspended Particulate Matter, VDC = Village Development Committee.

7.10 Cost for Executing the Environmental Management Plan

a. Specific Cost Details

Land Acquisition Costs

The costs for land and crops that will be lost due to the acquisition of land will be included under the environmental and social costs for this Project Budget. The actual payments to the PAPs losing such properties will be established by the Compensation Fixation Committee.

b. Environmental safeguard cost

Table 7.4: Environmental Safeguards Cost

Items	Cost (NRs.)	Remarks
Capacity building <ul style="list-style-type: none"> • Pre-construction orientation (senior level road builders, mid-level road builders) • Training (labor force leaders) • Refreshing workshop (senior level road builders, mid-level road builders) 	150,000.00	Part of Environmental Safeguard Cost (NRs. 1,500,000)
Safety Gadgets/facilities	720,000.00	Item of BoQ
Excess spoil materials (safe disposal)	3,496,224.00	Item of BoQ
Relocation of public utilities (Drinking water supply lines, electric poles, irrigation canal etc.)	9250,000.00	Item of BoQ
Road safety measures	48,352,303.00	Item of BoQ
Replantation (at the ratio of 1:25 and 5 years maintenance cost)	391,875.00	Part of Environmental Safeguard Cost (NRs. 1,500,000)
Bioengineering measures	7,773,712.00	Item of BoQ
Total Cost (NRs.)	70,134,114.00	

Source: Detail Engineering Report, Dolakha-Singati Road, 2016

7.11 Items to be included in Bid Document

Item to be included - as a safeguard respect to local environment - in bid document for any adverse impact associated with the proposed road upgrading including reinstatement of rural trails, water supply lines, irrigations canal systems etc under the issue of reinstatement of public utilities and services, as well as other as outlined in EMP may require to be addressed and to respecting it, and also to ensure it being incorporated in BoQ (Table 7.3). This exercise will be undertaken and executed in parallel with Design works by incorporating it in bid document as the picture of road requiring respect to EMAP become clearer.

Table 7.5: BoQ Related to Environmental Safeguard Managements

Environmental Issues	Unit	Rate (NRs)	Amount (NRs)	Remarks
Environmental Mitigation Works	PS	1,500,000.00	1,500,000.00	
Social compliance and safeguards	PS	1,500,000.00	1,500,000.00	
Safety Gadgets (for all road builders) (Quarry, Civil Works, Surface sealing etc.)	24 month	30,000.00	720,000.00	All road builders use safety gadgets including Supervising consultant, visitors
Excess cut materials (safe disposal)	109,257.00 cum	32.00	3,496,224.00	Contractor to bear cost for any land reclamation need on the valley side caused by his unsafe disposal
Relocation of Services	PS	1.00	9250,000.00	
Road safety measures			48,352,303.00	
Bio-engineering			7,773,712.00	
TOTAL (NRs.)			72,592,239.00	

Source: Detail Engineering Report, Dolakha-Singati Road, 2016

7.12 Cost for MoPIT, GESU Compliance Level Monitoring

The environmental monitoring of roads during the road operation phase shall concentrate on the major identified potential impacts of the roads, including slope stability, vegetative cover, drainage and sedimentation. The DoR, GESU shall undertake a 6-monthly inspection of the road formation and related features over the initial year following the completion of road construction. Standard report covering environmental features will be completed by GESU following each inspection. The estimated cost for environmental monitoring and evaluation during road operation is estimated as follows:

Table 7.6: Environmental Monitoring Cost

S. No.	Particular	Quantity and Unit Rate	Amount (NRs)
1.	Air Quality Monitoring	3 sites x 4 times x 50,000	600,000.00
2.	Water Quality Monitoring	3 sites x 8 times x 4,000	96,000.00
3.	Noise Level monitoring	4 sites x 4 times x 15,000	240,000.00
4.	Monitoring by GESU	LS	100,000.00
5.	Monitoring by MoPIT	LS	100,000.00
6.	Monitoring by PD	LS	100,000.00
TOTAL (NRs)			1,236,000.00

CHAPTER 8

8. CONCLUSIONS AND RECOMMENDATION

8.1 Conclusions

The environmental impacts of the proposed upgrading of Dolakha - Singati road Subproject are likely to have minimal adverse impact on environment. Most of the impacts identified and predicted are of minimal, temporary, reversible and short term nature associated with construction phase.

The upgraded road will provide smooth, easy and quick access eliminating existing traffic congestion and reduction in road accidents. Consequently, the transportation of goods and services from Dolakha to Singati and to other parts of the country will be easier, faster and cheaper.

Further beneficial impacts of upgraded road will be on human life, income generation from employment during the construction phase and enterprise development and commercialization during operational phase. Proposed bio-engineering works on road slopes and compensatory plantation of trees will assist to avoid and minimize road side scouring, erosion and attenuation of noise and dust, and will enhance local environment.

8.2 Recommendation

Taking into consideration the nature of the proposal, its location, stakeholder's positive response, and evaluated environmental impacts, this IEE Study recommends to implement the Proposal under the condition that the safeguard measures described in the environmental management plan are implemented and monitored accordingly. Further environmental assessment study at EIA level for implementation of the proposed road Subproject is not recommended.



CHAPTER 9

9. REFERENCES

- DDC Dolakha, 2004. District Profile (Nepali) of Dolakha. District Development Committee, Dolakha, Nepal.
- District Development Committee, Dolakha, 2014, Final Report on District climate and energy plan
- DoR, 2002. Twenty Year Road Plan 2002-2022. The Department of Roads, Ministry of Physical Planning and Works, Kathmandu.
- DoR, GESU. 2003. Reference Manual for Environmental and Social Aspects of Integrated Road Development, the Department of Roads, Ministry of Physical Planning and Works, Kathmandu.
- DoR, GESU. 2009. Roadside Geotechnical Problems: A Practical Guide to Their Solution, Geo-Environment and Social Unit, Department of Roads, Ministry of Physical Planning and Works, Kathmandu.
- DoR, GESU, 2008. Environmental and Social Management Framework, Geo-Environment and Social Unit, Department of Roads, Ministry of Physical Planning and Works, Kathmandu.
- DoR, GESU, 2000. Policy Document (Draft), Environmental Assessment in the Strategic Road Network, Geo-Environment and Social Unit, Department of Roads Ministry of Physical Planning and Works, Kathmandu.
- DOR, GESU, 1997. Environmental Management Guidelines, MoWT, Kathmandu.
- GoN. 1995. Forest Act, 1992, and its Rules, 1995. Ministry of Forest and Soil Conservation, Kathmandu, A guide to the Environment and Social Issues Associated with New Road Construction and Upgrading.
- GoN. Ministry of Physical Planning and Works 2001 (2058 BS). The National Transport Policy, Kathmandu.
- GoN. 2000. Environment Protection Act, 1997 and Environment Protection Rules, 1997 (amended in 1999). Ministry of Law, Justice and Parliamentary Affairs, Law Books Management Board for MoPE, Kathmandu.





ANNEXES

- ANNEX 1: Approval Letter and Approved Terms of Reference
- ANNEX 2: Copy of Public Notice and Deeds of Enquiry (*Muchulkas*)
- ANNEX 3: Recommendation Letters
- ANNEX 4: Minutes of Meetings
- ANNEX 5: Bio-engineering, Cross-section of Road
- ANNEX 6: Tree Estimation
- ANNEX 7: Probable Campsites, Disposal Sites Location Map
- ANNEX 8: Photographs
- ANNEX 9: Questionnaire Checklists
- ANNEX 10: Compliance to MoPIT Evaluation Committee's Comments of IEE Report
- ANNEX 11: GoN MoPIT Evaluation Committee's Comments on IEE Report



