

Environmental Assessment Document

Initial Environment Examination

Loan no: 3260

January 2017

NEP: Earthquake Emergency Assistance Project Dhagdhing- Gorkha Road Project

Main Report (1 of 5)

Prepared by the Government of Nepal for the Asian Development Bank.

This Report is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

Your attention is directed to the "terms of use" section of this website. In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.



Government of Nepal

MINISTRY OF PHYSICAL INFRASTRUCTURE & TRANSPORT

**DEPARTMENT OF ROADS
PROJECT DIRECTORATE (ADB)**

Project Directorate
Bishalnagar

Phone : 4437492
4437493
4414238

Fax: 977-1-4437488
e-mail: pdadb@wlink.com.np

**Bishalnagar
Kathmandu, Nepal**

PD ADB.EEAP.DG/073-74/Cha. No. 748

Date: March 09, 2017.

Mr. Kenichi Yokoyama,
Country Director
Asian Development Bank,
Nepal Resident Mission
Metropark, Lazimpat, Kathmandu

RECEIVED
10 MAR 2017

BY: _____

**Subject: ADB Loan No. 3260 NEP: Earthquake Emergency Assistance Project (EEAP)
Dhading-Gorkha Road Project: Initial Environmental Examination (IEE) Report**

Dear Mr. Yokoyama,

We would like to inform you that Initial Environmental Examination (IEE) Report, January 2017 of Dhading-Arughat-Gorkha Road has been approved by Ministry of Physical Planning & Transport.

Thanking you.

Sincerely yours,

Keshab Kumar Sharma
Project Director

CC:

Mr. Gagan R. Rai, Senior Project Officer, ADB, NRM, Lazimpat, Kathmandu



Government of Nepal

Ministry of Physical Infrastructure and Transport

Department of Roads

Babarmahal, Kathmandu

Initial Environmental Examination Report

Upgrading of Dhadingbesi-Arughat-Gorkha Road

in

Dhading and Gorkha Districts

Submitted to

Ministry of Physical Infrastructure and Transport

Singhdurbar, Kathmandu

Submitted by:

Geo-Environment and Social Unit
Department of Roads, Pulchowk, Lalitpur

Phone No: 977 1 5529075, 5005521,

Fax: 55291006

Email: gesu.dor@gmail.com,

gesunit@dor.gov.np

On behalf of

ADB Project Directorate

Bishalnagar, Kathmandu, Nepal

Prepared by:

MMM Group, Canada, In association with
ITECO Nepal (P) Ltd., Total Management
Services Pvt. Ltd. and Material Test Pvt.
Ltd.,

PO Box 675, Kathmandu, Nepal

Ward No 34, Min Bhawan, KMC

Telephone: 4620054

Fax: +977-1-4620054

Email: mmm.tppf@gmail.com, www.mmm.ca

January 2017



MMM GROUP

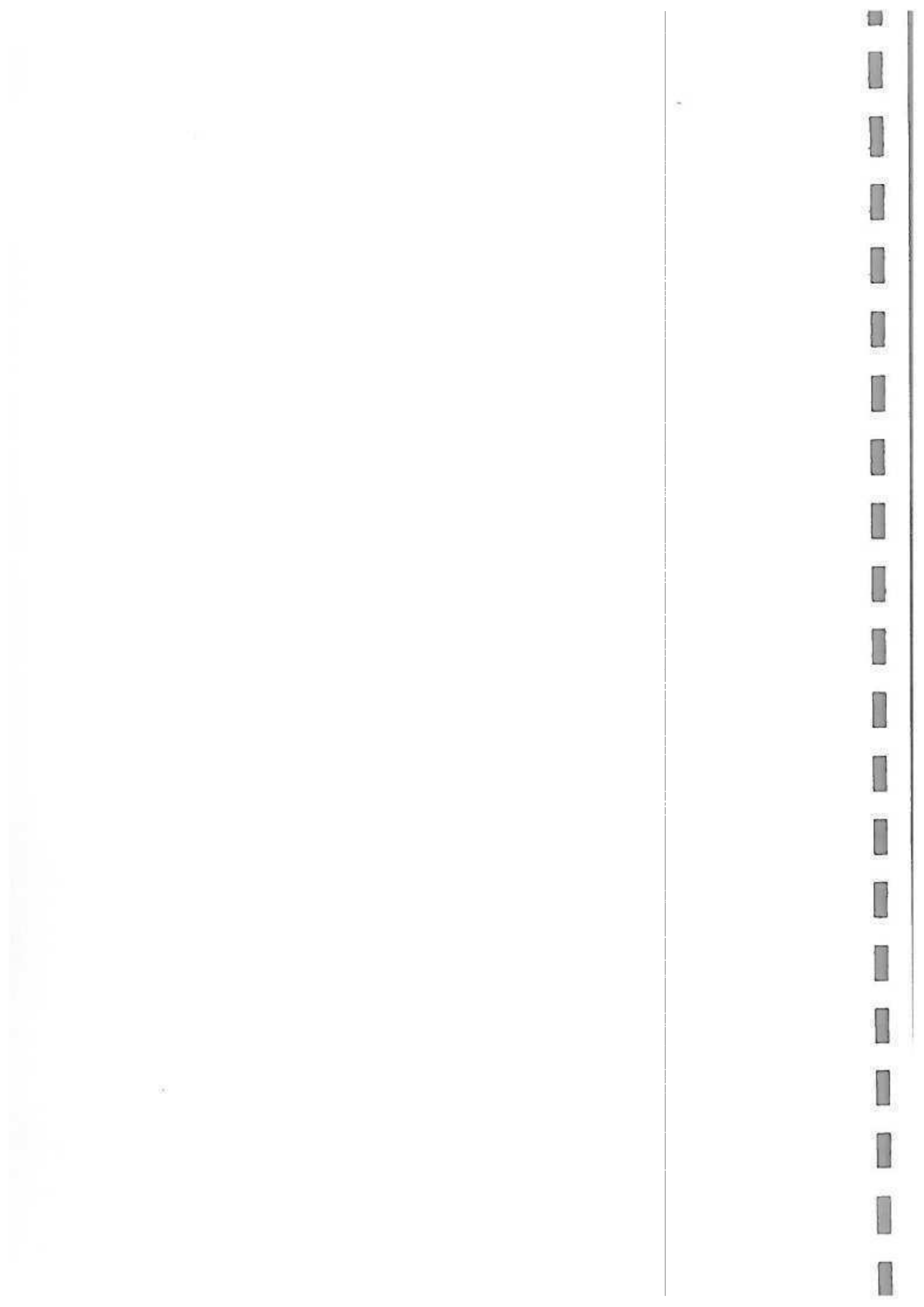


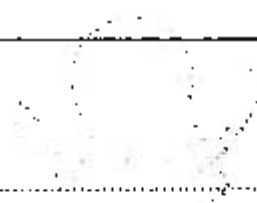
TABLE OF CONTENT

EXECUTIVE SUMMARY (In Nepali & English)



CHAPTER 1	1
1. NAME AND ADDRESS OF THE INSTITUTION PREPARING THE REPORT	1
1.1 Name of Proposal	1
1.2 Name of the Proponent and Address	1
1.3 Consultant	1
CHAPTER 2	2
2. SUMMARY OF THE PROPOSAL	2
2.1 Objective of the Proposal	2
2.2 Rationality of the IEE Study	2
2.3 Objective of the IEE	2
2.4 Anticipated Impacts by the Proposed Subproject	2
2.4.1 Impacts on Land Use	2
2.4.2 Adverse Impacts on the Environment, Impact on Human Life, and Population Pressure	3
2.4.3 Damage to be suffered by local goods or objects	4
2.5 Review of Acts/Rules, Plans/Policies, Guidelines, Standards, and Conventions	4
2.5.1 Constitution	4
2.5.2 Plans and Policies	4
2.5.3 Acts and Rules	5
2.5.4 Other Guidelines and Manuals	9
2.5.5 International Conventions and Treaties	13
2.6 Permissions and Clearances Required for the Project	14
CHAPTER 3	16
3. DESCRIPTION OF THE PROPOSAL	16
3.1 Type of Proposal	16
3.2 Nature and type of goods to be delivered	16
3.3 Proposal's Capacity	16
3.4 Brief Description of the project area and works	18
3.5 Key Upgrading Activities	19
3.6 Materials to be used	24
3.7 Emissions Resulting from Implementation of the Proposal	24
3.8 Energy to be used	24
3.9 Details on the technology	24
3.10 Manpower Requirements	25
3.11 Resources required for the implementation of the proposal	25
3.12 Construction planning, Construction schedule	25
3.13 Project Area Delineation	25
3.14 Other necessary matters	25
3.15 Description of Existing Environment	29
3.15.1 Physical Environment	29
3.15.2 Biological Environment	36
3.15.3 Socio-Economic and Cultural Environment	37
3.15.4 Socio-economic Profile of the Affected Households (DIA)	40
CHAPTER 4	43
4. IMPACT OF THE IMPLEMENTATION OF THE PROPOSAL ON THE ENVIRONMENT	43
4.1 Beneficial Impacts	43

4.1.1	Construction Stage	43
4.1.2	Operation Stage	44
4.2	Adverse Impacts	45
4.2.1	Physical Environment	46
4.2.2	Biological Environment	50
4.2.3	Socio-economic and Cultural Environment	52
4.2.4	Chemical Environment	56
4.3	Enhancement issues	57
4.4	Other Issues raised by Public during IEE study	57
CHAPTER 5	58
5. ALTERNATIVE ANALYSIS	58
5.1	Alternative design and construction approach	58
5.2	Alternative Alignment (Route)	58
5.3	Time Schedule	59
5.4	Raw Materials (Resource) to be used	59
5.5	Others	60
CHAPTER 6	60
6. MEASURES TO REDUCE OR CONTROL THE IMPACT OF IMPLEMENTATION OF PROPOSAL ON THE ENVIRONMENT	60
6.1	Benefit Augmentation Measures	60
6.1.1	Construction Stage	61
6.1.2	Operation Stage	62
6.2	Adverse Impacts Mitigation Measures	62
6.2.1	Physical Environment	71
6.2.2	Biological Environment	74
6.2.3	Socio-economic and Cultural Environment	78
6.2.4	Chemical Environment	79
6.3	Issues raised by Public	80
CHAPTER 7	80
7. MATTERS TO BE MONITORED WHILE IMPLEMENTING THE PROPOSAL/ENVIRONMENTAL MANAGEMENT PLAN (EMP)	80
7.1	Environmental Management Roles and Responsibility	81
7.2	Site Supervision, Monitoring and Reporting	83
7.2.1	Pre-construction Stage	83
7.2.2	Construction Stage	84
7.2.3	Post-Construction Stage	84
7.2.4	Operation and Maintenance Stage	85
7.3	Project Organization	85
7.4	Monitoring and Evaluation	85
7.5	Organization of Environmental Management	106
7.6	Cost for Executing the Environmental Management Plan	106
7.7	Items to be included in Bid Document	107
7.8	Cost for MoPIT, GESU Compliance Level Monitoring	108
CHAPTER 8	108
8. CONCLUSION AND RECOMMENDATION	108
8.1	Conclusion	108
8.2	Recommendation	109
CHAPTER 9	109
9. REFERENCES	109



List of Tables

Table 2.1: Permissions / Clearances Required for the Project	14
Table 3.1: Salient Features of the Project Road	17
Table 3.2: Summary of Estimated Quantities of Materials	24
Table 3.3: Study Team Composition	29
Table 3.4: Land Use Pattern along the Road Corridor	32
Table 3.5: Probable Construction Materials Quarry Sites	35
Table 3.6: Community Forests (CF) Along Road Alignment	36
Table 3.7: Demographic features of the project districts	37
Table 3.8: Demographic description of Project Affected Municipality/VDCs	38
Table 3.9: Demographic information of Affected (sampled) Households	40
Table 3.10: Caste/Ethnic Composition of the affected Households	40
Table 3.11: Literacy Status of Affected Population	41
Table 3.12: Occupation of Affected Population	41
Table 3.13: Food Sufficiency Level	41
Table 3.14: Affected Vulnerable Households	42
Table 3.15: Average Annual Household Income	42
Table 4.1: Project Impacts on land	53
Table 4.2: Types of assets by loss and affected people	53
Table 6.1: Probable Materials Stockpiling Location along the Road	62
Table 6.2: Estimated Compensation Cost for Loss of Standing Crops	74
Table 6.3: Estimated Compensation Cost for Land Acquisition	74
Table 6.4: Relocation and Transportation Assistance	75
Table 7.1: Role and Responsibility for implementing the EMP	80
Table 7.2: Compliance Monitoring for Dhading-Arughat-Gorkha Road Upgrading Works	87
Table 7.3: Impact monitoring for the road Upgrading Works	89
Table 7.4: Environmental Management Plan (EMP) for Dhadingbesi-Arughat-Gorkha Road	91
Institutional Responsibility	91
Table 7.5: Environmental Safeguards Cost	106
Table 7.6: BoQ Related to Environmental Safeguard Managements	106
Table 7.7: Environmental Monitoring Cost	107

List of Figures

Figure 2.1: Environmental Clearance Procedure in Nepal	15
Figure 3.1: Location Map of the Project Road in Dhading and Gorkha Districts	20
Figure 3.2: Location Map of Road showing Project Influenced Area	21
Figure 3.3: Alignment Map of Dhadingbesi – Ankukhola Road Section	22
Figure 3.4: Seismicity map (1803-2006) of Nepal and its adjoining region in the Central Himalaya	30
Figure 3.5: Geological Map of Dhadingbesi-Gorkha Road (Source: DMG, 1984)	31
Figure 7.1: Environmental Management Organization Structure	86

List of Annexes

Annex 1:	Approved ToR
Annex 2:	Copy of Public Notice and Deeds of Public Enquiry (Muchulka)
Annex 3:	Recommendation Letters
Annex 4:	Minutes of Meeting
Annex 5:	Questionnaire Checklist
Annex 6:	Typical Cross Section of Road
Annex 7:	Baseline Data
Annex 8:	List of Trees
Annex 9:	Location Map – Quarries, Campsites, and Disposal Sites
Annex 10:	Photographs



धादिङ्गबेसी-आरुघाट-गोरखा सडक को प्रारम्भिक वातावरणीय परीक्षण प्रतिवेदन

कार्यकारी सारांश

प्रस्ताव/प्रस्तावक:

यो प्रारम्भिक वातावरणीय परीक्षण प्रतिवेदन धादिङ्ग जिल्ला, निल्कण्ठ नगरपालिकाको धादिङ्गबेसी बजार हुँदै गोरखा जिल्ला, गोरखा (पृथ्वी नारायण) नगरपालिकाको गोरखा बजार सम्म जोड्ने ७६.९० कि.मी. लामो धादिङ्गबेसी-आरुघाट-गोरखा सडक मध्ये ४९.३६१ कि.मि.सडक खण्ड स्तरोन्नति गरी सबै मौसममा (बर्षै भरी) चल्ने मुख्य सहायक सडक (Main Feeder Road) बनाउन तयार पारिएको हो । यस आयोजनाको प्रस्तावक आयोजना निर्देशनालय-एडीबी, सडक विभाग, भौतिक पूर्वाधार तथा यातायात मन्त्रालय हो। धादिङ्गबेसी-आरुघाट-गोरखा सडक स्तरोन्नति आयोजनाको प्रारम्भिक वातावरणीय परीक्षणको प्रस्तावक योजना तथा डिजाइन महाशाखा, मू-वातावरण तथा सामाजिक युनिट, सडक विभाग रहेको छ ।

पृष्ठभूमि:

भुकम्प आपतकालिन सहयोग आयोजना (EEAP) एशियाली विकास बैङ्कको आर्थिक अनुदान सहयोगमा संचालित कार्यक्रम हो । यस आयोजनाको मुख्य उद्देश्य २०७२/१/१२ गते गोरखा केन्द्र विन्दु भएर गएको महा-भुकम्प बाट क्षति ग्रस्त सडक संरचना पुनर्निर्माण तथा पुनर्स्थापना साथै स्तरोन्नति गर्नु, आर्थिक र रोजगारीको अवसरलाई वृद्धि गर्नु, ग्रामिण क्षेत्रमा बजार तथा सामाजिक सेवाको पहुँचमा वृद्धि गर्नु रहेको छ ।

प्रारम्भिक वातावरणीय परीक्षणको उद्देश्य:

यस प्रारम्भिक वातावरणीय परीक्षणको मुख्य उद्देश्य प्रस्तावित आयोजनाको कार्यान्वयनबाट आयोजना क्षेत्रको भौतिक, जैविक, सामाजिक-आर्थिक तथा साँस्कृतिक वातावरणमा पर्ने सक्नेसकारात्मक तथा नकारात्मक प्रभावहरूको अध्ययन गरी सकारात्मक प्रभावको बढोत्तरी तथा नकारात्मक प्रभावहरूलाई न्यूनीकरण गर्ने उपायहरू प्रस्ताव गर्नु हो । यो अध्ययन प्रतिवेदन वातावरण संरक्षण ऐन, २०५३ (EPA, 1997) तथा वातावरण संरक्षण नियमावली, २०५४ (EPR, 1997) (संशोधित २०६४) को प्रावधान अनुसार तथा भौतिक पूर्वाधार तथा यातायात मन्त्रालयबाट वि.सं. २०७०/०३/२३ मा स्वीकृत गरिएको यसै प्रस्तावको कार्यसूची (Terms of Reference) मा उल्लेख गरिएको अध्ययन पद्धतिको अनुसरण गरी तयार पारिएको छ।

प्रारम्भिक वातावरणीय परीक्षण अध्ययनको अन्य उद्देश्यहरू निम्नानुसार छन् :

- आयोजना क्षेत्रमा गरिने विभिन्न निर्माण कार्यहरूले गर्दा भौतिक, जैविक, सामाजिक-आर्थिक तथा साँस्कृतिक वातावरणमा पर्ने मुख्य असरहरू पत्ता लगाउनु ।
- वातावरणमा पर्ने नकारात्मक प्रभावको न्यूनीकरणका उपायहरू र सकारात्मक प्रभाव बढाउने उपायहरू बारे सुझाव दिनुका साथै वातावरणीय अनुगमन योजना बनाई कार्यान्वयन गराउनु ।

- प्रस्तावित सडक आयोजनाको लागि प्रारम्भिक वातावरणीय परीक्षण गरे पुग्छ भन्ने कुराको यकिन गर्न ।

आयोजनाको विवरण:

प्रस्तावित धादिङ्गबेसी-आरुघाट-गोरखा सडक स्तरोन्नति आयोजना नेपालको मध्यमाञ्चल विकास क्षेत्रको बागमती अञ्चल, धादिङ्ग जिल्ला र पश्चिमाञ्चल क्षेत्र, गण्डकी अञ्चल अन्तर्गत गोरखा जिल्लामा पर्दछ । यो सडक खण्ड धादिङ्ग जिल्लाको निल्कण्ठ नगरपालिका अन्तर्गत धादिङ्गबेसी (पुछार बजार) हुँदै गोरखा (पृथ्वी नारायण) नगरपालिका को गोरखा बजारमा गएर टुङ्गिन्छ ।

प्रस्तावित सडक, सडक विभागको निर्देशिका अनुसार मुख्य सहायक सडक (Main Feeder Road) अन्तर्गत वर्गीकृत गरिएको छ । जसलाई हालको ग्राभेल/ottaseal सडक बाट विटुमिन (कालोपत्र)- DBST (सबै मौसममा चल्ने) मा स्तरोन्नति गर्न प्रस्ताव गरिएको छ । यस आयोजना अन्तर्गत कुल ४९.३६१ कि.मि. सडक फराकिलो तथा मजबुत पार्ने, पुलेसाहरु फेर्ने, पहिरोग्रस्त क्षेत्र सुघार्ने कार्यहरु पर्छन् । यस आयोजनाको कार्यक्षेत्र अन्तर्गत धादिङ्गबेसी-आरुघाट-गोरखा सडक लाई दुइ खण्डमा विभाजित गरिएको छ । पहिलो खण्ड धादिङ्गबेसी-आँखुखोला (००+०००-२६+७७४) र दोश्रो खण्ड ध्याम्पेसाल-गोरखा (२४+३००-७६+८८७) सडकखण्ड रहेको छ । आँखुखोला (२६+७७४) देखि ध्याम्पेसाल (२४+३००) सडक खण्ड मध्यपहाडी लोकमार्ग अन्तर्गत निर्माण भईरहेको छ । वर्तमान भुकम्प आपतकालिन सहयोग आयोजनाको कार्यक्षेत्र अन्तर्गत सडक खण्डको कूल लम्बाई ४९.३६१ कि.मी. हुनेछ ।

यस आयोजनाको कूल लागत करीब नेरु १४५४,१३९,१२२.०० र प्रति कि.मी. नेरु.२९,४५९,८६८.७६ रहने अनुमान गरिएको छ । आयोजना को निर्माण कार्य सन् २०१६ भित्र शुरु भई दुई (२) वर्षका लागि जारी रहने अपेक्षा गरिएको छ ।

विद्यमान स्थिति:

भौगोलिक रूपमा प्रस्तावित धादिङ्गबेसी-आरुघाट-गोरखा सडक आयोजना मध्य पहाडी खण्डमा अवस्थित छ । यो प्रस्तावित सडक धादिङ्ग जिल्लाको निल्कण्ठ नगरपालिकाको धादिङ्गबेसी (पुछार बजार) मा समुद्री सतह देखि ५७१.५० मी. को उचाईबाट शुरु भएर गोरखा (पृथ्वी नारायण) नगरपालिका को गोरखा बजार (हरमटारी चोक) मा समुद्री सतहदेखि १०२०.०० मी. उचाइमा गएर टुङ्गिन्छ । धादिङ्गबेसी बजार, गोलाभञ्ज्याङ्ग, शिखर बजार ज्यामिरे, तारीबेसी, सल्यानटार, आरुघाट र गोरखा बजार यस क्षेत्रका मुख्य बजारहरु हुन ।

प्रस्तावित सडक खण्ड उपोष्ण जलवायु भएको क्षेत्रमा रहेको छ । आयोजना क्षेत्रको तापक्रम अधिकतम र न्यूनतम क्रमश ३६ र ५ डिग्री सेल्सियस रहेको छ भने औसत वार्षिक वर्षा १,६०० मी.मी. रहेको छ । यस सडक खण्डमा विभिन्न प्रकारका चट्टानहरु जस्तै क्वार्टजाइट, फिलाइट, सिष्ट पाईन्छन् । एलुभियल, कोलुभियल तथा रेजीड्यूल प्रकारका माटोहरु यससडक खण्डमा पाईन्छन् । सडक खण्डमा पानीका मुख्य स्रोतहरुमा विभिन्न खहरे खोला सहित अन्य पानीका मुलस्रोतका रूपमा रहेका छन् । प्रस्तावित सडक क्षेत्रको वायु तथा पानी को गुणस्तर सफा नै रहेको देखिन्छ ।

साथै ध्वनि प्रदूषणको खास समस्या छैन। प्रस्तावित सडकको छेउछाउको भू-उपयोगमा बस्ति क्षेत्र/खेतियोग्य जमिन (५८.५०%), वन क्षेत्र (१८%), खेति योग्य तथा बाँझो जमिन (१४.५०%), तथा बस्ति क्षेत्र र बजार (९%) रहेको छ। यस आयोजना अन्तर्गतको सडकखण्डमा तिन (३) वटा सामान्य प्रकृतीका पहिरोहरु (चेनेजहरु १३+७२०, ५५+०३० र ६४+१४०) पर्दछन्।

यस धादिङ्गवेसी-आरुघाट-गोरखा सडक खण्डमा पर्ने मुख्य दुइ नदीहरुमा आँखु खोला (२६+७७५) र बुढीगण्डकी (३७+७००) छन्। यस सडकखण्डमा ३४ सिँचाइका पाईपहरु पर्दछन्। वर्तमान आयोजनाको स्तरोन्नति कार्य अन्तर्गत २ वटा स्ल्याब कल्भर्ट, १८३ पाईप कल्भर्टहरु, १ कजवे (causeway) हरू बनाइने छन्।

यो सडक खण्डमा अमरावती, सल्लाघारी लहरेपाखा, पटेला, बेतिनि देउराली, जलजला, भदौरे, बगैँचा, पाले, सातले टापु, सत्यदेवी ठुलोखोला र भोगटेनी च्यान्डाँडा गरी ११ सामुदायिक वनहरु पर्दछन्। यस सडक खण्डको प्रभावित क्षेत्रमा पाइने रुखहरुको प्रजातिहरुमा चिलाउने, कटुस, उत्तीस, साल, सिसौ तथा गैह्र काष्ठ वन पैदावारमा अमला, कुरिलो, असुरा, धसिगरे पर्दछन्। स्याल, दुम्सी, जंगली विरालो, बाँदर वन्य जन्तुका साथै कोइली, परेवा, काग, भँगेरा, जुरेली पक्षीहरु यस सडक खण्डका वनहरुमा पाइन्छन्। यो सडक कुनै संरक्षित वा मध्यवर्ती क्षेत्रमा पर्दैन।

यो सडक खण्डको प्रभावित क्षेत्र भित्र धादिङ्ग जिल्लाको निल्कण्ठ नगरपालिका र ज्याम्रुंग गा.वि.स. र गोरखा जिल्लाका आसरांग, बगुवा र ताप्ले गा.वि.स.हरु र गोरखा नगरपालिका पर्दछन्। यहाँ जम्मा घरधुरी संख्या २४,३८५ वटा र जनसंख्या ९५,७०५ रहेको छ र सरदर परिवार संख्या ३.९२ छ। यहाँ बसोबास गर्ने विभिन्न जात जातिका मानिसहरुमा मुख्य गरी तामाङ्ग (१६.८०%), क्षेत्री (१६.३९%), ब्राह्मण (१५.३४%), नेवार (१४.०४%), मगर (१२.८९%), र गुरुङ्ग (१०.३६%) जातिहरु पर्दछन्। दलितहरुमा दमै, कामी, कुमाल, सार्की जातिको बसोबास उल्लेख्य छ।

यहाँका बासिन्दाहरुको मुख्य पेसा कृषि, पशुपालन (२३.५९%) हो। यातायातको असुविधाले गर्दा तथा पहाडी क्षेत्र भएकोले कृषि उब्जनीले मात्र जीवन निर्वाहका लागि पर्याप्त नहुने हुँदा यहाँका अधिकांश मानिसहरु अन्य पेशामा मजदुरी तथा भरियाको रुपमा काम गर्ने (७.६०%), केहि मानिसहरु सरकारी तथा अन्य संस्थामा काम गर्ने (५.४२%), थोरै मानिसहरुले (१०.११%) व्यापार व्यवसाय गर्ने गर्दछन्। साथै जनसंख्याको उल्लेखनीय प्रतिशत मानिसहरु खेतीपातीको काम नहुने समयमा काठमाडौँ तथा भारतका विभिन्न ठाउँमा रोजगारीको लागि जाने गर्दछन् जुन जीविकोपार्जनको मुख्य आधार हो।

प्रस्तावको सान्दर्भिकता तथा अध्ययन प्रकृया:

यो प्रारम्भिक वातावरणीय परीक्षण प्रतिवेदन भौतिक पूर्वाधार तथा यातायात मन्त्रालयबाट वि.सं. २०७०/०३/२३ मा सचिव स्तरको निर्णयबाट स्वीकृत गरिएको कार्यसूची अनुसार तयार पारिएको हो। यस सन्दर्भमा नेपाल सरकारको वातावरण संरक्षण ऐन, २०५३ तथा वातावरण संरक्षण नियमावली २०५४ (पछिल्लो संशोधन २०५५) को नियम ३ सँग सम्बन्धित अनुसूची १(ई)(६) ले आकृष्ट गरे बमोजिम मुख्य सहायक सडक अथवा राष्ट्रिय राजमार्गहरु स्तरोन्नती कार्य गर्ने सँग सम्बन्धित

भएकोले प्रस्तावको प्रारम्भिक वातावरणीय परीक्षण कार्य गर्नु आवश्यक भएकोले सो बमोजिमको यो प्रतिवेदन तयार गरीएको हो।

जनवरी २०१६ (पुष/माघ २०७२) मा फिल्ड सर्वेक्षणबाट लिइएका तथ्याङ्क तथा अन्य उपलब्ध तथ्याङ्कहरूको सांख्यिकीय तथा प्राविधिक टोलीबाट पुनर्वास कार्यको समीक्षणको लागि संकलन गरेका तथ्याङ्कहरू केलाएर प्रारम्भिक वातावरणीय परीक्षण प्रतिवेदन तयार गरी निष्कर्ष तथा सुझावहरू दिइएका छन्। सार्वजनिक छलफल प्रभावित नगरपालिका र गा.वि.स.का बस्तीहरूमा स्थानिय नेता, स्थानिय व्यक्ति, सामुदायिक वन उपभोक्ता समुह, शिक्षकहरू आदि संग गरिएको थियो।

सकारात्मक प्रभावहरू:

यातायातको सुविधाले स्थानिय बासिन्दाहरूको जीवनमा थुप्रै सकारात्मक प्रभाव पर्दछन्। सडक स्तरोन्नति निर्माण कार्य गर्दा स्थानीय बासिन्दाहरूले श्रमिकको रूपमा रोजगारीका (करिब ४५,५०० दक्ष श्रमिक दिन र १८७,४०० अदक्ष श्रमिक दिन) अवसरहरू प्राप्त गर्ने र प्राविधिक सीप तथा ज्ञान समेत प्राप्त गर्ने छन्।

सडक निर्माण भई संचालनको अवस्थामा त्यस क्षेत्रमा खाद्यान्नको आपूर्ति सुचारु हुन गई आर्थिक तथा सामाजिक स्थिरता बढ्न जानेछ। साथै सडक यातायातले गर्दा ग्रामीण भेगबाट बजार क्षेत्र र बजार क्षेत्रबाट ग्रामीण भेगमा सेवा तथा सामानहरूको ओसार पसार छिटो, छरितो, सुलभ तथा सस्तो हुन जानेछ। बजारमा पहुँच भएको कारण कृषि उत्पादन बढाउन कृषकहरू उत्साही हुनेछन्। यसले गर्दा उत्पादकत्वमा वृद्धि भई अन्ततोगत्वा ग्रामीण भेगका बासिन्दाको जीवनस्तरमा सुधार हुन जाने छ। स्तरोन्नति भएको सडक संचालन हुँदा व्यापार व्यवसायमा वृद्धि हुन जानेछ। सडक स्तरोन्नति भई संचालनको अवस्थामा त्यस क्षेत्रमा पर्यटकको संख्या वृद्धि हुन जाने संभावना छ। त्यस क्षेत्रमा बजार लगायतका वस्तीमा व्यापार क्षेत्रको विकास भई यहाँका बासिन्दाहरूको जीवन स्तरमा सुधार हुन जानेछ। बजार क्षेत्रको विकासले गर्दा जग्गाको मूल्यमा समेत वृद्धि हुन जानेछ।

नकारात्मक प्रभावहरू:

सडक स्तरोन्नति/पुनर्निर्माण कार्य गर्दा भौतिक वातावरणमा पर्ने नकारात्मक प्रभावहरूमा भू-स्वामित्वको प्रयोगमा बदलाव, भिरालो जग्गामा पहिरो जाने, वायु तथा पानीमा प्रदुषण, खनेको माटो फालिँदा पर्ने प्रभावहरू मुख्य छन्। यस्तै प्रकार जैविक प्रभाव अन्तर्गत विभिन्न जातका गरी करिब ६११ वटा रुखहरू स्थानीय ११ सामुदायिक वनक्षेत्र बाट काटिन सक्दछ। आर्थिक तथा सामाजिक प्रभाव अन्तर्गत सडक स्तरोन्नति/पुनर्निर्माण गर्दा कुल ७६० घरघुरिका ४०२८ जनसंख्या प्रभावित हुन जानेछन् तथा ७ घरघुरिको ८ वटा निजी संरचना (३ वटा घर, ५ वटा घर/पसल) लाई हटाउनु पर्ने हुन्छ। यसका साथै श्रमिक तथा अन्य बासिन्दा हरूका स्वास्थ्यमा सडक निर्माण हुँदा प्रतिकुल असर पर्न जानेछ। प्रस्तावित सडक खण्ड स्तरोन्नती गर्दा करिब २०.७६ हेक्टर जग्गा (१६.०१ हेक्टर निजी जमीन तथा ४.७५ हेक्टर सरकारी जग्गा) अधिग्रहण गर्नुपर्ने देखिन्छ भने बाँकी जमिनहरू करिब ४.४० हे. वनक्षेत्र पर्दछ। १६.०१ हेक्टर निजी जमीन मध्ये ९.५१ हे. खेती गरिने

सुरक्षाका साधनहरू (सेफ्टी हेलमेट, मास्क, ईयर मफल्स) दिइने छ र कामदारको लागि खानेपानी को आपूर्ति तथा अस्थाई खाल्टे चर्पी हरु बनाइने छन्। साथै पानीको श्रोतहरू मा खनिएको माटो फालिने छैन। कामदारहरूको लागि औषधी तथा दुर्घटना बीमाको व्यवस्था गरिएको छ।

सडक संचालनको अवस्थामा साना साना पहिरो तथा भाटोका खसेका हिस्काहरूलाई तुरुन्तै उचित प्रविधिबाट सफा गरिने छ। सामुदायिक वन उपभोक्ता समूहहरू लाई वनको कार्ययोजना अनुसार संरक्षण र व्यवस्थापन गर्न सघाउ पुर्याइने छ। झडभरहरू लाई सचेत गराउन वन, स्कूल र आवास क्षेत्रमा हर्न बजाउन निषेध गरिएका साइनबोर्डहरू राखिने छन्। व्यवस्थित बस्ती विकासको लागि जनचेतना जगाउने कार्यक्रम संचालन गरिनेछन्। साथै संभावित दुर्घटना बाट जोगाउन उपयुक्त सडक सुरक्षाका उपायहरू अवलम्बन गरिनेछन्।

वर्तमान आयोजना अन्तर्गत सडक स्तरोन्नति/पुननिर्माण कार्य अन्तर्गत २ वटा स्ल्याब कल्भर्ट, १८३ पाईप कल्भर्टहरू, १ कजवे (causeway) र ३४ सिँचाइका पाईपहरू हरु को स्तरोन्नति कार्य गरिने छन्।

वातावरणीय व्यवस्थापन योजना (Environmental Management Plan)

यस प्रतिवेदनमा वातावरण व्यवस्थापन योजना अन्तर्गत आयोजनाबाट पर्ने संभावित असरहरू, असरहरूको प्रभाव, न्यूनीकरण विधि, अनुगमन विधी तथा कार्यतालिका प्रस्तावित गरिएको छ। यसका साथै न्यूनीकरणका उपायहरूको तथा अनुगमन कार्यको कार्यान्वयन गर्ने जिम्मेवार निकायहरूको पनि पहिचान गरिएको छ। अनुगमनका लागि आवश्यक भौतिक, जैविक, सामाजिक-आर्थिक तथा साँस्कृतिक वातावरणका विभिन्न अनुगमन सुचकाङ्कहरूको पनि पहिचान गरिएको छ। करिब १४९ करोड रुपैया (भ्याट र मैपरी आउने खर्च समेत गरी) लागत भएको यस स्तरोन्नती आयोजनाको वातावरणीय प्रभाव न्यूनीकरणका लागी करिब २ करोड ११ लाख ३७ हजार ९ सय ९२ रुपैया वातावरणीय व्यवस्थापन योजना कार्यान्वयन गर्न निम्नानुसार खर्च हुने अनुमान गरिएको छ।

क्र.सं.	विवरण	रकम (ने.रु.)	कैफियत
१.	वातावरण सम्बन्धी जनचेतनामूलक तालिम तथा अन्य तालिमहरू	१००,०००/-	आयोजनाको बजेटमा समावेश गरिने।
२.	श्रमिकहरूको विमा	१,३०४,०००/-	BoQ मा समावेश गरिने।
३.	बायो-इन्जिनियरिङ्ग	८,५१७,५६३/-	
५.	पुननिर्माण तथा अन्य (खानेपानीको पाइप, विजुलीको पोलहरू, सार्वजनिक धारा)	५४,५०,०००/-	BoQ मा समावेश गरिने।
६.	क्षतिपूर्ति वृक्षारोपण	१५,९६,२८५/-	आयोजनाको बजेटमा समावेश गरिने।
७.	पेशागत स्वास्थ्य सुरक्षा तथा जानकारीमूलक सूचनापाटी	३,१२०,१४४/-	BoQ मा समावेश गरिने।
८.	अनुगमन तथा मुल्यांकन	६५०,०००/-	आयोजनाको बजेटमा समावेश गरिने।
	जम्मा :	२,११,३७,९९२/-	

जमीन र ६.५ हे. बाँझो जग्गा पर्दछन् । यसबाट करिब २६१२२ के.जि. कृषि उब्जाँनी नोक्सानी हुन सक्दछ।

सडक संचालनको दौरान भौतिक वातावरणमा पर्ने नकारात्मक असरहरूमा भिरालोपनको स्थायित्व र यसको व्यवस्थापन, वायु तथा ध्वनि प्रदूषण तथा सडक सुरक्षाका समस्याहरू पर्दछन् । यसै प्रकार जैविक प्रभावमा वन्यश्रोत घट्नु, वन्यजन्तुहरूलाई अप्ठेरो पर्ने हुन् भने सामाजिक तथा आर्थिक प्रभावहरूमा नयाँ वस्ती र बजारको अव्यवस्थित विस्तार, सामाजिक व्यवहारमा परिवर्तन हुनु आदि पर्दछन् ।

सकारात्मक प्रभाव बढाउने तथा नकारात्मक प्रभाव न्यूनिकरणका उपायहरू

यस सडकको निर्माणबाट सकारात्मक तथा नकारात्मक दुवै प्रकारका प्रभावहरू पर्ने देखिन्छन् । सकारात्मक प्रभावबढाउने उपायहरू तथा नकारात्मक प्रभाव न्यूनिकरण गर्ने उपायहरूको प्रभावकारी कार्यान्वयनले गर्दा सकारात्मक प्रभाव बढ्न जानुका साथै नकारात्मक प्रभाव न्यून गर्न सकिने वा हटाउन सकिने छन्। प्रभावहरूको आकलनको आधारमा सडक निर्माण तथा संचालन दुवै चरणमा सकारात्मक प्रभाव बढ्ने उपाय र नकारात्मक प्रभाव घटाउने उपायहरू उल्लेख गरिएका छन् ।

सकारात्मक प्रभाव बढाउने उपायहरू

कामदार तथा प्रभावित क्षेत्रका बासिन्दाहरूको जीविकोपार्जन सुधार गर्नको लागि विभिन्न शीपमूलक तालिमहरू (आय आर्जन, इन्जिनियरिंग संरचनाको निर्माण तथा जैविक प्रविधिका कामहरू सम्बन्धी) दिइने छन् । साथै बजार क्षेत्रमा नालि निर्माण तथा अन्य आधारभूत सुविधा हरूको विस्तारको लागि सहयोग गरिने छ । सडक निर्माणका क्रममा महिला सहभागिता गराइने कार्यमा जोड दिइने छ।

नकारात्मक प्रभाव न्यूनिकरणका उपायहरू

श्रममा आधारित, वातावरणीय मैत्री तथा सहभागीता मूलक अवधारणा को अवलम्बन गरी वातावरणमा पर्ने प्रभावहरूको न्यूनिकरण गरिने छ । यस अनुरूप खन्ने र पुर्ने भाटोको आयतनमा सन्तुलन मिलाउनु को साथै खनीएका बस्तुहरूको पुनः प्रयोग तथा जैविक प्रविधि (वायो इन्जिनियरिंग) को प्रयोग गरिने छ । भिरालो जग्गाको व्यवस्थापनको लागि पर्याप्त प्रावधानहरू सडक आयोजनाको डिजाईनमा राखिने छन् । खानी संचालन (Quarries Operation) अस्थिर (कमजोर) क्षेत्रहरू, भूक्षय हुने क्षेत्रहरू, वन, बस्तीहरू तथा उर्वरा जमीनमा गरिने छैन।

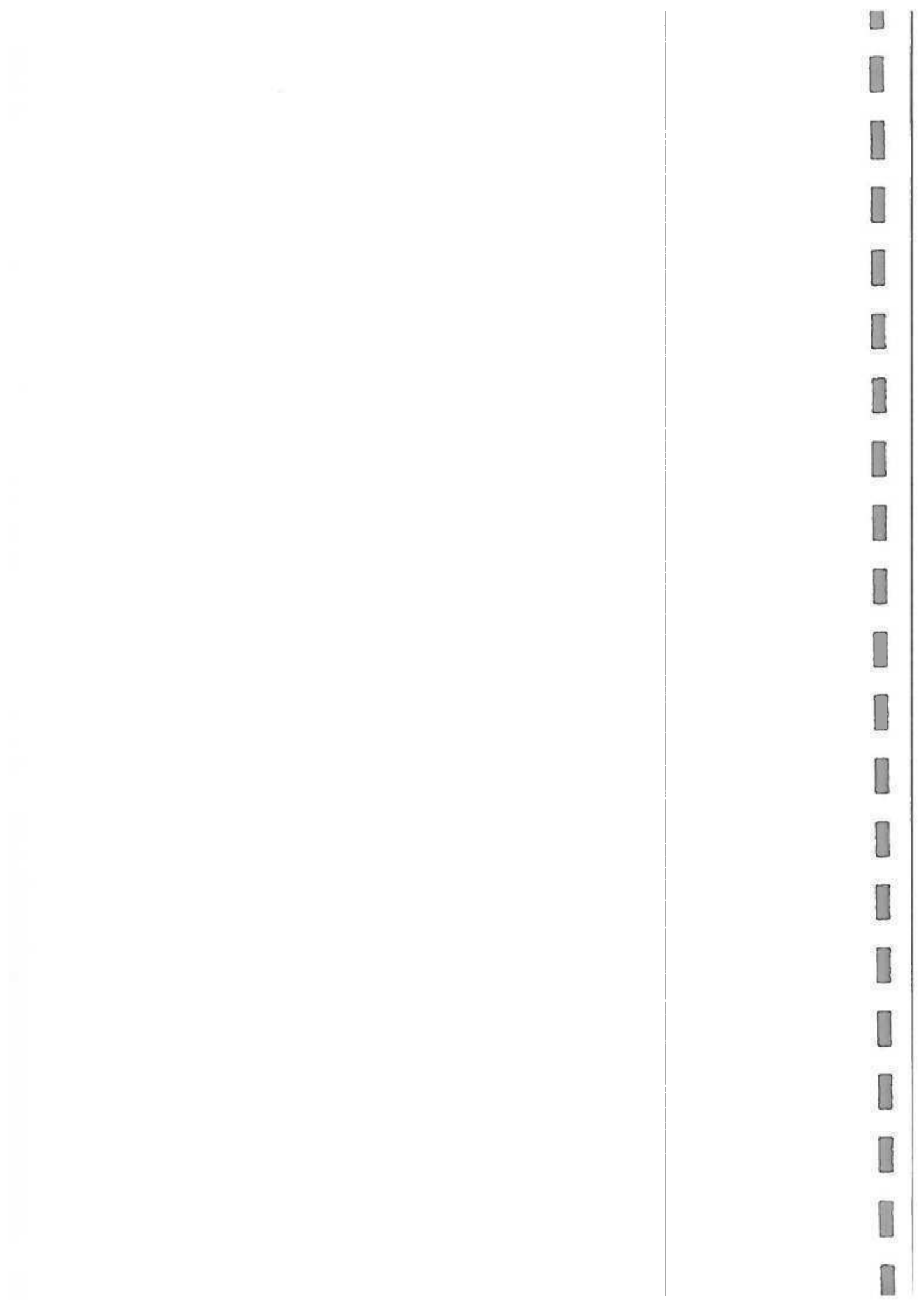
स्थानीय बासिन्दालाई आफ्नो निजी जग्गामा वृक्षारोपण गराउन प्रोत्साहन गराइने छ । यसै प्रकार, सामुदायिक वनहरू लाई १६,८०३ रुखहरू (अनुमानित लागत नेरु १,५९६,२८५.००) वृक्षारोपण गर्न गराउन सहयोग दिइनेछ जसले गर्दा रुखहरूको क्षती लाई परिपूर्ति गर्न सकिने छ ।

वन्य जन्तु र चराहरूलाई कम्प. मात्रामा अवरोध होस भन्नाको लागि वनको छेउछाउमा निर्माण कार्य गर्दाव्यवस्थित तरिकाले गरिने छ । सडकमा परेको जग्गा तथा अन्य संरचना, सम्पतीको प्राप्ती तथा क्षतिपूर्ति सम्बन्धि कुराहरू लाई समेट्न छुट्टै पुनर्वास योजना (Resettlement Plan) बनाइएको छ । जस अनुरूप घर तथा जग्गा अधिग्रहणका लागि करिब २१ करोड ४ लाख ९८ हजार ४ सय २० रुपैयाँ रकमको व्यवस्था आयोजनाबाट गरिएको छ। कामदारहरू लाई कामको प्रकृति अनुसार

निष्कर्ष तथा सुभावहरू :

प्रस्तावित धादिङ्गबेसी-आरुघाट-गोरखा सडक खण्डको स्तरोन्नती कार्यको प्रारम्भिक वातावरणीय परीक्षण प्रतिवेदनले सकारात्मक प्रभावहरू नकारात्मक प्रभावहरूको तुलनामा वढी महत्वपूर्ण रहेको र लामो समयसम्म रहने र नकारात्मक प्रभावहरू न्यूनीकरण गर्न सकिने कुरा देखाउँछ, । साथै सार्वजनिक छलफलमा उठेका सान्दीभिक सुभावहरू लाई प्रतिवेदनमा समेटिएको छ । यो सडक आयोजनाको स्वीकृतिको लागि प्रारम्भिक वातावरणीय परीक्षण पर्याप्त रहेको छ । यस अध्ययन अतिरिक्त वातावरणीय प्रभाव मूल्याङ्कन (EIA) अध्ययन गर्न नपर्ने निष्कर्ष छ। प्रभावहरूको न्यूनीकरण र संलग्न वातावरणीय अनुगमन योजना (Environmental Monitoring Plan) कार्यान्वयन गरी प्रस्तावित आयोजना कार्यान्वयनको लागि सिफारिस गरिन्छ।





Initial Environmental Examination Report of Dhadingbesi – Arughat – Gorkha Road Upgrading Project

Executive Summary

Proponent

This IEE Report has been prepared for the upgrading/improvement of 49.361 km road section of 76.90 km long Dhadingbesi-Arughat-Gorkha fair weather main feeder road connecting Dhadingbesi Bazaar of Nilkantha municipality of Dhading district with Gorkha Bazaar of Gorkha municipality in Gorkha district. The proponent of project is ADB Project Directorate, Department of Roads, Ministry of Physical Infrastructure and Transport (MoPIT).

The Proponent of this Initial Environmental Examination is the Planning and Design Branch, Geo Environment and Social Unit, Department of Roads.

Name of the Proposal is 'Initial Environmental Examination of Dhadingbesi - Arughat - Gorkha Road Upgrading Works' in Dhading and Gorkha Districts in Central and Western Development Region of Nepal. The objective of the Proposal is to widen and upgrade the Dhadingbesi - Arughat - Gorkha Road from existing single lane to intermediate lane bituminous paved standard under the Earthquake Emergency Assistance Project (EEAP) to restore critical public and social infrastructure and services with strengthened resiliency.

Background

Earthquake Emergency Assistance Project (EEAP) is a program to be implemented under the financial loan/grant of Asian Development Bank (ADB). The main objective of EEAP is to reconstruct and rehabilitate road infrastructures damaged by the Gorkha Earthquake of April 29 2015 having epicenter at Gorkha, increase economic and employment opportunity, enhance access to social services facility and market in rural area.

Proposed road section passes through major settlements such as Dhadingbesi Bazaar, Muralibhanjyang, Shikhar Bazaar Jyamire, Thumki, Gola Bhanjyang, Taribesi, Salyantar, Arughat, Ghyampesal, Kokhe, Ahale, Jhingate, Khanchok etc. and some scattered settlements, vacant plots, cultivated land, forest area and grazing fields.

The Department of Roads (DoR) intends to improve this Dhadingbesi - Arughat - Gorkha road to an all-weather bituminous intermediate-lane Feeder Road Standard.

Objectives of IEE

The main objective of the IEE study is to identify the impacts of physical, biological, socioeconomic and cultural environment of the Project area. The specific objectives of the proposed IEE study include to:

- identify the major issues that may arise as a result of proposed works on physical, biological, socio-economic and cultural environment of the project area,
- recommend practical and site specific environmental mitigation and enhancement measures,
- prepare an environmental monitoring plan for the Project, and
- make sure that IEE is sufficient or not for environmental requirement to implement for the proposed road Project.

Project Description

Proposed Dhadingbesi – Arughat – Gorkha Road upgrading project is located in Dhading district, in Bagmati Zone of Central Development Region and Gorkha district in Gandaki Zone of Western Development Region. The Road originates from Dhadingbesi (Puchhar Bazaar) of Nilkantha municipality of Dhading district and ends at Gorkha Bazaar in Gorkha (Prithvi Narayan) municipality of Gorkha district.

This road has been classified as main feeder road as per DoR Standard. The proposal is for improvement/upgrading of existing Dhadingbesi – Arughat – Gorkha fair-weather road to all weather bituminous intermediate lane feeder road. Under the EEAP, a total of 49.361 km of road section will be widened/rehabilitated and minor cross drainages structures will be replaced, landslide protection works will be carried out. The upgrading work will be limited to existing 4.5-5 m width.

Under the scope of EEAP, the road has been divided into two sections, namely: Dhadingbesi – Ankhu Khola Section (km 00+000 to km 26+774) and Ghyampesal - Gorkha Section (km 54+300 to km 76+887) Section. The middle section from Ankhu Khola to Ghympesal section (km 26+774 to km 54+300) falls on Mid Hill Highway alignment and is under construction as a high priority project of GoN. Under the present project scope, total length of road section is 49.361 km.

Total estimated project cost is NRs. 1454,139,122.00 (including VAT) and per kilometer cost is NRs.29,459,868.76. The construction work is expected to begin in 2016. A 24 month construction period is estimated.

Existing Condition

The Dhadingbesi – Arughat - Gorkha road is located in the mid-hills of the western Nepal. The road originates at Dhadingbesi (Puchhar Bazaar) in Nilkantha municipality at an elevation of 571.50 m amsl and ends at Gorkha Bazaar (Haramtari chok) in Gorkha (Prithvi Narayan) municipality at an elevation of 1020.00 m amsl. Dhadingbesi Bazaar, Gola Bhanjyang, Shikhar Bazaar Jyamire, Taribesi, Salyantar, Arughat and Gorkha Bazaar are major market centers.

Proposed road section lies in the sub-tropical and temperate climatic region. The Project area has average minimum temperature of 5°C and average maximum temperature of 36°C and total average annual rainfall of 1,600 mm. The road section comprises of different types of rocks like, quartzites, phylites and schists. In general, soil type along the road can be classified as alluvial, colluvial and residual. Ambient air and water quality in the proposed project area is found to be good and there is also no noise pollution.

The land use patterns include settlements/bazaar (9%), cultivated land and forests (14.50%), forest (18%), settlement/cultivated land (58.50%) including river, stream & rivulet channels. There are about 3 slides (km 13+720, km 55+030 and km 64+140) along the road alignment.

The road alignment crosses Ankhu Khola at km 26+775 and Budhigandaki River at km 37+700. There are a number of small crossings where small cross drainage structures are provided. There are thirty four (34) irrigation pipe crossings along the road alignment. Under

the present project scope, 2 slab culverts, 183 pipe culverts (900 mm dia.) and 1 causeway will be provided. There are eleven (11) community forests namely; Amarawati, Sallaghari, laharepakha, Patela, Betini, Deurali, Jaljala, Bhadaure, Bagaincha, Pale, Saattale Tapu, Satyadevi Thulokhola and Bhogateni Chyandanda community forest) along the proposed road alignment. The dominant forest and fodder species reported in the project affected area are *Schima wallichii* (Chilaune), *Castanopsis indica* (Katus), *Shorea robusta* (Sal), *Alnus nepalensis* (Uttis), *Dalbergia sissoo* (Sisau) etc. Major NTFP species found in the subproject area are *Amala* (*Emblia officinalis*), *Chutro* (*Berberis aristata*), *Swertia Chirayita* (Chiraito), *Koiralo* (*Bahunia variegata*), *Timur* (*Zanthoxylum armatum*), *Ghodtapre* (*Centella asiatica*) and *Bojho* (*Acorus calamus*) and *Majitho* (*Rubia manjith*).

Some notable species reported in the subproject area are Jackal (*Canis aureus*), Malsanpro (*Martes flavigula*), Monkey (*Macacca mulatta*), Fox (*Vulpes vulpes*), Dumsi (*Hystrix indica*), Lokharke (*Funambulus sp.*). However, none of these wild lives are endangered species. Bird species found in the Project area are Crow (*Corvus splendus*), Jureli (*Pycnonotus cafer*), Koili (*Cuculus micropterus*), Dhukur (*Streptopelia spp.*), Bhangera (*Passer domesticus*), Pigeon (*Columba livia*) etc. Fish habitat is limited to ankhukhola, Budhi Gandaki River and nearby Stul Khola. Most common species of fish are Kalle (*Accrocheilus spp.*), Buduna (*Garra annandalei*) and Asala (*Schizothorax plagiostomus*). The project area does not contain any national park, wildlife reserve, conservation area, hunting area, including buffer zone area, world heritage site and other protected areas.

The project affected municipalities and VDCs of the proposed road consists of two municipalities and four affected VDCs falling within its alignment viz. Nilkantha Municipality, Jyamrung VDC of Dhading district, and Baguwa, Asrang, Taple VDCs and Gorkha Municipality of Gorkha district. According to 2011 census, total population of two municipalities and four VDCs touched and traversed by the proposed upgrading road section is estimated at 95705 from 24385 households with average HH size of 3.92. Though varieties of Caste and Ethnic groups reside in subproject area, the Tamang (16.8%), Chhetree (16.39%), Brahmin Hill (15.34%), Newar (14.04%), Magar (12.89%) and Gurung (10.36%) are the dominant groups. Similarly Sarki, Kami, Dhimi/Dholi, Gharti/Bhujel, and Kumal do also have remarkable presence within the district.

Major occupation of the households is agriculture which comprises 23.59 % of the total household's members. Similarly, about 10.11% depend on trade and business whereas 7.22% are engaged in foreign employment, 5.42% are service holders and about 6.62% population are housewife and unemployed.

Relevancy of the Proposal and Study Methodology

This IEE report of Dhadingbesi – Arughat – Gorkha Road project in Dhading and Gorkha districts is prepared based on the Terms of Reference (ToR) approved on 2070/3/23 BS by the Secretary level decision of the Ministry of Physical Infrastructure and Transport (MoPIT).

The proposed road upgrading requires an Initial Environmental Examination (IEE) as per GoN, Environment Protection Act (EPA 1997) and Environment Protection Rules (EPR'97) 3, schedule 1(D)(6), the improvement of the standard, rehabilitation and reconstruction of feeder roads requires IEE. Thus, the IEE Study of the Proposal is a respect to mandatory requirement as per this provision. The approval of the IEE Report by the authorized agency, MoPIT is required before commencing the upgrading work.

The findings and conclusions of the report are based on the analysis of the information collected from the field during the month of January 2016 AD by undertaking a walk-through environmental survey along the proposed route and secondary information supplemented by information collected by the social and technical teams working on the resettlement survey and detail survey. Public consultation was made with the local people, teacher in the concerned affected areas.

Beneficial Impacts

The development efforts particularly the increasing access to transportation network will have multifold beneficial impacts. The immediate beneficial impacts from road development are apparent in the construction stage like there will be various employment opportunities (Approximately 45,500 skilled and 187,400 unskilled person days) for the local population, supports for the transfer of construction work skills and technical know-how to the local workers.

During operation stage, an improved road access will bring an improvement of food security situation and overall economic and social stability. The road will also provide cheap, safe and fast transport of goods and services from rural areas to urban centers and vice versa. The farmers will be more interested to increase agricultural production due to market accessibility. This will contribute significantly to increase the productivity in rural areas and eventually improve the overall socio-economic condition of the people.

Once the improved road is on operation, local trade and business activities will be further promoted. Dhading and Gorkha districts are famous for religious and historical places. More pilgrims will visit this area due to easy accessibility. Flow of visitors due to road upgrading will contribute in the enhancement of economic activities of the area which will increase the living condition of the local people. There is a possibility of increased economic opportunities and significant growth and extension of the local markets along the road alignment. In addition, construction of road will lead to appreciation of land values particularly near the market and settlement areas.

Adverse Impacts

The physical adverse impacts during construction stage will be due to change in land use, slope instability and air, dust and water pollution, quarry sites and spoil disposal. The biological impacts during road upgrading works will be loss of 611 number of trees, and loss of 4.40 ha of forest area from eleven (11) community forests.

Socio-economic impacts during the upgrading works will be loss of 20.76 ha land (16.01 ha private and 4.75 ha government land), loss of eight (8) private structures (3 residential and 5 residential/commercial) belonging to seven (7) households, and exposure to health and safety problems during road construction. Altogether 4028 people from 760 household will be affected from the improvement of road.

Out of the 16.01 ha private land, 9.51 ha of agricultural land and 6.50 ha barren and others will be required for road construction and rehabilitation work. This will lead to loss of food grain production (26122 kg) among the families losing lands to the project.

The adverse physical impacts during operation stage are slope instability and management, air and noise pollution, and road safety. Likewise, biological impacts are depletion of forest

resources and disturbance to wildlife. Socio-economic impacts are due to new settlement and market center development, change in social behavior during road operation stage.

Benefit Augmentation and Mitigation Measures

Impacts from the proposed road Project can be both beneficial as well as adverse. An effective implementation of benefit maximization measures and adverse impacts mitigation measures would optimize the benefits expected from the project and avoid/minimize the adverse impact from the project. Based on the impact assessment and identification, beneficial augmentation and adverse impact mitigation measures are presented in both constructions as well as in operation stage of the road.

Benefit Augmentation Measures

During the road construction more emphasis will be given to women workers. Agricultural support services will be improved for the increased income from the farm products and market linkages will be developed. Life skill training like, income generation activities, construction of soft engineering structures and bioengineering works for workers and project affected people will be conducted to improve their livelihood. Awareness raising programme for the promotion of co-operatives and linkage with bank and other financial institutions, agricultural support services and market linkages will be conducted.

Adverse Impacts Mitigation Measures

Spoils will be safely disposed and managed with minimum environmental damage which includes balanced cut and fill volume, re-use of excavated materials and minimum quantity of earth works and adoption of bio-engineering techniques. Adequate slope stabilization measures will be provisioned in design for the stabilization of slopes. Unstable sites, erosion prone area, dense forest area, settlements, fertile farm land will be avoided for quarrying operation.

According to the Work Procedure for Providing the Forest Land for Other Use, 2063 of Government of Nepal, project has to carry out plantation equivalent to the forest area lost from the upgrading of the road or pay for the plantation and protection cost for five years to the District Forest Office. Concerned DFO will carry out 4.40 ha of plantation in government forest with project support. Concerned CFUGs and DFO will be supported by the project for the compensatory plantation and protection for 5 years of 16803 trees (estimated cost is NRs. 15,96,285.00) in community forests. The construction activities near forest area will be appropriately managed so that there will be least disturbance to the wildlife and birds. A separate Resettlement Plan has been prepared to address land and property acquisition as well as compensation issues. Based on the Resettlement Plan, an estimated amount of NRs. 210,498,419.88 has been allocated for property and land acquisition.

The construction workers will be provided with safety helmets, masks, muffs depending on the nature of the construction work. Drinking water facility and temporary pit latrine will be established and disposal of excavated materials in the water bodies will be avoided. Workers will be provided with medicines and group accidental insurance facility. Provision has been made in the contract for the insurance of Contractor's employee and labours.

During operation stage, minor landslide and mass wasting will be immediately cleared and slope restored with appropriate technology. CFUGs will be supported to conserve and

manage their CFs according to operational plans. Appropriate sign boards will be erected informing drivers about prohibition of blowing horns in the forest areas and potential areas for wildlife crossing. Appropriate road safety measures with the help of 3-Es i.e. engineering, enforcement and education will be applied.

Extension and upgrading/rehabilitation of existing minor cross-drainage structures (2 slab culverts, 183 pipe culverts of 900 mm dia., 1 causeway and 34 irrigation pipe crossings) are provisioned in the design to avoid alteration of surface water hydrology by maintaining flow and course of stream and irrigation crossings.

Environmental Management Plan

The Environmental Management Plan (EMP) delineates key issues likely to arise from Project implementation, and proposes mitigation measures, including monitoring schedule and responsibility. The EMP also outlines environmental management roles and responsibilities, road design and construction management of different activities, site supervision, monitoring and reporting, records, and corrective measures, improvement proposals, and cost estimates for mitigation measures. The tentative cost for implementation of EMP is estimated at around NRs. 21,234,607.00 has been allocated.

S. No.	Items	Cost (NRs.)	Remarks
1.	Capacity building and Environmental awareness trainings	500,000.00	
2.	Contractor's employee and labours' insurance	13,04,000.00	Included in project cost
3.	Bio-engineering measures	8,517,563.00	Included in project cost
4.	Relocation of public utilities (Drinking water supply lines, electric poles, irrigation canal etc.)	54,50,000.00	Included in BoQ
5.	Compensatory plantation (at the ratio of 1:25 and 5 years maintenance cost)	15,96,285.00	
6.	Safety Gadgets/facilities	31,20,144.00	Included in BoQ
7.	Monitoring and Evaluation	650,000.00	Included in project cost
	Total Cost (NRs.)	21,137,992.00	

Source: Engineer's Estimate, Dhadingbesi-Arughat-Gorkha Road

Conclusion and Recommendation

The IEE study of the proposed Dhadingbesi – Arughat – Gorkha road project reveals that the benefits from the implementation of the proposed road project are more significant and long term in nature against the adverse impacts most of which could be mitigated or avoided. Therefore, this IEE is sufficient for approval of the proposed Project. This Project is recommended for the implementation with incorporation of mitigation measures and environmental monitoring plan.

ACRONYMS AND ABBREVIATIONS

AADT	Average Annual Daily Traffic
ADB	Asian Development Bank
ADT	Average Daily Traffic
AP	Affected People
CBOs	Community Based Organization
CBS	Central Bureau of Statistics
CF	Community Forest
CFUG	Community Forest User Group
CITES	Convention on International Trade in Endangered Species
CO	Carbon Monoxide
COI	Corridor of Impact
DBH	Diameter at breast height
DBST	Double Bituminous Surface Treatment
DDC	District Development Committee
DFID	Department for International Development, UK
DoHM	Department of Hydrology and Meteorology
DoF	Department of Forest
DoR	Department of Roads
DRILP	Decentralized Rural Infrastructure and Livelihood Project
DSC	Design and Supervision Consultant
EA	Executing Agency
EAG	Environmental Assessment Guidelines
EEAP	Earthquake Emergency Assistance Project
EIA	Environmental Impact Assessment
EMG	Environmental Management Guidelines
EMP	Environmental Management Plan
EPR	Environment Protection Rules
ES	Environmental Specialist
FIDIC	International Federation of Consulting Engineers
FS	Feasibility Study
GESU	Geo-Environment and Social Unit
GHG	Green House Gas
GRM	Grievance Redressal Mechanism
GTZ	German International Cooperation
IA	Implementing Agency
IEE	Initial Environmental Examination
IUCN	International Union for Conservation of Nature
JICA	Japan International Co-operative Agency
LPG	Liquefied Petroleum Gas
MHH	Mid-Hill Highway
MoPE	Ministry of Population and Environment
MoPIT	Ministry of Physical Infrastructure and Transport
NAAQS	Nepal Ambient Air Quality Standard
NEP	Nepal
NGO	Non-Government Organization
NOx	Nitrogen Oxide

PAF	Project Affected Family
PD	Project Directorate
PPE	Personal Protective Equipment
PIP	Priority Investment Plan
RAIDP	Rural Access Improvement and Decentralization Project
RAP	Rural Access Programme -DFID
RCC	Reinforced Cement Concrete
RoW	Right of Way
SC	Supervision Consultant
SDC	Social Development Consultant
SPAF	Severely Project Affected Family
SRN	Strategic Road Network
STI	Sexually Transmitted Infection
TMO	Transport Management Office
TPPF	Transport Project Preparation Facility – ADB
VDC	Village Development Committee
ZOI	Zone of Influence

CHAPTER 1

1. NAME AND ADDRESS OF THE INSTITUTION PREPARING THE REPORT

1.1 Name of Proposal

Name of the Proposal is 'Initial Environmental Examination of Dhadingbesi - Arughat - Gorkha Road Upgrading Works in Dhading and Gorkha Districts in Bagmati and Gandaki zones in Central and Western Development Regions of Nepal.

1.2 Name of the Proponent and Address

The Proponent is the Planning and Design Branch, Geo-Environment and Social Unit, Department of Roads. The Department of Roads (DoR) is the leading agency for road development under Ministry of Physical Infrastructure and Transport (MoPIT) and is responsible for translating government policies for the road sub-sector into the provision of services. The services it provides include planning, design, upgrading and maintenance of the Strategic Road Network, and provisions to ensure a reasonable level of safety for all road users.

The address of Proponent is:

Planning and Design Branch
Geo-Environment and Social Unit
Department of Roads
Chakupat, Lalitpur, Nepal
Telephone Number: 5260505, Fax Number: 5529106
Email: gesu.dor@gmail.com, gesunit@dor.gov.np

1.3 Consultant

The consultants of the Transport Project Preparatory Facility (TPPF), Project Preparatory Consultant (PPC - 2) are MM Group Limited Canada in association with ITECO Nepal (P) Ltd, Total Management Services Nepal and Material Test Pvt Ltd.

The address of Consultant is:

PO Box 675, Kathmandu, Nepal
Ward No 34, Min Bhawan, KMC
Telephone: 4620054
Fax: +977-1-4620054
Email: mmm.tppf@gmail.com
Web: www.mmm.ca

CHAPTER 2

2. SUMMARY OF THE PROPOSAL

2.1 Objective of the Proposal

The objective of the proposal is to upgrade the existing Dhadingbesi - Arughat- Gorkha Road Section following the design standards developed for feeder roads by the Department of Roads (DoR). The upgrading works will include widening of the road to a formation width of 7 m, geometric and grade improvements, improvements in slope stability through application of bio-engineering and upgrading the surface to Double Bituminous Surface Treatment (DBST) standard.

2.2 Rationality of the IEE Study

The proposed road upgrading requires an Initial Environmental Examination (IEE) as per GoN, Environment Protection Act (EPA 1997) and Environment Protection Rules (EPR'97) 3, schedule 1(D)(6), the improvement of the standard, rehabilitation and reconstruction of feeder roads requires IEE. Thus, the IEE Study of the Proposal is a respect to mandatory requirement as per this provision. The approval of the IEE Report by the authorized agency, MoPIT is required before commencing the upgrading work.

2.3 Objective of the IEE

The main objective of this IEE Study is to identify the impacts of proposed project implementation on physical, biological, socio-economic and cultural environment of the Project area and propose mitigation measures to avoid or mitigate such impacts.

The specific objectives of the proposed IEE study include to:

- identify the major issues that may arise as a result of proposed works on bio-physical, socio-economic and cultural environment of the project area,
- recommend practical and site specific environmental mitigation and enhancement measures, prepare and implement environmental monitoring plan for the Project, and
- make sure that IEE is sufficient or not for the proposed road Project.

2.4 Anticipated Impacts by the Proposed Subproject

The predicted environmental and social impacts will be both beneficial and adverse. The impacts are described as below:

2.4.1 Impacts on Land Use

During the implementation of project, about 20.76 ha land (16.01 ha. private land and 4.75 ha government land) and 4.40 ha of forest area lying within Col of the road needs to be acquired.

2.4.2 Adverse Impacts on the Environment, Impact on Human Life, and Population Pressure

The predicted environmental and social impacts will be both beneficial and adverse. The impacts are described as below:

a. Beneficial Impacts

During the construction stage, the project activities will create employment opportunities to the poor, vulnerable and socially excluded people of the project area (a total of 45,500 skilled and 187,400 unskilled for total project construction period of 24 months). The project provides construction work skills and technical know-how to the local workers.

During operation stage, an improved road access will bring an improvement of food security situation and overall economic and social stability. The road will also provide cheap, safe and fast transport of goods and services from rural areas to urban centres and vice versa. The farmers will be more encouraged to increase agricultural production due to easier market accessibility. This will contribute significantly to increase the productivity in rural areas and eventually improve the overall socio-economic condition of the people in the Project area.

b. Adverse Impacts

▪ During Construction Stage

Physical and Cultural Impacts:

As the road is already in operation and there will be not much adverse impact on physical and cultural environments. However, in some places where the road width is insufficient, 8 private structures and 20.76 ha land (18.01 ha. private land and 4.75 ha government land) needs to be acquired. Other adverse impacts due to road upgrading work are slope instability due to fresh cuts, dumping of spoil and operation of quarry sites.

Biological Impacts:

As this is upgrading project, there are limited risks for significant impacts on forests, terrestrial and aquatic fauna and flora. About 648 trees from 4.40 ha of forest area are found to fall within formation width (7 m). There is also possibility of disturbance to wildlife due to construction activities, hunting and harassment by construction workers.

Socio-economic Impacts:

Other impacts during upgrading activities are occupational health/safety risks to labors and the public in general. Dust emission, pollution of water, poor sanitation, road and work site accidents, sexually transmittable diseases, social conflicts and other pressures on the local communities are other impacts due to road upgrading work.

Availability of money to local labor, and influx of labor from outside the area can lead to conflict situations such as increase in alcohol consumption, gambling, prostitution and girl trafficking. Such problems persist or even increase during the operation stage and need special attention.

■ During Operation Stage

During operation stage, slopes along the road alignment and nearby areas may be destabilized due to rain, de-vegetation of the area, soil extraction and quarry operation on unstable slopes. Roadside drains will cause erosion of downhill agriculture land. Haphazard spoil disposal will cause damage to adjacent agriculture fields and settlement.

2.4.3 Damage to be suffered by local goods or objects

Altogether 8 private structures will be affected due to the implementation of the proposed subproject.

2.5 Review of Acts/Rules, Plans/Policies, Guidelines, Standards, and Conventions

In Nepal, various instruments are in place to make easy the integration of environmental aspects in development proposals. During the course of this study, relevant Acts, Regulations, Policies and Guidelines have been thoroughly reviewed in order to understand the provisions made to integrate the road development and environmental conservation. This study is made on the basis of these Acts, Rules, Regulation and Guidelines. The main documents that are also relevant to this Subproject are presented hereunder.

2.5.1 Constitution

a. Constitution of Nepal

Article 30 (1) mentioned that every citizen has the right to live in a clean and healthy environment. Under state policy, Article 51(f) mentioned that by increasing awareness of general public regarding environmental cleanness, minimizing the risk of industrial and physical development on environment conservation, promotion and sustainable use of forest, wildlife, birds, flora and biodiversity. Article 51(g) explains about applying appropriate minimization or mitigation measures for negative impact on nature, environment or biodiversity.

2.5.2 Plans and Policies

a. Thirteenth Three Year Plan (2070/71–2072/73 BS), 2014 AD

The government has recently endorsed the Thirteenth Three Year Plan (2070/71–2072/73). This plan will cover the period of 2013/14 - 2015/2016. Its long-term vision is to promote Nepal from its current status of a least developed country to a developing country by 2022. Its aim is to reduce human and economic poverty, bring change in the living standard of citizen by promoting green economy focusing on poverty reduction and reducing the percentage of population living below the poverty line from 23.8% to 18.0% during the plan period. The plan also aims to achieve 6.0% of annual economic growth rate. The priority areas of the plan are hydropower, energy, agriculture, basic education, health, drinking water, good governance, tourism, and environment. The GON will increase the participation and contribution of private sector, public sector, and cooperatives for the promotion and development of the priority areas during the plan period.

b. Forest Policy, 2071 BS (2014 AD)

The forest policy is attracted when a development project directly or indirectly impacts on the forest resources. The forest policy is directed, inter alia, to contribute food production through effective interaction between forestry and farming system, to protect land against degradation by soil erosion, landslide, and other effects of ecological disturbances, and to conserve ecosystem and genetic resources. However, the forest policy re-emphasizes to avoid forest destruction or tree cutting while constructing infrastructures during implementation of project other than forest sector. The policy has prioritized the protection of Siwalik, the geologically vulnerable area, with a view to ensure watershed conservation, and maintenance of water recharge. The policy also stresses conservation of endangered species. It has reiterated that forest area will not be used for any activities other than prescribed in Operational Forest Management Plan. The forest policy emphasizes the implementation of community and private forestry development programs, national parks and conservation areas management programs, soil and watershed conservation program, management and development of medicinal plants, and conservation of biological diversity.

2.5.3 Acts and Rules

a. Environment Protection Act, 2053 BS (1997 AD)

The Environment Protection Act, 2053 BS (1997) and Environment Protection Regulation, 2054 BS (1997) (latest amendment, 2007) contain several provisions to institutionalize the integration of environmental aspects in development projects including road sector, and empowers Ministry of Population and Environment to approve EIA report. Similarly, in case of IEE level study, line Ministry, which is Ministry of Physical Infrastructure and Transport for the proposed Project, is authorized to approve the Final IEE Report. Following are the highlights of the EPA, 1997.

The Act recognizes the interdependence between development and the environment and shows the concerns for minimizing the impacts of environmental degradation on people, animal, and plant species and their physical surroundings.

The Act obliges the proponent to undertake IEE and EIA of proposal, plans or projects which may cause changes in existing environmental condition and authorizes MOPE to clear all EIA and line ministry for IEE study.

Empowers MOPE to prohibit the use of any matter, fuel, equipment or plant, which has adverse effects on the environment,

The Act has provisions for polluters to compensate affected persons from polluting activities. Empowers government to provide additional incentives to any industry, occupation, technology or process, which has positive impacts on environmental conservation, has provision to establish an Environmental Protection Fund to be used for environmental protection, pollution control and heritage conservation, and it gives the government authority to declare specific area as environmentally protected area.

b. Environment Protection Rules, 2054 BS (1997 AD) (Latest Amendment, 2007)

In the process of implementing EPA (1997) effectively the Environment Protection Rule (EPR) came into force in 1997 and was amended in 1999. The EPR contains elaborate provisions for the process to be followed during the preparation and approval of Subprojects

requiring EIAs and IEEs including scoping documents, terms of reference, public consultations and hearings, and environmental monitoring and auditing. The environmental legislation empowers the concerned Ministry to monitor the environmental activities including mitigation measures and MOPE for environmental auditing. For IEE, the concerned Ministry, which is the Ministry of Physical Infrastructure and Transport in case of the proposed Subproject, is authorized to approve the Final IEE Report. The EPR also lists the types of development activities requiring IEE or EIA level Study. It also gives an outline of content of the terms of reference document, IEE and EIA report.

c. Water Resources Act, 2049 BS (1992 AD)

Water Resources Act 1992 empowers GoN for the rational use of surface and underground water. This Act also empowers to save environment especially water, from the hazardous effects likely to be caused by chemicals, industrial waste etc. Section 18 empowers GoN to fix and maintain quality standards of water resources for various usages. Section 19 (1) empowers GoN to prescribe a tolerance limit for water resources. Section 19 (2) states that no one shall pollute water resource by way of using or putting any litter, industrial wastes, poison, chemical or toxicant to the effect that the pollution tolerance limit of the water resource as prescribed) is exceeded. Section 20 emphasizes on the need for avoiding or minimizing adverse impacts made on environment by way of soil erosion, flood, landslide or similar other causes.

d. Public Roads Act, 2031 BS (1974 AD)

The Department of Roads may temporarily acquire the land and other property adopting compensatory measures during the construction, rehabilitation and maintenance of the public roads according to the Act (Article 14 & 15). The Act also empowers the DOR to operate quarries, borrow pits and other facilities during the road construction (Article 17). In sum the Act facilitates the acquisition of land and property for the extraction of construction materials and development of other facilities as well as to maintain greenery along the roadside with adoption of compensatory measures.

e. Road Board Act, 2058 BS (2002 AD)

Roads Board Act, 2002 provides necessary provisions on repair and maintenance of roads, minimizing the expenditures to be incurred in repairing and maintaining the roads and making transparent and effective the repairing and maintaining works of the roads. The autonomous body of Roads Board was established to carry out routine, recurrent, periodic, and emergency repair and maintenance works of the road and to make an arrangement for imposition on and collection of tolls from the motor vehicles plying on the road.

f. Labor Act 2049 BS (1992 AD) and Labor Rules, 2051 BS (1994 AD)

Labor Act, 1992 (first amendment 1998) and Labor Rules, 1994 deals deal with manual labor. Clause 46 under Section 7 deals particularly with Construction industry. The Act defines working time as eight hours a day and a weekend leave. A half and hour break should be given as snack and tea break before continuous work of maximum five hours. Attendance Registry should be maintained properly. Clause 27 to 32 under Section 5 gives details for occupational health and safety requirement to be maintained for labors. Child labor (below 14 years) is prohibited, and between 14 to 16 years of age should be given proper training before putting them in work. It calls for insurance and safety management of

labors. It also directs to establish camp near temporary working sites with drinking water, food, sanitation and residential facilities of numbers of labors are fifty or more in construction projects. The Labor Rule, 1994 guarantees equal wage for male and female. It also lists the percentage of compensation for different types of accidents during work at site.

g. Forest Act, 2049 BS (1993 AD, Amended in 1998) and its Rules, 2051 BS (1995 AD)

The Forest Act, 1992 (amended in 1998) contains several provisions to ensure the development, conservation, management and sustainable use of forest resources. The Act categories the forest into five categories viz.; state managed forest, community forest, leasehold forest, private forest and religious forest.

The Act in general, prohibits the use of forest areas for development projects, but its Article 68 empowers GON to issue permission to use the required portion of forest for development with the assurance that it does not significantly affect the environment. Based on Forest Legislation, GON has legally protected thirteen plant species including Khair and Sal.

The Forest Rules 1995 (amendment, 1999) further elaborate legal measures for the conservation of forests and wildlife. Based on forest legislation, thirteen plant species are included in the level protection list. Of them, GoN has banned the felling, transportation and export of Champ (*Michelia champaca*), Khayer (*Acacia catechu*) and Sal (*Shorea robusta*). The Rule also stipulates that the entire expenses for cutting and transporting the forest products in a forest area to be used by the approved project shall be borne by the proponents of the project.

h. Local Self-Governance Act, 2056 BS (1999 AD) and its Rules, 2057 BS (2000 AD)

The Local Self-Governance Act, 1999 empowers the local bodies for the conservation of soil, forest, and other natural resources and implementation of environmental conservation activities. The Village Development Committees (VDCs), Municipalities and District Development Committees (DDCs) are mandated to take up the responsibilities for the formulation and implementation of a programme relating to the protection of the environment and bio-diversity, and to give adequate priority for the protection of the environment during the formulation of local level plans and programme.

i. Land Acquisition Act, 2034 BS (1977 AD)

The Land Acquisition Act (as amended 1993) guides the compulsory acquisition of land. GON can acquire land at any place and in any quantity by giving compensation pursuant to the Act for the land acquired for any public purpose(s) or for operation of any development project initiated by GON institutions.

j. Land Acquisition, Resettlement, and Rehabilitation Policy for Infrastructure Development Project, 2071 BS (2015 AD)

This policy has provided clear guidelines to screen, assess, and plan land acquisition and resettlement aspects in development projects. The policy has the following major guiding principles:

- Involuntary resettlement will be avoided where feasible or minimized, exploring all available alternative project design. Where it is not possible to avoid resettlement,

resettlement activities will be conceived and executed as sustainable development programs, providing sufficient investment resources;

- Appropriate and adequate compensation for the loss of assets or income is a fundamental right of affected person;
- Physically displaced people must be relocated with facilities such as school, health post, drinking water, security etc.;
- Vulnerable groups such as Janajati/Adivasi, Dalits, landless, women, especially women-headed households, poverty groups and senior citizens are entitled to special benefit and assistance packages in addition to compensation and resettlement;
- Affected persons will be assisted to restore at least their pre-project income and livelihood sources. The absence of legal title to land will not be a bar for compensation, resettlement and rehabilitation assistance.

k. Soil and Watershed Conservation Act, 2039 BS (1982 AD)

Soil and Watershed Conservation Act makes provision to control floods landslides (watershed conservation rules, 1985) the watershed conservation office is authority and district watershed conservation committee must implement watershed conservation practices and public participation for soil and land protection

l. The Aquatic Animal Protection Act, 2028 BS (1961 AD) and First Amendment, 1998

This Act indicates an early recognition of the value of wetlands and aquatic animals, Section 3 renders punishable to any party introducing poisonous, noxious or explosive materials into a water source, or destroying any dam, bridge or water system with the intent of catching or killing aquatic life. Under Section 4 of the Act, Government is empowered to prohibit catching, killing and harming of certain kinds of aquatic animals by notification in Nepal Gazette.

m. Child-Related Act, 2050 BS (1993 AD) and Child Labour Act, 2058 BS (2001 AD)

The Child-Related Act 1993 and the Child Labour (abolition and regulation) Act, 2001 are the major acts related to child labour in Nepal. The Article 2 (Ka) of these acts refers "Child" to the children below 16 years of age. The Child Labour (Abolition and Regulation) Act is the most recent and revolutionary decision to overcome the child labour problem in Nepal. Article 3 clause 1 of the act states that any child below the age of 14 years prohibited for labour employment. However, clause 2 states that it is prohibited to engage children below 16 years in works in risk-prone sectors such as public transportation and construction related works. In other words, any employment of children below the age 16 is to be excluded from becoming contracted in any of the SRN subprojects' construction works. Children between 14 and 16 years of age may become engaged in other light and low-risk jobs such as roadside planting and drainage clearing.

n. Motor Vehicle and Transportation Management Act, 2049 BS (1992 AD) and Rules, 2054 BS (1997 AD)

This act sets standard for vehicles emission and mechanical condition for vehicle registration by the transport management office and the TMO can deny a permit based on

environmental factor. Standard are set for petrol and diesel engine under the Nepal vehicle mass emission standard 1999.

o. Solid Waste Management Act, 2068 BS (2011 AD)

The Act is related for sustainable management of garbage and to minimize the negative impacts of garbage on environment and public health.

Chapter-2 section 3(1) of the Act outlines the responsibility to construct and operate the infrastructure or structure required for the collection, final disposal and processing of solid waste, including construction of any transfer station, landfill site, processing plant, compost plant, and bio-gas plant for the management of solid waste shall rest with the Local Body. Likewise, the section 4 sub-section (2) of the act clearly defines the responsibility for processing and management of hazardous waste, medical waste, chemical waste or industrial waste under the prescribed standards shall rest with the person or institution that has generated the solid waste. Similarly, according to sub-section (3) of section 4, if any industry or medical institution requests for the management of solid waste remained after processing of hazardous waste, medical waste, chemical waste and industrial waste or other solid waste, or for using a Sanitary Landfill Site constructed by the Local Body, the Local Body may manage the solid waste or allow the institution to use the Sanitary Landfill Site by levying fees as determined by the Local Body. The Local Body shall only transport solid waste that is discharged and collected after segregation at source pursuant to Section 6 separately.

p. Solid Waste Management Rule, 2070 BS (2013 AD)

Followings are the highlights of Solid Waste Management Rule:

- Makes the provision of methodology, procedures, technology and execution of solid waste management, and describes about the segregation and management of solid waste;
- Outlines management and execution of hazardous/chemical wastes and emphasizes on the segregation of hazardous/chemical wastes at source and makes the procedures of such wastes responsible for their proper disposal and management;
- Local body is made responsible for conducting awareness programme on reduction and segregation of solid wastes at source and adopting suitable technology for their management

2.5.4 Other Guidelines and Manuals

The following guidelines were reviewed and applied during the preparation of the report.

a. Reference Manual for Environmental and Social Aspects of Integrated Road Development, 2060 BS (2003 AD)

The manual has been prepared by DOR under Road Maintenance and Development Project (RMDP). The Manual is designed to help integrate social and environmental considerations, including public involvement strategies, with technical road construction practices. It suggests stepwise process of addressing E&S issues alongside the technical, financial and others. The Manual is based on the experiences of Nepal, as well as incorporates the national (EPA, 1997; EPR, 1997) and international 'best practices'. It suggests process of

environmental and social assessment process, roles and responsibilities of stakeholders at various stages of the project, advice on impact mitigation action plans, and process for involving the public.

b. EIA Guidelines for Forestry Sector, 1995

The GoN in keeping with the spirit of the National Environmental Impact Assessment Guidelines, 1993 framed EIA guidelines for the forestry sector in 1995. The Guideline aim to facilitate the sustainable use of forest resources for socio-economic development and meeting basic need to the community regarding the forest products, to make proposals socio culturally acceptable, economically feasible, and environmental friendly to conserve genetic resources and biodiversity and minimize environmental damage in forest areas and facilitate in identification of positive and negative impacts of programs to be implemented by other agencies in forest areas. The guideline emphasized the need of carrying out an EIA/EE study of development projects and programs proposed for implementation in forest areas.

c. Forest, Production, Collection and Sales Distribution Guidelines, 2057 BS (1998 AD)

The Clauses 3 to 10 of the Guidelines have specified various procedure and formats for getting approval for vegetation clearance, delineation of lands for vegetation clearance, evaluation of wood volume etc. and government offices and officials responsible for the approval, delineation and evaluation. These provisions have a direct relevance to the development of the project and need compliance to these provisions. These provisions have a direct relevance to the development of the project and need compliance to these provisions. The project requires to fell down an estimated of 611 number of trees (size having DBH greater than 10 cm) from community forests. Hence, it is the obligation to the project for getting approval in view of vegetation clearance and evaluation of wood volume from district forest office prior to the construction stage.

d. Community Forest Guidelines, 2058 BS (2001 AD)

This guideline has been prepared by including amendments of acts, rules by officials of GoN and related experts. Through these guidelines persons involved in the development and management of community forest like facilitators, User Groups, forester and managers etc will get help to understand about the process and stages of development of community forest. Forest Users Group, forest officials, NGOs and INGOs are getting benefit by this guideline. Till date, more than 15000 Community Forests have been handed over to the Community Forest Users Groups.

e. Community Forest Inventory Guidelines, 2062 BS (2005 AD)

The guideline for inventory of community forests advice to classify the forest into timber trees, pole size trees and regeneration on the basis of diameter. It has recommended using 20m x 20m size of quadrant for timber trees, 10m x 10m for shrub and 5m x 5m for regeneration plots in the community forest. Plants having DBH (Diameter at breast height, i.e. 1.3m above ground) greater than 30 cm are considered as trees. Trees having DBH between 10 to 30 cm are categorized as pole and plants having less than 10 cm DBH belong to regeneration species.

f. Public Works Directives, 2059 BS (2002 AD)

The PWD combine Financial Administration Regulation (FAR) and other rules and regulations on technical, social and environmental matters to provide a single source of procedures and reference documents for implementing public construction works. The PWD are intended for use by GoN's agencies in the implementation of central-level and district-level projects carried out by regional, divisional or district offices of GoN. The PWD also incorporate procedures and procurement documents for implementing small projects and thus local bodies may benefit from adopting many of the contents of the PWD. Definitions of Public Works and Project are given in the PWD Procedural Directives. It is clear from these that Public Works involve 'any type of construction', whilst the term Project is slightly vague and includes 'social development activity'. The PWD also make clear reference to Projects Implemented by Local Bodies, and notes that the Local Self Government Act, Local Self Government Rules and Local Body FAR are framed under GoN's decentralization policy.

g. Guide to Road Slope Protection Works, DOR, 2060 BS (2003 AD)

This guide provides the concept on road slope disaster management whose objectives are to maintain the traffic operation, to secure the traffic safety, to reduce the environment degradation and to minimize the traffic operation cost, slope protection works and option for road slope protection in details.

h. Nepal Road Statistics, 2068 BS (2011 AD)

The Department of Roads (DOR), Ministry of Physical Infrastructure and Transport have published Statistics of Strategic Road Network, which contains data and maps of road network till the year 2011 AD. This document is prepared based on Geographic Information System (GIS). It helps the performance of road sector projecting an overall growth of road network in the country.

i. National Environmental Impact Assessment Guidelines, 2050 BS (1993 AD)

In order to integrate the environmental aspects in development projects and programs, the government has developed the National EIA Guidelines (1993). The guidelines provide guidance to project proponent on integrating environmental mitigation measures, particularly on the management of quarries, borrow pits, stockpiling of materials and spoil disposal, operation of the work camps, earthworks and slope stabilization, location of stone crushing plants, etc.

j. Environmental Management Guidelines, GESU/DoR, 2056 BS (1999 AD)

Environmental Management Guidelines, GESU/DOR, July 1999 have been prepared as part of the program undertaken jointly by GoN and the World Bank under the Road Maintenance and Rehabilitation Project. These Guidelines are formally approved by Minister level decision on Kartik 22, 2053 BS (1997). The Guidelines are the part of operational practices for all road maintenance, rehabilitation and construction activities under DOR. The guideline consists of environmental mitigation measures to be incorporated into DOR Subprojects, procedures for public participation, and socio-economic considerations. The environmental mitigation measures are broken down into twelve categories including (i) quarries; (ii) borrow pits; (iii) spoil and construction waste disposal; (iv) work camp location and operation; (v) labour camp location and operation (vi) earthwork/slope stabilization (vii) use of bitumen (viii) stockpiling of materials (ix) explosive, combustible and toxic materials

management (x) setting up and operation of stone crushing plants (xi) water management (xii) air and water pollution.

Implementation methods for undertaking mitigation measures for each of the activities are also given in the guideline. The Guideline suggests methods for determining how and when the public will be included in the environmental analysis. The guidelines also advise on socio-economic impacts and strategies for reducing or avoiding the potential negative impacts and for maximizing the beneficial impacts to local residents. The socio-economic impacts include important issues of land acquisition and compensation and other economic impacts with markets for agriculture production, agriculture inputs, nutrition, extraction of natural resources beyond replenishment, migration and influx of migrants, land speculation, illegal logging and mining, portering, etc. It also includes impacts on cultural heritage.

k. Policy Document of DoR on Environmental Assessment in the Strategic Road Network, 2057 BS (2000 AD)

The purpose of the Policy Document is to explain, basically the DOR Engineers on what environmental assessment procedures involve and to propose a straightforward set of procedures which make it workable and useful. The document lists Screening, IEE, Scoping, EIA and Monitoring as the five main types of environmental assessment activities. The different stage when a particular type of EA is required is also listed in the document. The document lists the category of environmental adverse impacts, the problems and their general mitigation measures. The document then guides the various steps to be taken while carrying out an EA. Indicative environmental monitoring checklist is given in the document.

l. Environmental and Social Management Framework, 2064 BS (2007 AD)

The Environmental and Social Management Framework report (ESMF) is prepared for the Department of Roads (DOR) to compile in an overview and guidance manner, various safeguard and compliance aspects of environmental and social issues related with the Sector Wide Road Program and the Priority Investment Plan Study for Nepal's Strategic Road Network (SRN) planning for 2007 to 2016. The study commenced in September 2005 and was completed in December 2006. GESU/DoR, June, 2007 has been prepared as part of the Sector Wide Road Program and Priority Investment Plan Study under funding from World Bank/International Development Agency/Road Maintenance and Development Project. The Environmental and social Management Framework, 2007 is a guide to Environment and social issues associated with new road construction and upgrading. It suggests for the mechanism in line with the current legal and policy framework for integration of environmental and social recommendation in to project planning, design and implementation.

m. Interim Guidelines for Enhancing Poverty Reduction Impact of Road Projects, 2064 BS (2007 AD)

This guideline develops the procedures in line with the national policy and to complement the methods and producers as provided public works directives to provide guidance for adopting suitable mechanism to contribute to enhancing poverty reduction impacts of road project and to familiarize the DOR officials on the basic poverty concepts, its measurement, links between road sector investment and poverty reduction, scope of enhancing poverty reduction impacts within DOR road project

n. Priority Investment Plan, DoR, 2063 BS (2006 AD)

The Priority Investment Plan (PIP) Study conducted for the Department of Roads (DoR). The Study was conducted in two Parts: Part I was the overall planning study and Part II involved the detailed feasibility study of around 800km of high priority road improvement. A summary of the overall Study findings: Part I: Planning Studies, including the Sector Wide Road Programme and preparation of the 10-Year Priority Investment Plan (PIP); and Part II: Detailed Technical & Economic Feasibility Studies for upgrading and new construction of over 800 km of priority road.

2.5.5 International Conventions and Treaties

(i) Convention on Biological Diversity, 2049 BS (1992 AD)

The Convention on Biological Diversity was signed by Nepal at Rio de Janeiro on June 12, 1992. The convention, and particularly Article 14 provides a broad framework on the need for carrying out EIA to minimize adverse impacts of the projects and programs on biodiversity.

The purpose of an environmental study in relation to biodiversity conservation is to identify in advance:

- The aspects of the project which is likely to have significant adverse effects on biological diversity at genetic, species and ecosystem level, and
- The steps to be taken to avoid or minimize significant adverse effects to ensure that the proposed project comply with existing environmental legislation.
- The GoN has included 17 species of plants and 39 species of wild animals in the protection list.

If the project area is in the core habitat of these species and project activity will likely to affect them, mitigation measures shall be proposed and be implemented to avoid and/or mitigate the adverse impacts. Nepal is a party to the convention of Biological diversity and in accordance to the article 14, adequate attention should be given to minimize and or avoid the impacts.

(ii) The Convention on International Trade in Endangered Species of Wild Fauna and Flora, (CITES), 2053 BS, amended 2059 BS (1973 AD, amended 1979 AD)

Nepal became party to CITES in 1975. CITES has facilitated international co-operation to regulate international trade in endangered wild flora and fauna with the aim of reducing or eliminating trade in species whose numbers or conditions suggest that further removal from their natural habitat would lead to their extinction. The National Parks and Wildlife Conservation (NPWC) Act, 1973 regulates the trade of species listed in CITES appendices. The Government has designated the Natural History Museum (Tribhuvan University) and the Department of Plant Resources as the scientific authorities for wild fauna and wild flora respectively. Similarly, the Government has designated the Department of National Parks and Wildlife Conservation and the Department of Forest as the management authorities for wild fauna and flora respectively. The Convention urges Parties not to allow trade in specimens of species included in the CITES Appendices I, II and III except in accordance with the provisions of the Convention.

(iii) Plant Protection Convention, 1951 AD

The International Plant Protection Convention (IPPC) is a 1951 multilateral treaty overseen by the Food and Agriculture Organization that aims to secure coordinated, effective action to prevent and to control the introduction and spread of pests of plants and plant products. The Convention extends beyond the protection of cultivated plants to the protection of natural flora and plant products. It also takes into consideration both direct and indirect damage by pests, so it includes weeds. Its main objective is to maintain and increase international co-operation in controlling pests and diseases of plants and plant products, and in preventing their introduction and spread across national boundaries.

(iv) United Nations Framework Convention on Climate Change (UNFCCC), 2049 BS (1992 AD)

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions. This amount to an average of five per cent against 1990 levels over the five-year period 2008-2012.

2.6 Permissions and Clearances Required for the Project

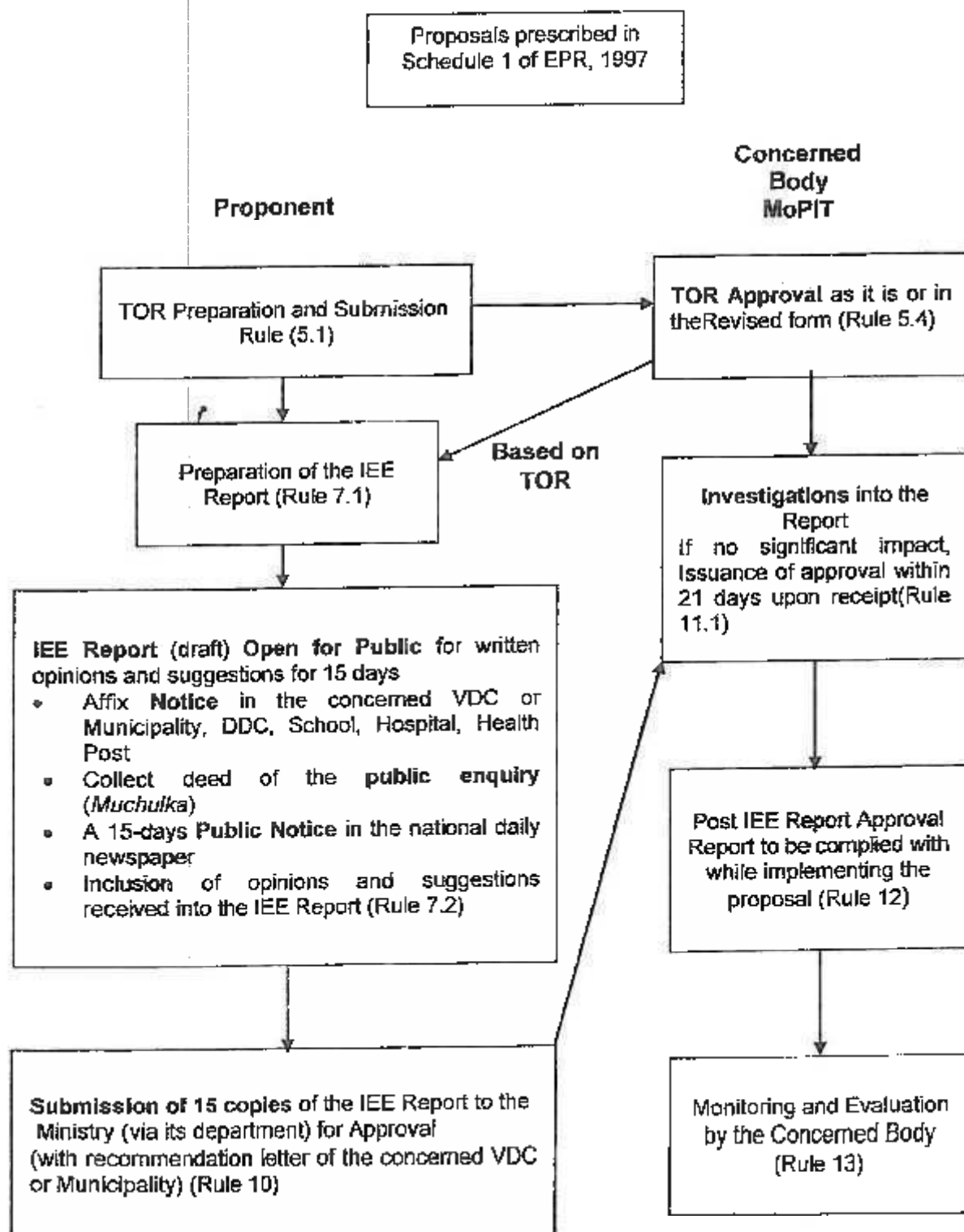
The legal framework of the country consists of several acts, notifications, rules, and regulations to protect environment and wildlife. List of required clearances/permissions related to environment has been summarized in Table 2.1.

Table 2.1: Permissions / Clearances Required for the Project

S.N.	Clearance	Act/Rule/Notification/Guideline	Concerned Agency	Responsibility
A. Pre-construction Stage				
1	Environmental Clearance (categorized as "B" with IEE requirement)	Environment Protection Act 1996 and Environment Protection Rules, 1997 (with amendments).	Ministry of Physical Infrastructure and Transport	Department of Roads / PD, DoR (ADB)
2	Land Acquisition and Compensation	Land Acquisition Act, 1977 (with amendments)	Ministry of Physical Infrastructure and Transport	Department of Roads / PD, DoR (ADB)
3	Forestry clearance for felling of Trees	Forest Act, 1993 (with amendment), Forest Rule, 1995, Forest Products Collection and Sales Distribution Guidelines, 2001 and Local Self-Governance Act, 1999	Ministry of Forest and Soil Conservation	Department of Roads / PD, DoR (ADB)
B. Implementation Stage				
4	Permission for construction material quarrying (stone, cobble, sand, gravel, soil etc)	Local Self-Governance Act, 1999 and Soil and Watershed Conservation Act, 1982 and Watershed Conservation Rule, 1985. PA, 1996 and EPR, 1997 (with amendments)	Concerned Project and Concerned VDC, DDC and Municipality	Contractor
5	Consent to operate Hot mix plant, Crushers, Batching Plant	Local Self-Governance Act, 1999	Concerned Project and Concerned VDC, DDC and Municipality	Contractor

S.N.	Clearance	Act/Rule/Notification/Guideline	Concerned Agency	Responsibility
6	Consent for disposal of sewage from labour camps	Water Resource Act, 1992	Concerned Project	Contractor
7	Pollution Under Control Certificate	Motor Vehicle and Transportation Management Act, 1993	Department of Transport Management	Contractor

Figure 2.1: Environmental Clearance Procedure in Nepal



CHAPTER 3

3. DESCRIPTION OF THE PROPOSAL

3.1 Type of Proposal

The present proposal is of the service delivery type (Transportation service) for upgrading/widening of the feeder road from present single-lane road to intermediate-lane Double Bituminous Surface Treatment (DBST) road from (i) Dhadingbesi to Ankhu Khola Section (from km 0+000 to 26+774) and (ii) Ghyampesal - Gorkha Section (km 54+300 to km 76+887) Section.

For the design purpose, the road is divided into two sections (i) Dhadingbesi - Ankhu Khola Section (from km 0+000 to 26+774) and (ii) Ghyampesal - Gorkha Section (km 54+300 to km 76+887) Section. The middle section from Ankhu Khola to Ghyampesal section (km 26+774 to km 54+300) falls on Mid Hill Highway alignment and is under construction as a high priority project of GoN. The total length of both the road section is 76.887 Km. Under the scope of proposed EEAP, length of road considered for upgrading is approximately 49.361 km.

3.2 Nature and type of goods to be delivered

The proposal includes civil works such as earthwork in filling, base, sub-base and wearing coat laying, shoulder slope protection, gabion works, and side drain improvement/extension, minor cross drainage works. The project after completion will result in an intermediate-lane, Double Bituminous Surface Treatment (DBST) road from Dhadingbesi to Ankhu Khola and from Ghyampesal to Gorkha Bazaar. The final output of the Project is 49.361 km DBST road with 7 metre formation width with required longitudinal and cross drainage works.

3.3 Proposal's Capacity

After the road is upgraded to an intermediate-lane, DBST surface standard, it is expected that the volume of traffic in the Dhadingbesi-Ankhu Khola Section will increase from the present 320 vpd to 508 in 2017 and 4,252 vehicle per day for the year 2037 respectively and similarly in the Ghyampesal - Gorkha Section from 472 vpd to 784 in 2017 and 7,054 vehicle per day for the year 2037, respectively., assuming 7% annual growth.

Brief Description of road section is given in the following Table 3.1.

Table 3.1: Salient Features of the Project Road

Name of the Project	Earthquake Emergency Assistance Project (EEAP)
Name of the Subproject	Dhadingbesi – Arughat – Gorkha Road Upgrading Work
Affected Municipalities/VDCs	Nilkantha Municipality, Jyamrung VDC of Dhading district, and Baguwa, Asrang, Taple VDCs and Gorkha Municipality of Gorkha district (धादिङ्ग जिल्लाको निल्कण्ठ नगरपालिका र ज्याम्रुङ गा.वि.स. र गोरखा जिल्लाका आसराङ, बगुवा र ताप्ले गा.वि.स.हरू र गोरखा नगरपालिका)
LOCATION	
Development Region	Central and Western
Districts	Dhading and Gorkha
Start Point	Dhadingbesi Bazar
End Point	Gorkha Bazaar (Haramtari Chowk)
GEOGRAPHICAL FEATURES	
Terrain	Mountainous
Altitude	Start Point: 571.50 m at Dhading Bazaar, Nilkantha municipality End Point: 1020.00 m at Haramtari chowk, Gorkha Bazaar, Gorkha Municipality
Climate	sub-tropical
Road Type	
Classification of road	Feeder Road, Class IV
Length of Road	49.361 km
Type of Pavement	DBST
Standard of Pavement	Overseas Road Note 31 (RN 31) and/or AASHTO design method
Design Parameters	
Design Speed	30 km/hr
Right of Way	30 m (15 m either side from the centre of road)
Carriageway Width	5.5 m (Intermediate Lane) with 0.75 m shoulder on both sides
Total Formation (Road Way) Width	7.0 m
Camber of Carriage way/ Shoulder	3%
Minimum Length of Vertical Curve	
Maximum Grade Change	12 %
Minimum Length of Vertical Curve	120 m
Gradient	
Maximum/ Exceptional Gradient	12 %
Maximum Gradient at Bridge Approach	6%
Maximum Length of Grade in Excess of 7% and up to Maximum Gradient at a time	300 m
Minimum Length of Recovery at Grade Specified	150 @4%
Hairpin Bends	
Design Speed	15 km/hr
Min. spacing between centers of bends	100 m
Maximum Gradient	5%
Minimum Gradient	0.5 %
Maximum super elevation	7%

Minimum Radius of Curve	12.5 m
Cross Drainage Structures	
Slab culvert	2
Pipe culvert 900 mm dia.	183
Irrigation pipe crossings	34
Causeway	1
Side Drain	49.63 km
Earthwork Quantity	
Cutting, m ³	596,810.00
Filling, m ³	44,444.00
River/Streams	Ankhu Khola (Ch. 26+775) and Budhigandaki (Ch. 37+700)
Traffic Volume	Dhadingbesi-Ankhu Khola Section: 320 vpd (2015), 508 vpd (2017 AD), and 4,252 vpd (2037 AD) Ghyampesal - Gorkha Section: 472 vpd (2015 AD), 784 vpd (2017 AD) and 7,054 vpd (2037 AD)
EMP Cost	NRs. 21,137,992.00
Total Project Cost	NRs. 1454,139,122.00 (including VAT)

Source: Detail Design Report, TPPF, 2016

3.4 Brief Description of the project area and works

The road starts just before the bridge over Thopal Khola on Malekhu Dhading road and traverses the basins of Thopal Khola, which is one of the tributary of Trishuli River. Most of the road alignment passes through rolling to mountainous terrain. At some section road passes through steep terrain. As the road passes through proposed alignment of Puspahal (Mid Hill) Highway from Ankhu Khola to Ghyampesal, the stated section is not overlapped on this EEAP. Ankhu Khola and Budhi Gandaki River are major perennial crossings along the proposed alignment. Formation width of this section road varies from 5m to 5.5m at most locations at present. The existing wearing surface of this section also comprise mostly of earth which should be regarded as sub-grade.

Existing width of the road is 4.0 m on an average and condition of road, structures and drainage facilities are in fairly good condition throughout the road section. The road alignment follows on rolling terrain after Ankhu Khola to Budhigandaki (Arughat) and then ascends till Ghyampesal.

From Ghyampesal to Gorkha the alignment passes over mountainous terrain having schistic phyllite as a bed rock. Most of the ridge alignment faces south, though there are some seepage areas near, Km 64+140 and Km 71+640. Most of the alignment passes over stable zone.

After Ankhu Khola, the road ascends to Salyantar and then descending to Arughat. After crossing the Budhi Gandaki Bridge at Km 37+700 in Arughat Bazaar the road alignment ascends toward Ghyampesal bazaar and at Pipaldada, in Ghyampesal VDC point where the road bifurcates, one towards south-west direction following last section of Ghyampesal - Gorkha Section (km 54+300 to km 76+887) to Gorkha while another towards north-west direction along Mid Hill Highway alignment linking Pokhara Baglung. Ghyampesal - Gorkha Section of the road alignment lies in the Gandaki Zone, Western Development of Nepal. Initially the road was constructed by the assistance of GTZ on the Green road Project. The road was initially improved by DRILP Project under DOLIDAR.

3.5 Key Upgrading Activities

The proposed project involves key upgrading activities including geometry improvement, pavement upgrading, drainage improvement, retaining structures; slope protection/stabilization, other off-road works, and works on traffic management and road safety. Typical cross-sections of the road are given in Annex VI.

Geometry Improvement: This involves widening of road width to 5.5 m to meet the design standards including sections along rock falls, landslides, religious and cultural sites, markets, and built-up areas. This includes horizontal radius enlargement, grade smoothing etc.

Along selected major built-up areas and market fronts consideration has been made in design to widen the road to full width. This road is difficult to ply for heavy vehicles because of geometry constraints. The geometry improvement will enhance serviceability of road, provide hard stand to parking/stopping vehicles and better drainage management.

Pavement upgrading: The road pavement activities involve strengthening, and resurfacing/reconstruction on existing sections. It also covers shoulder improvement for the road. The existing road surface is earth or natural material (i.e. rocky, gravel). As part of its upgrading, full pavement with Double Bituminous Surface Technique (DBST) is designed for this road. Based on terrain evaluation, suitable subgrade strength has been assumed for various sections of the road. Generally, the road sections are assumed to fall under two subgrade strength categories as per TRL: S2 (5-7%) and S3 (8-14%).

Drainage Improvement: This involves lining of side drains, improvement of existing natural drainage systems, culverts and causeways and construction of 2 slab culvert 183 new pipe culverts (900 mm dia.) and 1 causeway, and 49.63 km side drains along the road alignment. The road has earth ditches at places for side drainage and cross-drainage works comprising major/minor bridge, pipe culverts and causeways.

Retaining Structures: This involves construction of new retaining structures including repair/rehabilitation of existing ones.

Slope protection/stabilization: This involves landslide stabilization and slope protection activities. Both civil engineering and bioengineering activities has been proposed under the upgrading works. Bio-engineering works have been proposed in 27,804.00 sq. m. of area along the road alignment.

Road Safety Measures: This includes provision of signs, delineators, barriers and pavement markings, minor realignment at identified black spots including pedestrian foot paths in market areas. No existing posts, traffic signs and delineators exist in this road. The project has proposed for installation of 1343 traffic signs and 2116 delineators.

Bridges: The road alignment crosses Ankhu Khola at km 26+775 and Budhigandaki at km 37+700. Apart from this no other bridges are on this road. The type of substructure of bridge is RCC, solid and intermediate lane without sidewalks. No new bridges are provisioned under EEAP.

Typical cross section of road section is presented in Annex 6.



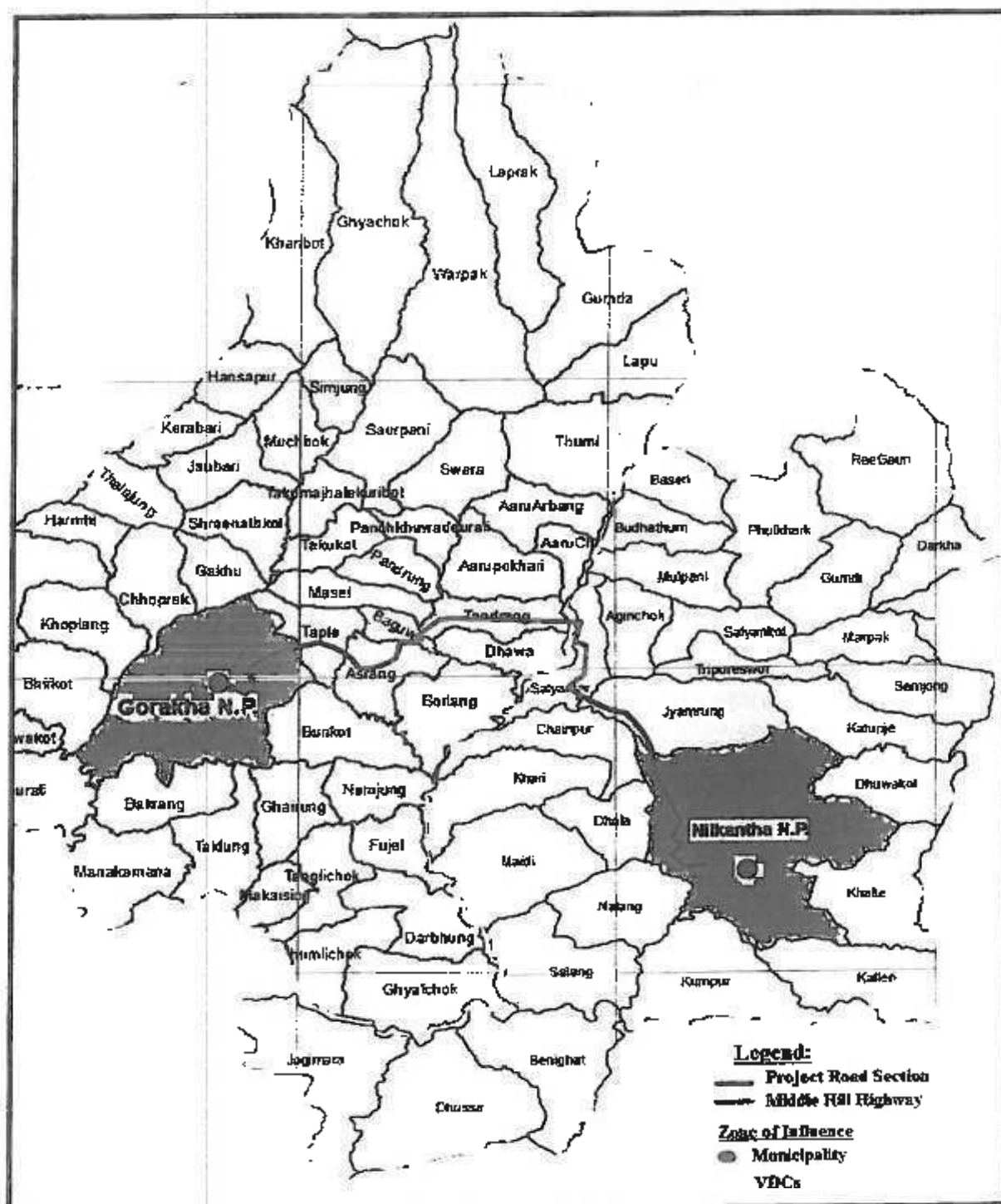


Figure 3.3: Alignment Map of Dhadingbesi – Ankhukhola Road Section

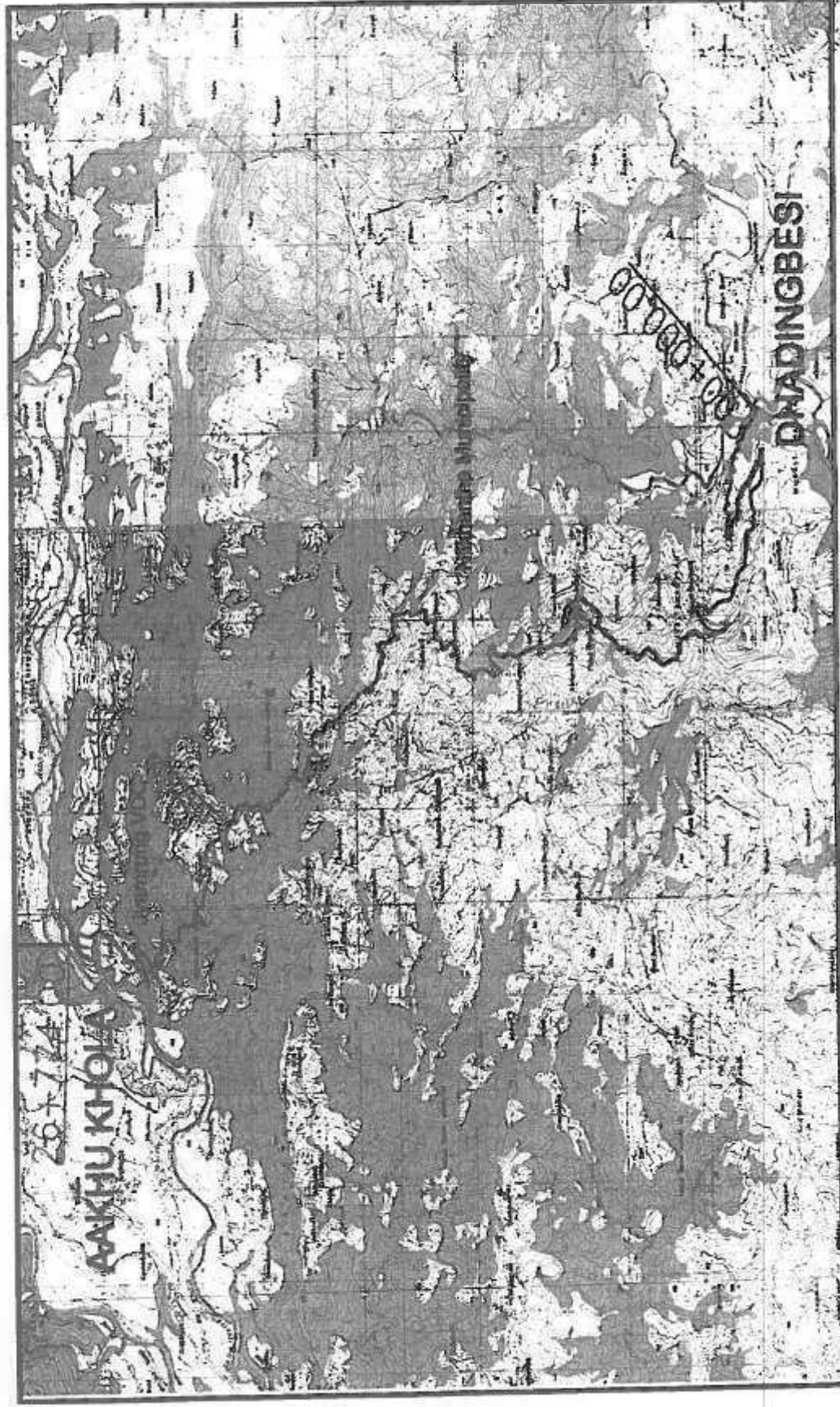
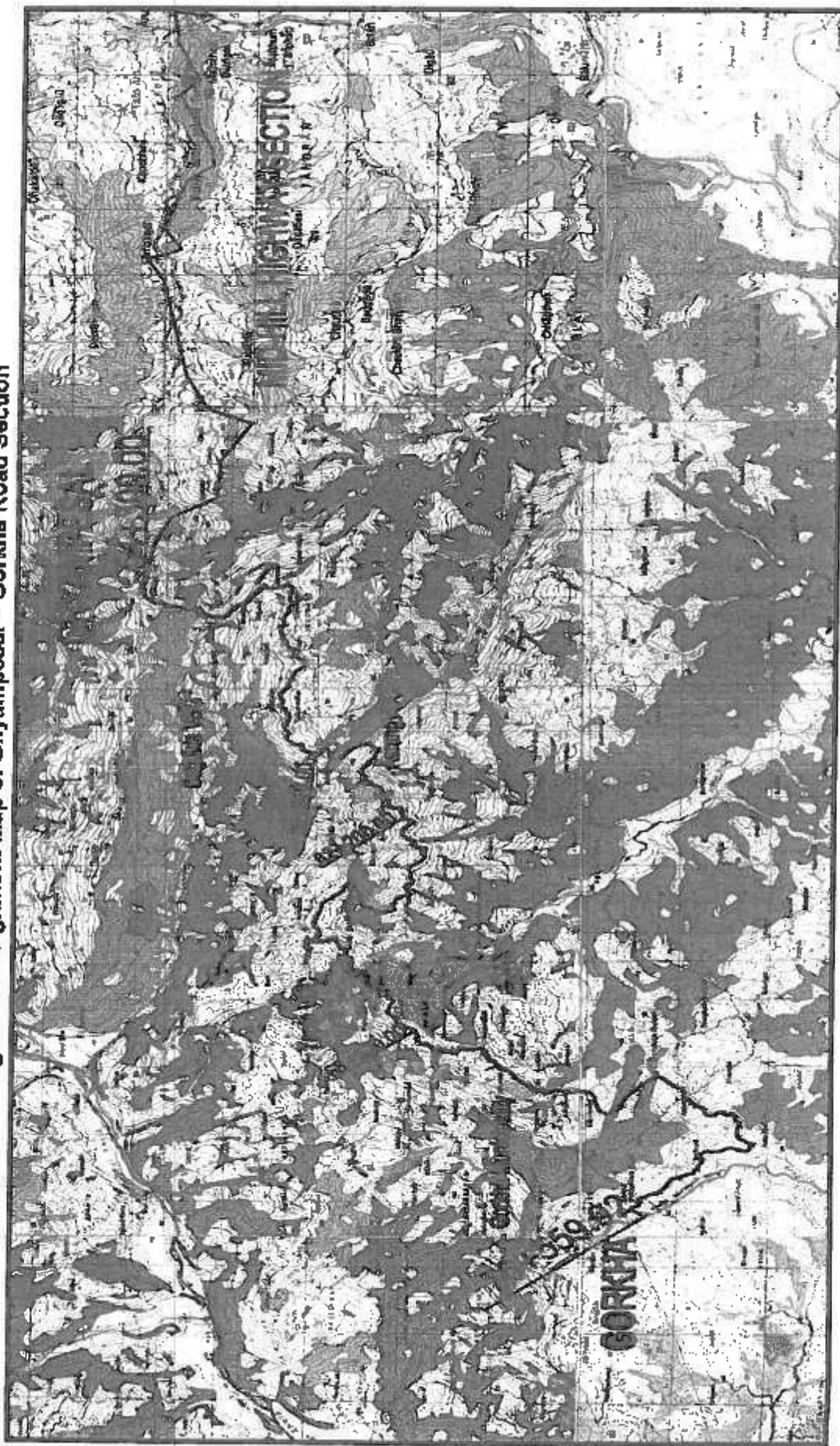


Figure 3.4: Alignment Map of Ghyampesal – Gorkha Road Section



3.6 Materials to be used

The materials to be used in the Subproject works are presented in Table 3.2.

Table 3.2: Summary of Estimated Quantities of Materials

Item Description	Unit	Quantity
Earthwork Excavation	cu.m.	596,810.00
Boulders for soling, random rubble masonry, dry rubble masonry and gabion boxes	cu.m.	50975.00
Reinforced concrete pipe (NP3, 90Ø; NP2, 30Ø)	RM	1591.00
Reinforcement steel	MT	10.50
Formwork materials	sq.m.	11,520.00
Gravel materials for sub base	cu.m.	65,797.00
Base materials	cu.m.	54,592.00
Bitumen for DBST	lit	463,360.00

Source: Detail Design Report of Dolakha-Singali Road, 2016

3.7 Emissions Resulting from Implementation of the Proposal

Solids: Being mainly upgrading works, there will be about 527,685 cu. m. quantity of materials to be excavated and dumped as spoil.

Liquid: Water is required for construction works and at campsites as well. There will be generation of wastewater from worker's campsites and offices.

Noise: The expected noise level along the road is low (maximum 50 dBA) as the traffic is low during the dry season. During upgrading, the movement and operation of construction plant and equipment will increase noise level to some extent. However, by applying mitigation measures, the noise level is expected to be within acceptable level.

Dust: The dust level in the air is observed generally to be low, except during passing of occasional vehicles along the road. The upgraded road will have sealed bituminous layer, and hence the dust emission will be controlled.

3.8 Energy to be used

Mainly diesel and petrol are used for the construction work; LPG and kerosene for labor camp. All such energy demands will be fulfilled by the contractor from outside the project area so as not to create pressure on local fuel demand. The project strictly prohibits illegal extraction of fuel wood and inhibit opening burning as well.

3.9 Details on the technology

The technology used for the construction work will be both machine and labour based. Machine based method is mainly used for specialized works like use of vibrator for surface laying and compacting, use of distributor for laying and use of compactor for finishing bituminous seal etc. whereas labour is mainly employed for the manual work like earthwork, construction of side drain, bioengineering etc.



3.10 Manpower Requirements

For total project construction period (24 months) work force required for the project works is estimated at approximately 45,500 skilled and 187,400 md unskilled laborers.

3.11 Resources required for the implementation of the proposal

The total estimated cost for road upgrading project is estimated to be NRs1454.14million including contingency and VAT.

3.12 Construction planning, Construction schedule

The detailed design and preparation of bid documents for EEAP roads has been carried out under TPPF/PPC-2. The construction work is expected to begin at the third quarter of 2016. A 24 month construction period is estimated followed by a 12-month Defects Liability Period (DLP) enabling the completed project road to be opened by 2019.

3.13 Project Area Delineation

Direct Impact Area (DIA):

This project impact area includes all the areas where activities related to the road construction will take place. This area will be studied in greater detail regarding the impacts on physical, biological as well as socio-economic and cultural environment. The areas within the RoW (30 m) of proposed road (15 m on either side from the centre line of the road) are referred as Corridor of impact (Col) in this Report. The area, within which upgrading work is carried out, is referred as formation width (6.5 m). It includes Nilkantha Municipality(wards 8, 9), Jyamrung VDC (wards 6,7 & 8) of Dhading district, and Baguwa (wards 3,5,8 & 9), Asrang(ward 1), Taple(wards 4,5, 6,7, 8 & 9) VDCs and Gorkha Municipality(wards 3&12) of Gorkha district.

Indirect Impact Area (IIA):

In this area, physical and biological environment will probably experience minimal impacts. However, influx of labor from these areas may affect the socio-economic and cultural environment of the project area. The concerned municipality, VDCs and areas within 200 m from the centre line of road on either side (excluding DIA) are referred as Indirect Impact area (IIA) in this study.

Zone of Influence (Zol):

The zone of influence of project road consists of two municipalities and four affected VDCs falling within its alignment viz. Nilkantha Municipality, Jyamrung VDC of Dhading district, and Baguwa, Asrang, Taple VDCs and Gorkha Municipality of Gorkha district.

3.14 Other necessary matters

Data requirement and study methodology

In order to meet the objectives of IEE, primary and secondary information were collected through field studies, and literature review. The primary data were collected employing the following techniques: PRA, focus group discussions, field observation, and walkthrough along the road alignment. Secondary information were collected from various documents, reports, maps, designs and cost estimates. The likely Impacts (both beneficial and adverse)

were identified and/ predicted by adopting the simple checklists and matrix methods outlined in the environmental guidelines. Based on the likely impacts in terms of its magnitude, duration and extent, the suitable mitigation measures have been designed. Similarly, Environmental Monitoring Plans have been prepared taking into consideration the types of impacts and suggested mitigation measures. Following approach and methodology were adopted during the IEE report preparation.

Methodology Adopted for IEE Study

Terms of Reference (ToR), submitted to the Geo-environment and Social Unit (GESU) of Department of Roads (DoR) for the IEE Study of Road upgrading, was approved by the Ministry of Physical Infrastructure and Transport (MoPIT) on 2070/03/23 BS. Based on approved ToR, IEE Study of the subproject Road has been conducted. The current Study has followed the procedures outlined in approved ToR. The major activities undertaken during the preparation of this report are as follows.

a. Desk Study

The study of the reports and documents relevant to the subproject were carried out to generate secondary data on physical, biological and socio-economic and cultural environment of the subproject area.

b. Field Survey

A walkthrough survey along the proposed road alignment was carried out during January, 2016 to collect information on the physical, biological and socio-economic and cultural environment of subproject area.

(i) Physical Environment

Existing environmental constraints and potential impacts in the project area were studied through field surveys, complemented by secondary information from reports and interviews with some of government officials, schools and local people. Data on physical environment have been derived from available topographical map, site observation, and photographs, consultation with local communities and enquiring about the history of natural disasters like landslides and flooding in the area.

(ii) Biological Environment

The information on composition, distribution patterns and characteristics of vegetation and forest types and sensitive habitat in the project area were assessed from direct field observations, transect walk survey, maps, interaction with forest user groups, and collection of information from district forest offices. A detailed survey was conducted in affected forests for the identification of species, analysis of vegetation and bio-diversity status. Trees losses were estimated by counting method.

In general, possible impact on forest area, especially on 7 m road formation width including areas with drains and other structures) were discussed. By this way total number of trees and plants required to be felled were counted and totalled.

The volume of the affected tree species (timber, fodder and litter) were quantified together with the loss of forest. Tree species having more than 30 cm diameters at breast height (DBH) were counted and measured as tree. Tree species having DBH range between 10 cm

– 30 cm were counted and measured as pole and rest were counted as seedling and saplings. Diameter at breast height (d) was measured at 1.3 meter from the ground level.

The data from tree measurements were quantitatively analyzed for basal area and to calculate the wood volume. Basal Area is the trunk cross-sectional area. The basal area of each of trees was calculated on the basis of diameter at breast height. These parameters were calculated by using following formulae:

$$\text{Basal Area} = \pi d^2/4$$

$$\text{Volume} = \text{Basal Area} \times \text{Tree height} \times \text{Form factor (0.50)} \text{ [m}^3\text{]}$$

(iii) Socioeconomic and Cultural Environment

Data Collection Tools

After identification of PAFs, their baseline information was collected by using the following techniques: Households' Survey, Key Informant Survey, Public Consultation, Observation, and Photographs.

• Households' Survey

A Socio-economic survey of project affected households (whose land and house will be permanently acquired) was carried out. The pre-tested questionnaire was applied by a trained team of enumerators to solicit information from project affected families. Households' survey was conducted for 481 project affected families losing to land and structure. The questionnaire has been designed to cover demographic characteristics, basic health conditions, income and expenditure, water and sanitation related issues, attitude towards resettlement and expectations from the project etc.

• Key Informant Survey

Key informant survey was employed during the field visit to collect information on socio-economic and cultural activities. The VDC level checklist was designed to collect information on basic demographic and migration patterns, food sufficiency and cropping patterns, existence of user's group/committees, public facilities and infrastructure, labour force availability, existence of archaeological and religious sites etc.



Interview with a local person during the field visit Group discussion with local people

• Group Discussions

A group discussion was organized to give special attention to issues concerning specific target groups such as women, children and farmers. Local people, leaders, teachers and key persons were also included in the discussion.

• **Field Observation**

The field observation of the project site was made by the team of sociologist and support staff during September/October, 2015 AD to collect the baseline information of the project area during Poverty and Social Assessment study and during January, 2016 AD to identify the potential environmental impact and the pertinent issues. During the field visit, the team met local stakeholders. Meetings were mainly focused on issues likely to arise due to implementation of the project, existing environment condition of the project area and views/concerns of stakeholders.

c. **Data Processing**

The information collected from different sources were processed and analyzed according to the physical, biological, socio-economic and cultural environment within the zone of influence. The collected primary data during the field survey were the major sources for verification and crosschecking of secondary data. The generated information from primary source was analyzed, tabulated and prioritized.

Impacts were classified in terms of extent (site specific, local, and regional), magnitude (low, moderate, and high) and duration (short term, medium term and long term) as well as nature (direct, indirect), reversibility (reversible, irreversible) and level (low, moderate, and significant). The likely impacts were assessed covering both adverse and beneficial ones.

d. **Public Consultation**

According to Rule 7 (1) of EPR, a 15 days Public Notice, seeking the written opinions from the concerned stakeholders and institutions on possible impacts from implementation of the Proposal, was published in *Annapurna Post*, a national daily newspaper on 26th of Pausa 2072 BS.

Copies of the Public Notice were pasted at the offices of DDC, VDCs, DFO, CFUGs, Schools etc., and a public deed of enquiry (*Muchulka*) was collected confirming the pasting of such notice. Some comments or suggestions from the concerned stakeholders and affected peoples were also collected.

e. **Preparation of IEE Report**

Based on the analysis of impacts and their nature, appropriate beneficial impacts augmentation measures and adverse impacts mitigation measures were prepared. Such measures were based on site-specific issues, past experience on similar projects, and expert judgments. Monitoring plan for the implementation of mitigation measures was prepared. This Report has been prepared in the format prescribed in EPR, Schedule 5 pertaining to Rule 7 of the EPR.

f. **Time, Cost and Specialists Involved**

Total time stipulated for the IEE study was twenty (20) weeks and the study has been carried out under Earthquake Emergency Assistance Project (EEAP). The budget for the IEE study is a part of consulting services for Project Preparatory Consultant under Transport Project Preparatory Facility (TPPF).

Table 3.3: Study Team Composition

S. No.	Name	Position
1.	Shiv Shanker Karki	Environmental Specialist
2.	Prof. Dr. Vishnu Dongol	Geologist
3.	Shiv Prasad Dhakal	Sociologist
4.	Chintamani Sharma	Resettlement Expert
5.	Utsav Subedi	Highway Engineer
6.	Tito Khatriwada	Biologist

3.15 Description of Existing Environment

Baseline information on the existing physical, biological as well as socio-economic and cultural environment of the proposed Project area described in this section.

3.15.1 Physical Environment

a. Road Environment

Dhadingbesi – Arughat – Gorkha Road, designated as a Feeder Road no. F123 as per SRN/DoR starts at Dhadingbesi, the district headquarter of Dhading district, in Bagmati Zone of Central Development Region and ends at Gorkha Bazaar, the district headquarter of Gorkha district. For the study and design purpose the road has been divided into two sections, namely; Dhadingbesi – Ankhu Khola Section (km 00+000 to km 26+774) and Ghyampesal - Gorkha Section (km 54+300 to km 76+887) Section. The middle section from Ankhu Khola to Ghyampesal section (km 26+774 to km 54+300) falls on Mid Hill Highway alignment and is under construction as a high priority project of GoN.

b. Topography and Soils

The road alignment is located in the Lesser Himalaya of the western Nepal. In Dhadingbesi-Ankhu khola section, the road level at start point is 571.50 m amsl at Dhadingbesi Bazaar and 459.378 m amsl at Ankhu Khola Bridge (km 26+774). The highest elevation along this road section is 1206.00 m at km 13+650. The road alignment ascends from the start point up to km 13+650 at Nigalepani and starts descending up to Ankhu Khola Bridge (km 26+775). After Ankhu Khola, the road alignment ascends up to Salyantar and then descends up to Arughat Bazaar. After crossing the Budhi Gandaki River Bridge at Km 37+700 in Arughat Bazaar, the road alignment ascends towards Ghyampesal bazaar. At Pipaldanda, in Ghampesal VDC, the road bifurcates, one towards south-west direction following last section of Ghyampesal - Gorkha Section (km 54+300 to km 76+887) up to Gorkha while another towards north-west direction along Mid Hill Highway alignment linking Pokhara – Baglung Road. In Ghyampesal-Gorkha section, the elevation at start point is 1047.06 m and at end point is 1020.00 amsl at Haramtari chowk in Gorkha Bazaar.

Major parts of the road alignment follow the hilly terrain and a few stretches follow valley sections. The road runs on a moderate to steep sloping terrain covered mainly by cultivated land and partly by forest and bushes. In general, the road passes through rolling to mountainous terrain and whenever it runs through quartzitic terrain, the slope is steeper.

The soils within the road corridor are mainly of three types: alluvial, colluvial and residual soils and are exclusively used for terrace/slope farming. Generally, the soils are of light to medium textured. Colluvial soil is the most dominant soil type along the road corridor and

covers the different places along the road alignment. The loamy and boulder types are found in the lower hilly areas. Steeper slope with rocky exposures are usually covered with thin layers of colluvial soil.

c. Seismicity

Nepal is a seismically active country lying between collisions of the Indian and Eurasian plates and moving continuously resulting in frequent and often devastating earthquakes within the region. Nepal has experienced catastrophic earthquake damages in 1934, 1988 and recently in 2015. Recently tremor of earthquake having epicenter at Barpak of Gorkha and Sindhupalchok in 2015 and its aftershock has caused loss of several thousands of peoples and damaged tremendous value of infrastructures.

The proposed project road falls under the Seismic Zone V, which is susceptible to major earthquakes as per the seismic zone map of Nepal, shown below in Figure 3.4. The project road has minimum impact from the recent 2015 earthquake.

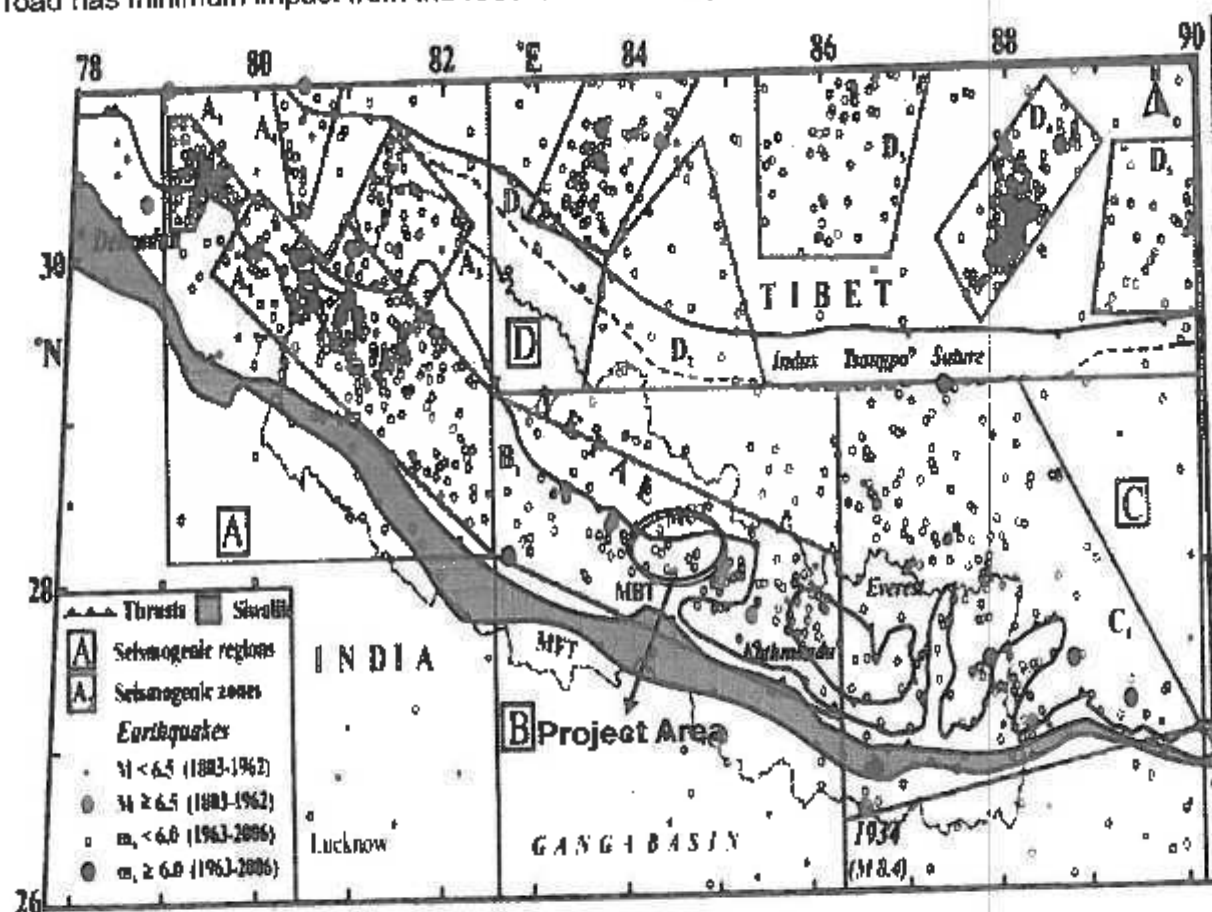


Figure 3.4: Seismicity map (1803-2006) of Nepal and its adjoining region in the Central Himalaya

Source: D. Shanker *et al.*: Discourse on Seismotectonics of Nepal Himalaya and Vicinity-Appraisal to Earthquake Hazard, Geosciences, 2011

d. Geology

The road is located in the Lesser Himalaya of the western Nepal. Geologically, the road alignment passes through the rocks of the Ranimatta Formation (Fig. 3.5), which is equivalent to Kuncha Formation of Central Nepal. The rocks of the Ranimatta Formation is

composed of grey greenish-grey gritty phyllites with conglomerates and white quartzite and basic rocks. The major rock types along the road alignment are phyllites and quartzites, whereas the superficial materials are represented by alluvial and colluvial deposits as well as residual soils.

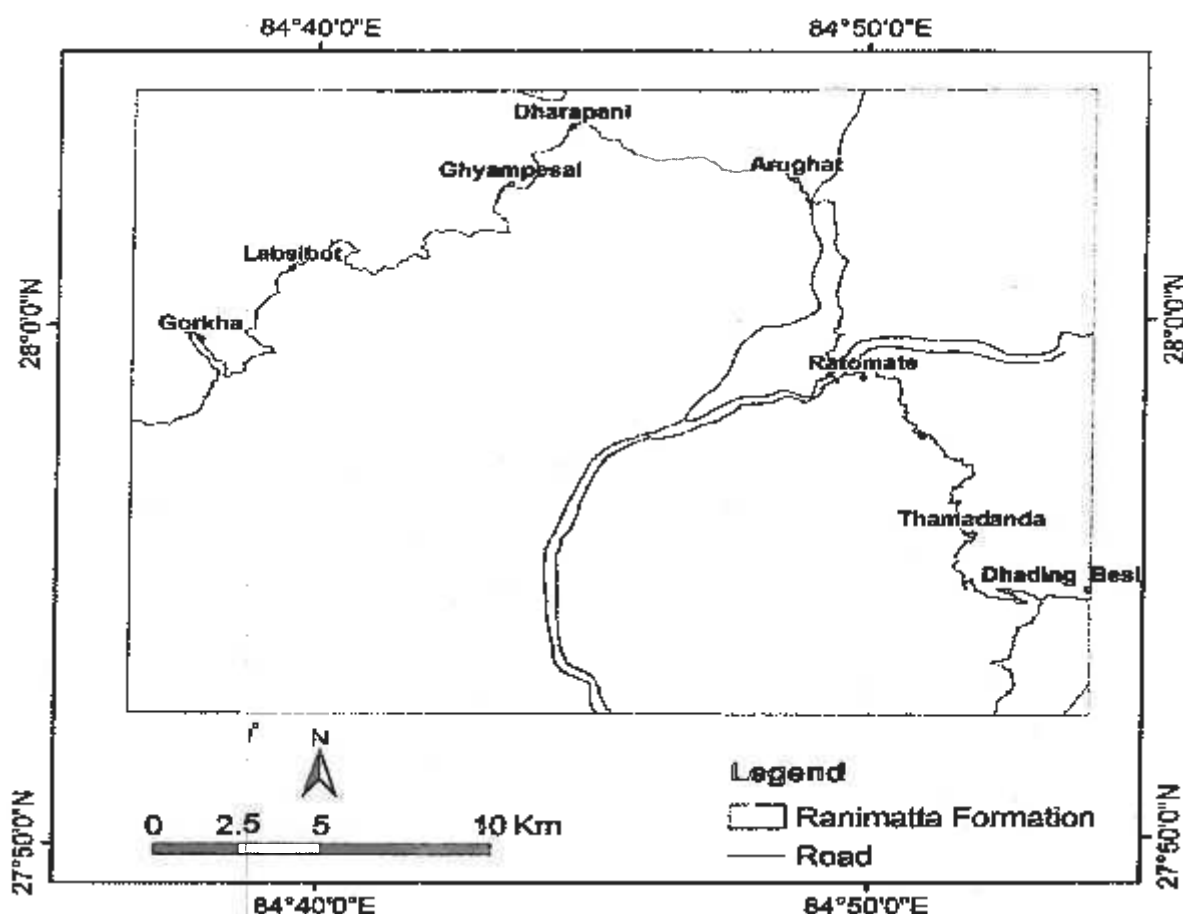


Figure 3.5: Geological Map of Dhadingbesi-Gorkha Road (Source: DMG, 1984)

e. Land Use Pattern

Land use patterns of the direct corridor of impact (CoI) i.e 30 meter (15m on either side from the centerline of the road) was observed and noted during alignment walkthrough survey. The major land use patterns include settlements/bazaar (9%), cultivated land and forests (14.50%), forest (18%), settlement/cultivated land/forests (58.50%) including river, stream & rivulet channels. Details of the land use with chainage of the road alignment has been provided in Table 3.4 below.

Table 3.4: Land Use Pattern along the Road Corridor

Dhading-Ankhu Khola Section (00+000 – 26+774)					Ghympesal-Gorkha Section (54+300 – 76+900)				
S. No.	Chainage		Land Use Pattern	Remarks	Chainage		Land Use Pattern	Remarks	
	From	To			From	To			
1	0+000	0+100	MA	Puchhar bazaar	54+300	55+540	FA+CL		
2	0+100	0+450	FA	Amarawati CF	55+540	55+570	MA	Khanchok, Baguwa VDC – 5	
3	0+450	6+650	SA+CL+FA	Block factory at RHS (Ch. 1+510) Village road on both sides (Ch. 03+270) Village road at RHS (Ch. 6+500)	55+570	67+770	SA+FA+CL		
4	6+650	6+800	FA	Sallaghari Laharapakha CF	57+770	57+840	FA		
5	6+800	7+140	SA+CL+FA		57+840	58+100	SA+CL	Kusinthok (Ch. 58+020 – 58+060)	
6	7+140	7+640	FA	Sri Patela CF	58+100	60+200	SA+CL+FA		
7	7+640	8+900	FA+SA+CL		60+200	60+240	MA	Jhingateya, Ashrang VDC	
8	8+900	9+260	FA		60+240	62+220	SA+CL+FA		
9	9+260	9+860	FA+SA+CL		62+220	62+280	MA	Tapleshyam bazar	
10	9+860	10+400	FA	Sri Betini Deurali CFUG	62+280	62+480	SA+CL+FA		
11	10+400	10+560	FA+CL		62+480	62+720	CL+FA		
12	10+480	10+700	MA	Jyamire bazar, Nlikantha - 9	62+720	62+760	SA		
13	10+700	10+900	FA		62+720	64+940	FA+CL		
14	10+900	11+100	FA+CL		64+940	65+400	SA+CL+FA		
15	11+100	12+520	FA	Sri Jaljala CF	65+400	65+600	MA	Kokhe, Ahale Bhanjyang – 4, Gorkha	
16	12+520	14+480	SA+CL+FA		65+600	65+710	CL		
17	14+480	14+700	FA	Sri Bhadaure CF	65+710	65+820	SA		
18	14+700	18+500	SA+FA+CL		65+820	67+300	SA+CL+FA		
19	18+500	19+180	FA	Sri Bagalicha CF	67+300	68+660	FA+CL		
20	19+180	19+200	SA+FA+CL		68+660	70+480	SA+CL+FA		
21	19+200	19+72	FA+CL		70+480	71+020	CL+FA		
22	19+720	20+000	SA	Thumki, Jyamung VDC (Ch. 19+845)	71+020	71+200	SA		
23	20+000	20+420	CL		71+200	71+660	SA+CL+FA	Way to Namjung (Ch. 71+960)	
24	20+420	20+760	SA+CL+FA		71+660	72+100	FA		

Dhading-Ankhu Khola Section (00+000 – 26+774)					Ghyampesal-Gorkha Section (84+300 – 76+900)				
S. No.	Chainage		Land Use Pattern	Remarks	Chainage		Land Use Pattern	Remarks	
	From	To			From	To			
25	20+780	22+720	FA	Sri Pale CF	72+100	73+480	SA+CL+FA	APF Camp at Ch-72+840	
26	22+720	22+760	MA+SA		73+480	73+880	FA	Sri Bhogateni Chyandanda CF	
27	22+760	23+700	FA	Sri Seetale Taapu CF	73+880	74+400	SA+CL+FA		
30	23+700	25+070	SA +CL+FA		74+000	76+900	Settlement Area	Gorkha Bazaar	
31	25+070	26+070	FA	Sri Satyadevi Thulokhola CF					
32	26+070	26+774	MA+SA+CL	Tarebesi, Jyamrung (Ch. 26+070 – 26+130)					

Source: Field Survey, 2015
Legend: FA- Forest Area, CF-Community Forest, MA- Market Area, SA- Settlement Area, CL- Cultivated Land

Source: Field Survey, 2015

Legend: FA- Forest Area, CF-Community Forest, MA- Market Area, SA- Settlement Area, CL- Cultivated Land

f. Meteorology and Climate

Dhadingbesi – Arughat - Gorkha road lies in the sub-tropical and temperate climatic region. Generally, rainy season starts from June and ends in September. The meteorological record shows unevenly distributed monsoon rain in the Subproject area with the total average annual rainfall of 1,600 ml. The general climatic condition is cold in winter and hot in summer with average minimum temperature of 5°C and average maximum temperature of 36°C.

g. Hydrology and Drainage

There are few small and large streams (including dry streams) across the Dhadingbesi-Arughat-Gorkha road alignment as water resources. The road alignment crosses Ankhu Khola at km 26+775 and Budhigandaki at km 37+700. The type of substructure of bridge is RCC, solid and intermediate lane without sidewalks. No new bridges are provisioned under the scope of EEAP. There are a number of small crossings where small cross drainage structures are provided in the project road sections.

There are thirty four (34) irrigation pipe crossings along the road alignment (Chainages: 14+930, 15+220, 15+300, 15+380, 15+775, 15+930, 16+450, 16+620, 16+660, 17+820, 17+980, 18+140, 18+300, 18+310, 20+087, 20+100, 20+230, 20+340, 22+500, 22+600, 24+450, 24+465, 24+560, 24+620, 24+800, 55+940, 55+960, 57+900, 57+960, 59+285, 61+830, 67+060, 68+850, 70+460). No wetlands are found within the vicinity of the road.

h. Slope Stability

There are about 3 slides (km 13+720, km 55+030 and km 64+140) along the road alignment. These are treatable size of cut slope failures in the colluvial deposits. Seepage around km 13+720 is treatable with minor drain management. Slide around km 55+030 is minor failure and cannot produce any hazards for upgrading of road alignment. Seepage around km 64+140 is in cultivated land and the area is moist. Special water management and geotechnical stability measures are essential on this location.

i. Cross Drainage Structures

The Dhadingbesi-Arughat-Gorkha road alignment crosses Ankhu Khola at km 26+775 and Budhigandaki at km 37+700. No new bridges are provisioned under EEAP. There are a number of small crossings where small cross drainage structures are provided in the project road sections. Under the present project scope, 2 slab culverts, 183 pipe culverts (900 mm dia.) and 1 causeway will be provided. No new bridges are proposed under the proposed upgrading works.

j. Source of Construction Materials

The work requires boulders for stone pitching, dry stone masonry and gabion walls. Environmentally acceptable and technically viable sources of boulders are identified to be one local crusher plant at km. 26+000 and the source of gravel is Ankhu River basin at km. 26+775. Other sources are at km. 37+700 (Budhigandaki), Hill Quarry and as elsewhere river basin sources are Daraudi River at 23 Km and Marshyangdi river at 35 Km from project end point Gorkha bazaar of Gorkha District and Trisuli river 19 Km from project road start point Dhadingbesi (Annex 9).

Table 3.5: Probable Construction Materials Quarry Sites

S. No.	Chainage	Type of material	Extractable Quantity, m ³	Equipment used for materials Extraction
1	26+000			
	Crusher Plant River Boulder (Ankhu Khola Bank) Crushed boulder Aggregate	Base Course (CSB)	NA	
2	27+500		43200	
	Natural River Gravel (Ankhu Khola Bank)	Boulder	2160	Excavator, Bulldozer, Loader, Tipper, Trucks, Tractors, Shovel and Crusher Plant and Screen plant etc.
		Sand	8640	
		Sub-base	10800	
		Base Course (CSB)	17280	
		Pavement Aggregate	4320	
3	36+300		42000	
	Natural River Gravel (Budhigandaki Bank), Arughat	Boulder	2100	Excavator, Bulldozer, Loader, Tipper, Trucks, Tractors, Shovel and Crusher Plant and Screen plant etc.
		Sand	8400	
		Sub-base	10500	
		Base Course (CSB)	14700	
		Pavement Aggregate	6300	
4	55+200			
	Hill Side (Ghyampesal)	Boulder	Hill Side Alignment	Excavator, Bulldozer, Loader, Tipper, Trucks, Tractors, Shovel and Crusher Plant and Screen plant etc.
		Sub-base		
5	59+800			
	Hill Side	Boulder	Alignment Hill side	
		Sub-base		
6	70+800			
	Hill Side	Boulder	Alignment Hill side	
		Sub-base		
7	Elsewhere Quarry		38500	
	River gravel (Daraundi River Bank)	Boulder	1925	Excavator, Bulldozer, Loader, Tipper, Trucks, Tractors, Shovel and Crusher Plant and Screen plant etc.
		Sand	11550	
		Sub-base	9625	
		Base Course (CSB)	11550	
		Pavement Aggregate	3850	
8	Elsewhere Quarry		29800	
	River Gravel (Marshyangdi Khola) Confluence of Daraundi Khola	Boulder	1490	Excavator, Bulldozer, Loader, Tipper, Trucks, Tractors, Shovel and Crusher Plant and Screen plant etc.
		Sand	7450	
		Sub-base	7450	
		Base Course (CSB)	8940	
		Pavement Aggregate	4470	
9	Elsewhere Quarry		24000	
	Trisuli River Basin Natural Gravel (U/S Malekhu-Dhading Bridge)	Boulder	1200	Excavator, Bulldozer, Loader, Tipper, Trucks, Tractors, Shovel and Crusher Plant and Screen plant etc.
		Sand	4800	
		Sub-base	6000	
		Base Course (CSB)	8400	
		v. Pavement Aggregate	3600	

k. Air, Noise and Water Quality

The air quality observed was good and expected to be within national ambient air quality standards of Nepal. Likewise, water quality in the proposed road section is observed to be good since it is free from any kind of pollution. There is no defecation problem observed around the drinking water sources. However, during the monsoon season the quality of water may be deteriorated due the accumulation of silt, landslide, gully erosion etc. The proposed area does not have any sources of noise nuisance.

3.15.2 Biological Environment

a. Vegetation

The dominant forest and fodder species reported along the road alignment are *Schima wallichii* (Chilaune), *Castanopsis indica* (Katus), *Shorea robusta* (Sal), *Alnus nepalensis* (Uttis), *Dalbergia sissoo* (Sisau) etc.

b. Non Timber Forest Products (NTFP)

Non timber forest products (NTFPs) are defined as any kind of products derived from forest species other than timber and fuel wood. The major NTFP species found in the subproject area are Amala (*Embllica officinalis*), Chutro (*Berberis aristata*), Swertia Chirayita (Chiraito), Koiralo (*Bahunia variegata*), Timur (*Zanthoxylum armatum*), Ghodtapre (*Centella asiatica*) and Bojho (*Acorus calamus*) and Majitho (*Rubia manjith*).

c. Protected Vegetation

Among the plant species present in the forest area along the road alignment, only Sal (*Shorea robusta*) is the protected plant species, and is legally protected as per Forest Act 1993 and Forest Rules, 1995.

d. Community Forests

There are eleven (11) CFs along the proposed road alignment as given in the Table 3.6.

Table 3.6: Community Forests (CF) Along Road Alignment

SN	Name of Community Forest	Location	Main Species
1	Amarawati CFUG	Nilkantha – 8, Dhading	Uttis, Chilaune, Sal
2	Sallaghari Laharepakha CFUG	Nilkantha – 10, Nigalepani, Dhading	Uttis, Chilaune, Sal
3	Sri Patela CFUG	Jyamrung – 6	Sal, Uttis, Chilaune
4	Sri Betini Deurali CFUG	Jyamrung-6	Sal, Uttis, Chilaune
5	Sri Jaljala CFUG	Jyamrung-6	Sal, Uttis, Chilaune
6	Sri Bhadaure CFUG	Jyamrung-6	Sal, Uttis, Chilaune
7	Sri Bagaincha CFUG	Jyamrung – 6	Uttis, Sal, Chilaune
8	Sri Pale CFUG	Jyamrung - 7	Uttis, Chilaune, Sal
9	Sri Saattale Taapu CFUG	Jyamrung - 7	Uttis, Chilaune, Sal
10	Sri Satyadevi Thulokhola CFUG	Golabhanjyang, Jyamrung-8	Chilaune, Katus, Sal
11	Sri Bhogateni Chyandanda CFUG	Taple – 4,5,6, Gorkha	Chilaune, Katus

Source: Field survey, 2016

e. Private forest

Local people have planted trees in some patches of their private land. The maintree species is Uttis, Chilaune and other fodder species. These are not registered as a private forest in DFO. People do not use the private trees for commercial purpose. No religious, leasehold and government forest are found along the road alignment.

f. Trees on Farm land

Trees have been planted on farm land. The species are mainly fodder species and common species are Salla, Uttis, and Chilaune etc. Other species include Lapsi, Alaichi, Amriso, Orange etc.

g. Terrestrial Wildlife

Some notable species reported in the project area are Jungle cat (*Felis chaus*), Jackal (*Canis aureus*), Malsanpro (*Martes flavigula*), Monkey (*Macacca mulatta*), Fox (*Vulpes vulpes*), Dumsi (*Hystrix indica*), Lokharke (*Funambulus sp.*).

Similarly, birds are Crow (*Corvus splendens*), Jureli (*Pycnonotus cafer*), Koili (*Cuculus micropterus*), Dhukur (*Streptopelia spp.*), Bhangera (*Passer domesticus*), Pigeon (*Columba livia*) etc. However, none of these wild lives are endangered species. The road does not fall under any protected or buffer zone area.

h. Fish, Amphibians and reptiles

The major rivers in the road corridor is the Ankhu Khola and Budhi Gandaki River. Most common species of fish are Katle (*Accrocheilus spp.*), Buduna (*Garra annandalei*) and Asala (*Schizothorax plagiostomus*). The road does not fall under any protected or buffer zone area.

i. Protected area

The project area does not contain any national park, wildlife reserve, conservation area, hunting area, including buffer zone area, world heritage site and other protected areas.

3.15.3 Socio-Economic and Cultural Environment

a. Population status of project affected districts

According to the Census 2011 (CBS), total population of Dhading and Gorkha districts are 336,067 and 271,061 respectively and having 46.96% and 44.65% male, 53.03% and 55.35% female population respectively. The average family size of project districts is 4.55 and 4.07 respectively. The population density per square kilometer is 174.49 sq. km in Dhading and 74.98 sq. km in Gorkha.

Table 3.7: Population of the project districts

District	Total HHs	Total Population	Male (%)	Female (%)	Average HH Size	Population density	Area in Sq. km
Dhading	73,851	336,067	46.96	53.04	4.55	174.49	1926.00
Gorkha	66,506	271,061	44.65	55.35	4.07	74.98	3614.70
Total	140,357	607,128	45.81	54.20	4.31	124.73	2770.35

b. Demographic status of project affected municipalities/VDCs

According to 2011 census, total population of 2 municipalities and 4 VDCs touched and traversed by the proposed upgrading road section is estimated at 95705 with 24385 households. Which accounts for 9.30 % of the project districts population. Gender-wise population distribution is estimated at 44.94% male and 55.06% female.

Table 3.8: Demographic description of Project Affected Municipality/VDCs

Municipality/VDCs	Total HHs	Population			Average HH Size
		Total	Male	Female	
Dhading District					
Nilkantha Municipality ¹	9702	39578	18111	21467	4.10
Jyamrung VDC	1653	6998	3024	3974	4.23
Gorkha District					
Asrang	831	3,406	1,443	1,963	4.10
Baguwa	494	1965	862	1103	3.98
Taple	1120	4496	1925	2571	4.01
Gorkha Municipality	10585	39262	17585	21677	3.77
Total	24386	95705	42960	52755	4.03

Source: CBS 2011

c. Caste/Ethnic Composition, Language and Religion

Though varieties of Caste and Ethnic groups reside in subproject area, the Kshetri (16.39%), Tamang (16.8%), Brahmin Hill (15.34%), Newar (14.04%), and Magar (12.89%) are the dominant groups. Similarly Sarki, Kami, Dhimi/Dholi, Gharti/Bhujel, and Kumal do also have remarkable presence within the district. Ethnic composition of affected municipality and VDCs is presented in Annex 7.

In subproject area, languagewise, 84.55% of total population speak Nepali, 3.8% people speak Gurung and 3.36% people speak Tamang. Urdu is spoken by 1.95% followed jointly by Magar and Kumal language with 1.69%, and Newari 1.46%. Along with these languages there are also various languages having users less than 1% as presented in Annex 7.

d. Literacy Rate and Education Level

As per Census report 2011, about 64.39% population aged five and above are literate and can read and write. Overall literacy rate in the subproject area is 61.15%. About 10.84% population have passed School Leaving Certificate (Annex 7).

e. 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.

¹Nilkantha Municipality is a Municipality in Dhading District in the Bagmati Zone of central Nepal. The municipality was established in 18th May 2014 merging with the existing Nilkantha (Dhading Besi), Sunaula Bazar, Murali Bhanjyang, Sangkosh Village development committees.

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 (Source: Baseline Survey, September 2015).

f. Sanitation

Access to toilet is considered as an indicator of sanitation. In the project influence area 87.14% of the households have private toilets (CBS, 2011). Those who have toilet mostly possess either pan or pit type toilet with flush system (Annex 7).

g. Drinking Water

A major source of drinking water was found to be from piped water (60.04%) supplied through community made water tanks. About 34.11% of the household also use spout water as a source of drinking water. About 0.34 % of the households use river/stream for the purpose of drinking water (CBS, 2011). The use of underground water for drinking water is insignificant (Annex 7).

h. Occupational Status

Households are found to depend on more than one occupation in each settlement. Almost all reported that they are involved in different occupation. However, the majority of population are students (35.14%). The major occupation of the households is agriculture which comprises 23.59 % of the total household's members. Similarly, about 10.11% depend on trade and business whereas 7.22% are engaged in foreign employment, 5.42% are service holders and about 6.62% population are housewife and unemployed. Foreign employment especially in gulf countries and Malaysia is also emerging as a new source of economic opportunities for the local people within Zol (Annex 7).

i. Physical or Cultural Heritage

Dhading District has many religious temples. Among them Tripurasundari Mai is one of the famous in Nepal as well, which lies in the northern part of the district. Similarly Siddha Sthan in Salang VDC is a famous Hindu religious site. Others are Bhairabi in Sunaula Bazar.

Most of the local people in Zol of the Subproject are Hindu. There's also significant presence of Muslims in Gorkha municipality, Taple and Asrang VDCs. They celebrate festivals, cultural rites and rituals as per their religion and tradition. Hindu followers mainly celebrate Dashain, Tihar, Maghe Sakranti, Saune Sakranti and others, whereas Muslim people celebrate Id, Bakarid etc. Manakamana Temple situated in the Gorkha district of Nepal is the sacred place of the Hindu Goddess Bhagwati, an incarnation of Parvati. The name Manakamana originates from two words, "mana" meaning heart and "kamana" meaning wish. Venerated since the 17th century, it is believed that Goddess Bhagawati grants the wishes of all those who make the pilgrimage to her shrine to worship her.

3.15.4 Socio-economic Profile of the Affected Households (DIA)

a. Demographic information

Based on the household survey data, estimated 4028 persons of 760 households will be affected from the implementation of the project. Out of 760 affected households 25 households are PAF and 7 households are Severely Project Affected Families (SPAFs) (Refer Table 3.14, Table 1.2: Summary Resettlement Plan). Details of sampled affected households and their demographic structures is given in table 3.9 below.

Table 3.9: Demographic information of Affected (sampled) Households

Districts	VDC/Municipality	HHs	Male	Female	Total	Average HH Size
Dhading	Nitkantha Municipality	168	419	417	836	4.98
	Jyamrung VDC	74	225	195	420	5.68
Gorkha	Asrang VDC	11	42	34	76	6.91
	Baguwa VDC	34	96	80	176	5.18
	Baguwa VDC	21	66	52	118	5.62
	Taple VDC	105	313	258	571	5.44
	Gorkha Municipality	48	146	119	265	5.52
	Total	481	1367	1203	2570	5.34

Source: Household Survey, February 2016

b. Caste/ethnicity

Table 3.10 below shows the ethnic composition of sampled affected households. Brahmin caste group consists of 37.42%, followed by Dalits with 18.10 %, IP with 17.67% and Chhetri 15.38% and remaining others caste groups include Muslim with 11.43%.

Table 3.10: Caste/Ethnic Composition of the affected Households

S.N	Caste/Ethnicity	No of HHs	%
1	Brahmin	180	37.42
2	Chhetri	74	15.38
3	Dalit	87	18.10
4	Janjati	85	17.67
5	Muslim	55	11.43
	Total	481	100.00

Source: Household Survey, Feb 2016

c. Literacy Status of affected Population

The overall literacy status of affected household reveals that 5.57% population are illiterate, and 26.28% are just able to read and write. However, the highest percent of population (15.88%) have been found within class 6-10 education. The proportion of people obtaining higher education or above bachelor's level has been found to be 8.61 %. Women literacy status is comparatively low in comparison to male literacy status.

Table 3.11: Literacy Status of Affected Population

S.N	Education	Gender(below 5 years)			%
		Male	Female	Total	
1	Literate	248	384	632	26.28
2	Primary	249	160	409	17.01
3	Lower Secondary	182	157	339	14.10
4	Secondary	219	163	382	15.88
5	Higher Secondary	200	102	302	12.56
6	Bachelor	130	77	207	8.61
7	Illiterate	45	89	134	5.57
	Total	1273	1132	2405	100.0

Source: Household Survey, Feb 2016

d. Occupational Status

Major occupation of the households is agriculture which comprises 34.60% of the total households. Similarly, about 7.00% depend on trade and business whereas 10.03% are engaged in foreign employment, 11.10% are service holders, 24.61% are students and about 4.28% population are unemployed. Remaining 6.64% are others and 1.74% are only wage labors.

Table 3.12: Occupation of Affected Population

S.N	Occupation (above 14 years)	Population			
		Male	Female	Numbers	%
1	Agriculture sector	276	500	776	34.60
2	Wage Labour	25	14	39	1.74
3	Services	90	13	103	4.59
4	Private job	111	35	146	6.51
5	Business	97	60	157	7.00
6	Students	295	257	552	24.61
7	Unemployed	39	57	96	4.28
8	Foreign Employment	213	12	225	10.03
9	Others (old age, not respondent etc)	33	116	149	6.64
	Total	1197	1064	2243	100.0

Source: Household Survey, February 2016

e. Food Sufficiency Level

Among the surveyed affected household's about 26% have sufficient production for their household consumption. Table 3.13 below shows the food sufficiency level among affected households.

Table 3.13: Food Sufficiency Level

S.N	Food Sufficiency Level	HHs	Percentage
1	No production	24	4.99
2	Less than 3 Months	72	14.97
3	3 to 6 Months	130	27.03

S.N	Food Sufficiency Level	HHs	Percentage
4	6 to 9 Months	111	23.08
5	9 to 12 Months	123	25.57
6	Saving	21	4.37
	Total	481	100.00

Source: Household Survey, February 2016

f. Vulnerable Households

Of the total 481 surveyed affected households, 25 households are reported as vulnerable of different categories. Among them, 15 households fall below poverty level and 10 households are female headed. Table 3.14 provide the breakdown of affected vulnerable households by type of vulnerable categories.

Table 3.14: Affected Vulnerable Households

S.N.	Vulnerable Category	No. of HHs	Percentage
1	Below Poverty Level	15	60.00
2	Female headed	10	40.00
	Total	25	100.00

Source: Household Survey, February 2016

g. Average Annual Income and Poverty Status

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 3.15: Average Annual Household Income

Income Range	No of HHs	%
<50000	12	2.49
50000- 130500	91	18.92
130500- 200000	68	14.14
200000- 300000	144	29.94
300000- 400000	73	15.18
400000- 500000	39	8.11
>500000	54	11.23
Total	481	100.00

Source: Household Survey, February 2016

Based on the CBS criteria of consumption requirement for minimum subsistence, out of 481 surveyed households, 101 (21.45%) fall under the below poverty line.²

² 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

CHAPTER 4

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

The identification and prediction of impacts has been made by giving due consideration to the proposed actions/activities during construction and operation stages of the Project. Both beneficial and potential adverse impacts have been analysed.

The potential impacts have been predicted in terms of their magnitude of significance (low, moderate and high), extent (site specific, local and regional) and duration (short term, medium term and long term) as well as their nature (reversible, irreversible). The possible impacts from the proposal during the construction and operation stages are presented as following:

4.1 Beneficial Impacts

Summary matrices of the potential impacts and the corresponding augmentation related to Social, Economic and Cultural Environment are presented in Table 4.1.

4.1.1 Construction Stage

Following beneficial impacts are anticipated during construction stage:

i. Increased Income

The road upgrading/improvement will create about 187,400 unskilled and 45,500 skilled person days' work. Local people would generate income from unskilled and semi-skilled jobs. The amount of money that is earned by the wages will directly enhance the operation of various economic activities and enterprise development. *This impact is direct, high significance, local in extent and short term in nature.*

ii. Employment of Women and Disadvantageous Groups

Priority will be given to women and disadvantageous peoples for both skilled and unskilled work. This will increase employment of these peoples and contribute to enhance quality of life. *This is direct impact, high significance, local in extent and short term in nature.*

iii. Rent from Land Acquired Temporarily During Construction

Land will be needed for establishment of campsite, stockpiling of construction material etc. during construction. The land used for such purpose also acts as a means to income. *This is indirect impact of low significance, local in extent and short term in nature.*

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.

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 in extent and long-term in nature.*

v. Skill Enhancement

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 in extent and long-term in nature.

4.1.2 Operation Stage

i. Employment of Local People

Following the increased access and transport, other socio-economic developments like education, health, irrigation, water supply, electricity, communication, market, and banking will follow. The operation of road will also contribute to raise quality services as more competent agencies and people will enter into the area to provide the services. New market will need people with different qualifications. Hence this will increase employment at local level. *This impact will be indirect, moderate significance, regional in extent and long-term in nature.*

ii. Improved Access and Reduced Travel Costs

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 in extent and long-term in nature.

iii. Increased 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.

This impact is indirect, moderate significance, regional in extent and long term in nature.

iv. Rise of Land Values

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, high significance, local and long term in nature.

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 impact is indirect, moderate significance, local in extent and long-term in nature.*

vi. Explore Opportunities on horticultural crops/ cash crops cultivation

Improved road facility provides increased access to market centers for the local farmers. It will encourage them to grow more crops in accordance with the market demand. The demand for citrus fruits, vegetables and other livestock products will grow in the local market as well as in bigger markets such as Kathmandu and other urban centers. The combined effect of improved market accessibility and agricultural support service will increase the agricultural productivity and cropping intensity in the area. *The impact will be indirect, moderate significance, regional in extent and long-term in nature.*

vii. Development of Tourism

Both the Project districts are famous for religious and historical places. More pilgrims will visit this area due to easy accessibility. Flow of visitors due to road upgrading will contribute in the enhancement of economic activities of the area which will increase the living condition of the local people. *The impact will be indirect, moderate significance, local in extent and long-term in nature.*

4.2 Adverse Impacts

4.2.1 Physical Environment

A. Pre-Construction Stage activities to be done

i. Location of Stockpiling of Construction Materials

Locations for stockpiling construction materials will be selected by the contractor and get consent from landowner/relevant government authority and get approval from the Supervision Consultant.

ii. Permission/clearance from concerned agencies

Necessary permission/clearance will be taken by the contractor from concerned agencies like District Forest Office, DDC, Municipality, VDCs etc. before commencing the actual construction work.

iii. Dismantling of structures

Dismantling of the existing structures including stockpiling of the reusable materials and disposal of unusable materials, such as Stone masonry, Gabion masonry, Concrete (plain and reinforced), Dry stone masonry, RCC Pipe culverts etc. will be done during the pre-construction stage.

iv. Clearance of site

As a part of site clearance, the contractor will perform the activities like clearing and grubbing including uprooting, transporting and disposing of vegetation, grass, bush, sapling and trees of girth up to 300 mm (measured at a height of 1m above the ground level).

B. Construction Stage

i. Land Use Change

About 20.76 ha of additional land will be required for the Project works. Of total additional land falling on road alignment, 16.01 ha is agricultural/cultivated land and remaining 4.75 ha is government land. As the road passes through 11 community forests, 4.40 ha of forest area will be affected. *The impact will be direct, of low significance, site specific, and long-term in nature.*

ii. Damaged private structures

About eight (8) private structures (3 residential and 5 residential cum commercial) belonging to seven (7) households is required to be dismantled. *Impact is direct, high significance, site-specific, and long-term in nature.*

iii. Landslides and Erosion slope destabilization

There are about three (3) numbers of minor cut slope failures in colluvial deposits along the road section. Seepage around km 13+720 is treatable with minor drainage management. Slide around km 55+030 is minor failure and cannot produce any hazards during upgrading of road. These two slides are natural type. Seepage around km 64+140 is man made and in cultivated land and the area is moist. Special water management and geotechnical stability measures are required on this location. *Impact will be direct, moderate magnitude, site specific and short-term in nature.*

iv. Sedimentation

Removal of vegetation and open cuts which expose soil to rain and wind could cause soil erosion, downstream sedimentation as well as landslides. This can become a major source of silt in the monsoon increasing suspended and bed load in rivers and clogging drains of road and irrigation canals. Such erosion can also trigger landslides. However, being an existing road, the construction work will not require major earth excavation. Project road sections do not cross any major rivers. *The impact will be direct, low magnitude, site specific and short-term in nature.*

v. Solid waste Disposal

Labour camps, contractor's site office, work camps and other project office will generate about 150 kg/day of solid wastes. Though these sites will be located at different locations,

haphazard dumping and open burning of solid wastes will degrade the local environment. It may spread different types of diseases if the biodegradable wastes are allowed to decay at open spaces.

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

vi. Liquid waste and its management

Water is required for construction works and at campsites as well. There will be generation of wastewater from worker's campsites and offices. *The impact will be indirect, of low magnitude, site specific and short term in nature.*

vii. Hazards caused by Combustible and toxic materials

During road upgrading works, contractors need fuel, oil and lubricants, petrol and diesel, bitumen, solvents and other toxic chemicals for use in construction related activities. Inappropriate storage and handling may cause spillage or leakage polluting surface and ground water sources, contaminate soil, cause fire and explosion hazards and nuisance to public. *The impact will be direct, of moderate magnitude, local in extent and short term in nature.*

viii. Water Pollution

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, sewage, garbage and waste water from worker camps will be washed out to nearby water sources causing water pollution and consequently affecting aquatic fauna and flora, farmlands and creating health hazards. Two road sections under the present project do not have any major rivers crossed by them. *The impact is indirect, low magnitude, local in extent and short term in nature.*

ix. Noise and Vibration

At present, the Subproject area does not experience significant noise pollution. However, during construction, the increased construction activities, mainly movement of heavy equipment and the operation of crusher plants, may cause noise pollution in the vicinity of the plants. There may be vibration effects along the road alignment resulting in cracks in old sheds and houses due to use of vibratory rollers, tippers, chips spreaders etc. Increased noise and vibration will affect the nearby communities and wild animals as well. *The anticipated impacts from noise and vibration is direct, moderate magnitude, site-specific in extent and short term in nature.*

x. Stockpiling of Construction Materials

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. Erosion from stockpiled material will cause water pollution, land degradation, loss of agricultural productivity, and nuisance. *The impact is direct, moderate magnitude, site specific and short term in nature.*

xi. Change in River Flow Pattern

Proposed road upgrading crosses few number of minor natural drainages along its alignment. 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, re-construction/repairing of culverts etc. The main impact of this is creation of temporary inundation areas closer to the above locations during rainy season. The project road sections do not cross any major rivers. *The impact due to this will be direct, of low magnitude, site specific, and short-term in nature.*

xli. Impact due to Spoil Disposal from Construction and Labor Camps

Spoil is generated whenever there is more cut than fill. Disposal of spoil along hillside will cause problem to agricultural land and forest. Besides this spoil may also be generated from labor camp. The common problems from inappropriate disposal of spoils are contamination of water bodies, bad odor, forest degradation, damage to property downhill, and degradation of agricultural land especially when combined with unmanaged surface water runoff. An estimated 527685 cubic meter of spoil will be generated from the proposed road upgrading works. *The impact from spoil disposal will be direct, of moderate magnitude, site-specific and short-term in nature.*

xlii. Impacts due to Quarrying of Materials and Borrow Pit Operation

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. Material quarry sources are Ankhu River basin at km. 26+775, Budhigandaki river at km. 37+700 and as elsewhere river basin sources are Daraudi River at 23 Km and Marshyangdi river at 35 Km from project end point Gorkha bazaar of Gorkha District and Trisuli river at 19 Km from project road start point Dhadingbesi. *Impacts from quarrying and borrowing will be direct, high magnitude, site-specific and long-term in nature.*

xlii. Impact due to Air and Noise Pollution Cutting, filling

The main 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. Air pollution will cause inconvenience to local people who reside closer to the proposed road or quarries etc. Noise impacts will not be significant during cutting and filling activities.

Impact is predicted as direct, of low magnitude, site-specific and short term in nature.

xv. Impact on Irrigation canal

There are thirty four (34) irrigation pipe crossings along the road alignment (Chainages: 14+930, 15+220, 15+300, 15+380, 15+775, 15+930, 16+450, 16+620, 16+660, 17+820, 17+980, 18+140, 18+300, 18+310, 20+087, 20+100, 20+230, 20+340, 22+500, 22+600, 24+450, 24+465, 24+560, 24+620, 24+800, 55+940, 55+960, 57+900, 57+980, 59+285, 61+830, 67+060, 68+850, 70+460). The road upgrading work will impact these irrigation

crossings and damage as well. *Impact is predicted as direct, of moderate magnitude, site-specific and short term in nature.*

xvi. Flood/rainfall

Roads that intersect drainage basins generally modify the natural flow of surface water by concentrating flows at certain points and, in many cases, increase the flow velocity. Diversion or disruption of natural surface water flow and drainage is often inevitable in road projects. Blockage of natural drainage path during construction or maintenance – for example by disposal of spoil material – may generate water depletion, water logging, concentration of water flow as well as increase the velocity of flow, which will be erosive in nature. Diversion as well as overloading existing drains results in water flowing where it normally would not, e.g. on vulnerable soils where frequent effects are scouring, gullying, bank cutting and soil erosion. The effects of disruption can extend well beyond the immediate vicinity of a road or point sources of any immediate impact. Roads can act as low height dams and cause disruption of natural drainage, water logging, water pounding, flooding.

The impact will be indirect, of low magnitude, local in extent and long-term in nature.

xvii. Drain scouring

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.

Impact will be indirect, of moderate magnitude, local in extent and short-term in nature.

xviii. Pressure on Existing Facilities

Influx of labour will exert pressure on existing local social service facilities such as telephone, water supply, health and medicine, transportation etc. *This impact will be indirect, low magnitude, local in extent and short-term in nature.*

xix. Construction Hazard

On construction period, large number of labour is deployed to perform the construction activities. The labour deployed in rock cutting and rock break-up works in quarry site and rock widening site are highly prone to risk if they are not aware on safety issue and do not take safety measures like helmet, glove, boots, goggle, ear guards with sponge muffler etc. It even brings loss of life if this kind of impact is subject to negligent.

The impact is direct, high magnitude, local in extent and short term in nature.

xx. Road Safety

Construction and operation of roads also increase chances of road accidents, particularly involving children. Inadequate provisions of road safety measures such as road safety signals, lack of enforcement of traffic rules, houses built adjoining road within the RoW, and school adjacent to road etc. during operation period may invite accidents. *This is an indirect impact of moderate magnitude, local in extent and short-term in nature.*

C. Operation Stage

i. Impacts due to Slope Instability

The destabilization of slope may also be expedited due to human activities in the road neighborhood such as quarrying stones or soil, animal grazing, irrigated cultivation. This may 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. *This is an indirect impact of moderate magnitude, local in extent and long term in nature.*

ii. 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 magnitude, local in extent and long-term in nature.

iii. Change in Land use

Better access can lead to conversion of agriculture land close to roads, especially in bazaar area for residential and commercial purposes. This will result in loss of productive land and agricultural production. *Impacts will be indirect, of high magnitude, local in extent and long-term in nature.*

iv. Air and Noise Pollution

The source of air pollution in the project 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 impact will be of direct nature, moderate magnitude, local in extent and long term in nature.*

4.2.2 Biological Environment

A. Construction Stage

i. Loss of forest land

There will be loss of about 4.40 ha forest land during the implementation of the proposed road upgrading works. *The anticipated impact will be direct, moderate magnitude, site specific and long-term in nature.*

ii. Cutting of trees and clearing of shrubs and herbs of the forest areas which eventually causes loss in biodiversity of the project area

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 project area along the

entire stretch of the proposed road. There will be clearing of shrubs and herbs of the forest areas on either side of the road to make room for the construction works. About 611 trees amounting to 263,725 cu. m. wood volume need to be felled during the implementation of road upgrading from 11 community forests. An estimated total of NRs. 2, 51, 09,061.00 is the monetary values of the lost forest area resources. (Refer Annex 8). *The anticipated impact will be direct, of moderate magnitude, site specific and long-term in nature.*

iii. Disturbances on aquatic lives and fish activities

During construction, more construction vehicles will be moving on the road section. 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.

Impact on aquatic life and fishes will be indirect, of low magnitude, site-specific and short term in nature.

iv. Disturbances on ecosystem

Proposed Road upgrading work will directly cause minor degradation of local ecology through the clearance of small areas of vegetation at work sites and ancillary sites such as materials extraction sites, and material stockpiling areas. Construction activities will impact only a narrow band of vegetation within the existing road corridor. Apart from these, there are no other significant impacts identified on the local ecology and ecological balance. *The impact will be indirect, low magnitude, site specific and short term in nature.*

v. Disturbances on the corridor of the wildlife movement

The wildlife population is reportedly low in the Project area, however, due to the frequent movement of the vehicles there will be minor disturbances on the corridor of movement of wildlife. Vehicle movement, noise and vibration and light may disturb the home range of wild fauna. The possible adverse impacts on those species home range will be minimal. The frequency of above-mentioned wildlife visiting is low due to fragmented vegetation and frequent human interference. *The impact will be indirect, low magnitude, site specific and short term in nature.*

vi. Impact on Forest Resource (Source of Energy/Fuel)

Construction Crew/Contractor will be likely to use forest resources nearby the road corridor by illegally collecting firewood for cooking and heating purpose, and for construction. *This is an indirect impact of low magnitude, local in extent and short-term in nature.*

vii. Possible illegal hunting and poaching of wildlife

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. Nevertheless, as the project road does not pass through any important wildlife areas or fishing rivers, the impact anticipated is low. *Impacts will be indirect, of low magnitude, site-specific and short-term in nature.*

B. Operation Stage

i. Increased wildlife Disturbance and Poaching

Vehicular movement and excessive use of horn in forest and other habitat areas may disturb wildlife. Typical road-associated impacts are collision with wildlife and easy access for poachers and traders of wildlife. *Impact on wildlife will be indirect, of low magnitude, site-specific and long term in nature.*

ii. Impacts on Forest Resources

The pressure on forest and forest resources during operation stage will result indirectly from the improved public/vehicular access to forest lands. Undesired cumulative and induced impacts may include accelerated logging, illegal extraction of timber and other forest products, incidental forest fires, and the introduction of invasive species (weeds, pests). As, most of the forest portion where the Road passes is under community forest, and CFUGs are quite concerned about conservation of forest and forest products. Similarly, impacts on rare and endangered fauna are not envisaged. *The impact will be indirect, of low magnitude, local, and long-term in nature.*

iii. 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 movement on road stretch crossed by forests. This in combination with fast driving (especially during night time) and or in combination with relentless horn honking over the stretch harboring 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. The project road does not pass through any important wildlife areas. *Impact is indirect, low magnitude, local in extent and long-term in nature.*

iv. Possible illegal hunting and poaching of wildlife

Where the road stretch is crossed by forests harboring 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 magnitude, local, and long-term in nature.*

4.2.3 Socio-economic and Cultural Environment

A. Construction Stage

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

About 20.76 ha land (16.01 private and 4.75 ha government land) will be acquired. Out of the 16.01 ha private land, 9.5 ha will be agricultural land. This will lead to loss of food grain production (26122 kg) among the families losing lands to the project. There will be no loss of farm trees. *Impact is direct, moderate magnitude, site-specific, and long-term in nature.*

Table 4.1: Project Impacts on land

Affected HHS	Land Area to be Acquired (ha)	No of affected land parcel	Affected population
760	16.3	1201	4028

Source: Resettlement Plan, Dhading-Arughat-Gorkha Road, 2016

ii. Population displacement

About 37 people from seven (7) households is to be displaced. *Impact is direct, moderate magnitude, site-specific, and long-term in nature.*

Table 4.2: Types of assets by loss and affected people

Type of Asset Affected	No of affected HHS	No of affected structures	No. of APs
Residential Structures	2	3	11
Residential cum commercial structure	5	5	26
Total	7	8	37

Source: Resettlement Plan, Dhading-Arughat-Gorkha Road, 2016

iii. Land and Property acquisition, resettlements

About 20.76 ha of land (16.01 ha of private land and 4.75 ha of government land), eight (8) private structures belonging to seven (7) households is required to be acquired. *Impact is direct, low magnitude, site-specific, and long-term in nature.*

iv. Impacts due to Loss of Structures/Infrastructures

A total of eight (8) private structures (3 in Khanchok-3 and 5 in Shyam bazaar, Taple VDC-6) belonging to seven (7) households is going to be impacted. Out of 8 structures, three (3) are residential and five (5) are residential cum commercial structures. *Impact is direct, low magnitude, site-specific, and long-term in nature.*

v. Pressures 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 magnitude, local in extent and short-term in nature.*

vi. Loss of agricultural products

The improvement/upgrading works of road formation and side drain construction will require about 9.50 ha of agricultural land. There will be loss of approximately 26122 kg of agricultural products. *Impact is indirect, low magnitude, site-specific, and long-term in nature.*

vii. Impacts due to Workforce camp operation

Impacts anticipated through construction camp include generation of solid waste (organic waste, plastic and metal scrap, domestic effluent, etc.) and their disposal need, pressure on public service 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, insect borne diseases, etc), poor water supply, use of alcohol and drug, gambling and conflict with local communities.

Impact is direct, moderate magnitude, site specific and short-term in nature.

xxi. Social Conflict and Disputes

The amount of money that flows into the area during construction stage as wage payment may induce local inflation. Increased income of local labours and construction crews of contractor can lead to negative impacts such as spread of alcohol consumption, gambling and prostitutions.

However, the impact due to change in habit factors like alcohol consumption, gambling etc. and impact due to long term diseases like HIV/AIDS will be persisted in the Project Area and even spread to the regional level even after the completion of construction works and returning of outside construction workforce. *These impacts will be indirect, low magnitude, local in extent and short-term in nature.*

xxii. Workers Sanitation and STI-HIV/AIDS Issues

During construction, labors groups will be exposed to various risks and hazards. Many of the health hazards will be caused during rock cutting slope cutting etc. Other potential impacts to health are respiration and eye diseases due to exposure to dust, risk of accident during work, stomach problems due to drinking water.

This impact will be direct, low magnitude, local in extent and short-term in nature.

xxiii. Occupational Health and Safety including awareness of dust, noise, and bitumen heating issue

During construction, workers will be exposed to various risks and hazards. Potential impacts to health are respiration and eye diseases due to exposure to dust, risk of accident during work. Noise impacts will be significant during construction period due to increase of vehicular movements and machinery and crushing operations, material transport etc.

Bitumen which is used to seal the gravel is highly combustible if fire catches it. So accidental spillage or leakage of bitumen and exposure of bitumen to the fire will bring life threatening impact if not properly cared during heating. Moreover, it also bring adverse impact to human health as it can causes skin burning if not properly handled, distributed during construction period.

This impact will be direct, moderate magnitude, local in extent and short-term in nature.

B. Operation Stage

i. Road side safety issue with peoples living near to the road side due to vehicular movement

Fast driving temptation especially among the public transports drivers following roadup 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 magnitude, local in extent and long-term innature.*

ii. RoW Encroachment

People would make teashops/houses along the road once the road construction/upgrading is completed and it becomes operational, the market/growth centres would expand and people would more likely encroach the ROW. This will reduce road capacity and increase chances of road accidents.

Impact is indirect, moderate magnitude, local and long-term in nature.

iii. Population pressure and impact due to new settlements along the road alignment and possible ribbon settlements development

Settlements, shops, food stalls' emergence along the road-side soon after new road construction or upgrading work completion is common practice in Nepal. It surfaces up as theeconomic 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 roadside and encroachment of public land by them, causing to becoming source of socialconflicts associated with road accidents – road blockage, delays etc. *Impact is indirect, moderate magnitude, local, and long-term in nature.*

iv. Health (HIV/AIDS)

The impact due to long term diseases like HIV/AIDS will persist in the Project Areaand even spread to the regional level even after the completion of construction works andreturning of outside construction workforce. *This impact will be indirect, low magnitude, local in extent and long-term and in nature.*

v. Social Conflicts due to change in community structures

Improvement of road condition 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, moderate magnitude, local, and long-term innature.*

vi. Cultural conflicts due to in-migration of people from outside the area

Improved road accessibility and connectivity following construction completion, maytrigger socially unacceptable activities including illegal drug peddling, humantrafficking, sex life etc. Public life associated with alcohol, gambling etc. also maycause social conflict especially among the local people and in-migrant labor force. *Impact is indirect, low magnitude, local, and long-term in nature.*

vii. Displacement of local and poor people by rich peoples from outside attracted due to enhanced access

Due to the improved/enhanced transportation facility, rich people from outside will be attracted to the subproject area and entice local and poor people offering better/lucrative price for their lands. It can lead to the displacement of local and poor people from the area.

Impact is indirect, moderate magnitude, local in extent and long-term in nature.

4.2.4 Chemical Environment

A. Pre- Construction Stage Issues

i. Impacts due to use 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, workshop wastes are potential source of environmental hazards unless it is handled correctly. *Impact is indirect, moderate magnitude, site specific, and short-term in nature.*

B. Construction Stage

i. Impacts due to 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 magnitude, local and short-term in nature.*

ii. Impacts due to 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 magnitude, site-specific and short-term in nature.*

C. Operation Stage

i. Effect on water quality

Inappropriate driver 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, site-specific in extent and long-term.

4.3 Enhancement issues

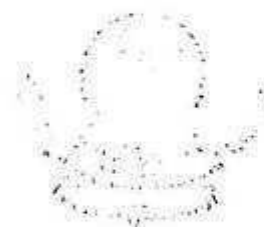
Following enhancement issues have been considered during the preparation of IEE report:

- a. Orientation of EMP for implementing authority and contractor groups (Pre-construction stage)
Orientation program has been included in EMP and necessary budget has been allocated for the activity
- b. Orientation to workers about Occupational Health and Safety
Orientation will be given to contractor's workforce regarding occupational health and safety by the contractor's Health and Safety Officer
- c. Provision of paved shoulders at destination/roadside settlements/villages
- d. Provision of bus bays to avoid traffic obstruction
Provision of thirteen (13) bus bays have been made in the design estimate.

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
- ii. Compensatory plantation for trees required to be cut
- iii. To consider the possible landslides, soil erosion issues into consideration
- iv. Provide adequate compensation for private and public properties losses
- v. To implement the project as soon as possible



CHAPTER 5

5. ALTERNATIVE ANALYSIS

The aim of alternative analysis is to arrive at a development option, which maximizes the benefits while minimizing the adverse impacts. The various alternatives to achieve the subproject objectives with minimum environmental degradation are discussed below:

5.1 Alternative design and construction approach

There are two types of road design and construction methods. They are conventional and green road approach. In conventional method, heavy machineries and equipment, explosives, heavy concrete structures with the application of bituminous surfacing, side drains, bridges and culverts etc. are extensively involved. Green road approach which is normally referred as a labour based, environmental friendly and participatory (LEP) focuses to conserve the delicate mountain ecology through the protection of vegetation cover as means of soil conservation. Under this approach, construction work is done manually from the local labour without using heavy machinery and explosives. Under green road approach, majority of the work will be performed manually.

The proposed road has been designed considering conventional approach with labour based approach to some extent. Due to this, Local people will be benefited by availability to work in the project and earning from it.

5.2 Alternative Alignment (Route)

The alignment of the road is an existing motorable and fair weather with 4.5 to 5 m width. 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. However, it is understood that the alignment has been made after thorough investigation in terms of geology, hydrology, socio-economic and topographic aspects.

This alternative is therefore not relevant.

5.3 Time Schedule

The upgrading of Dhadingbesi-Arughat-Gorkha road under EEAP will be implemented over 2 years commencing in the third quarter of 2016 and is expected to be completed in the third quarter of 2018. 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. The schedule for construction works should be arranged such that the rainy season as well as agriculture season should be avoided. Working during the agriculture off-season would be most appropriate since the local people could be involved as construction labours. 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

In the absence of the road improvement, the potential socio-economic development of the project 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 cost. 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 be worsened and will further erode the quality of life in the project area.

Proposal alternatives

The people living in the 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.

Considering the Project alternatives, the proposed rehabilitation/upgrading works of the existing Road can be the best option to serve the purpose of transportation requirement.

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 Project and avoid/minimize the adverse impacts from the 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 Stage

i. Increased Income

Following benefit augmentation measures will be adopted:

- 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).
- To utilize their money earned from the project works, project will implement income generation activities to improve their livelihood.
- The Subproject will give emphasis in recruiting labour from the road influence area.
- 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.

ii. Employment of Women and Disadvantaged Groups

During the road construction and rehabilitation, large number of local people will work as labourer giving more emphasis to women (at least 40%), ethnic minority and dalit (occupational caste). They will get direct employment and it will contribute significantly in their livelihood. This will also increase their economy and keep them occupied in earning and skill learning job during agricultural lean season. In this context, benefit augmentation measures will be implemented as much as possible through NGOs/CBOs. They will be given training to do the job. To utilize their money earned from the project works, EEAP will implement income generation activities to improve their livelihood.

iii. Rent from Land Acquired Temporarily During Construction

Contractor will make an amicable agreement with the land owners.

iv. 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.

v. Skill Enhancement

During the road upgrading works, the local labourers will receive manifold skill training in construction techniques, machine operation, small engineering structures and bio-engineering works etc. The project will also organize training for Community Based Organization (CBO), forest groups, Machine operators etc. 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 project will find it easier to get skilled jobs in the future, thus securing their livelihood as an alternative/additional occupation to agriculture.

6.1.2 Operation Stage

i. Employment of Local People

The project will employ some local workers and technicians in the implementation and maintenance stage as per their skills.

ii. Improved Access and Reduced Travel Costs

The upgraded road provides the easy, comfortable and improved access to the people. This will enhance the economic status of people. The benefit augmentation measures will be proper maintenance of the road during Defect Liability Period (DLP) and after DLP period.

iii. Increased Crop Productivity and Sale of Farm Products

- Provide easier and cheaper agricultural inputs to farmers.
- Enhance the market facilities to local farmers and entrepreneurs.

iv. Rise of Land Values

Benefit enhancement measures will be promotion of planned land development activities and control of encroachment within RoW.

v. Women Empowerment

The employment emphasis is given to the women as a part of benefit augmentation measure imparted by the road project.

vi. Explore Opportunities on horticultural Crops / cash crops cultivation

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

vii. Development of Tourism

The upgrading of road increases accessibility to the different places mainly of northern Gorkha i.e. Manasalu Conservation Area for trekking/mountaineering and Budhi Gandaki for the rafting purposes. This may increase ecotourism in the project site and increase the income level of local people. Development of lodges, restaurants and hotels for the tourists will be supported.



6.2 Adverse Impacts Mitigation Measures

Prior to undertaking activities of proposed road upgrading, contractor needs to prepare site specific environmental management plan, submit to Resident Engineer and secure his approval. The plan should include issues as enlisted below:

- Labor force Campsite Establishment, Management and Decommissioning Plan
- Contractor's Office, Workshop Camp Establishment, Management and Decommissioning Plan
- Public Utilities / Existing Services Reinstatement Plan
- Quarry and Borrow pit Operation Plan (Field Identification, Extraction and Safe Closure)
- Surplus Earth Materials Safe Disposal Plan
- Crusher Plant Operation Plan (Site Identification, Plant Installation, Operation and Decommission)
- Bitumen Storage, Blending and Decommissioning Plan
- Materials Stockpile Plan
- Top soil saving and its Re-use Plan
- Road Diversion Plan

6.2.1 Physical Environment

A. Pre- Construction Stage

i. Stockpiling of Construction Materials

Following mitigation measures will be applied.

- Appropriate sites for stockpiling of construction materials will be selected during pre-construction stage by the contractor.
- The land for storing the construction material will be far from the agriculture land and water bodies.
- Stockpile should not be located on water courses; or within 50m of schools, hospitals or public standpipes; and should not affect locals and their properties.
- Consent should be obtained from the landowner prior using their land for stockpile.

Following locations have been selected as probable locations for stockpiling of construction materials:

Table 6.1: Probable Materials Stockpiling Location along the Road

Dhadingbesi-Ankhu Khola Section	Ghyampesal-Gorkha Section
Chainages	
05+000 – 06+600	55+570 – 57+770
08+000 – 09+500	62+280 – 64+940
10+900 – 11+100	65+600 – 66+710
19+200 – 19+720	70+460 – 71+020
20+000 – 20+420	

Dhadingbesi-Ankhu Khola Section	Ghyampesal-Gorkha Section
23+700 – 25+070	

Source: Field Survey, 2016

B. Construction Stage

i. Land Use Change

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

ii. Landslides and Erosion slope destabilization

Following mitigation measures will be adopted:

- Ensuring minimum cut slope during design
- Selecting cut and fill slope at correct angle depending upon the soil type
- Re-vegetation of cut and fill slope or exposed areas as soon as possible by using native plant species
- Adoption of bio-engineering techniques
- Ensuring minimum damage of vegetation during upgrading
- No upgrading work during rainy season.

iii. Sedimentation

Following mitigation measures will be adopted:

- The Contractor will orient workers not to dispose excavated spoils and debris into streams water.
- The Contractor will arrange training programme to all equipment operators, drivers, and warehouse personnel on immediate response for spill contamination and eventual cleanup. Further, emergency procedures and reports preferably written in easy to understand local dialects will be distributed to the local people.
- Silt fencing and/or brush barrier will be installed for collecting sediments before letting them into the water body. Silt/sediment will be collected and stockpiled for possible reuse as surfacing of slopes for re-vegetation.
- All wastes generated from the construction sites will be disposed off in an environmentally accepted manner so as not to block the flow of water in the channels. The wastes will be collected, stored and transported to approve disposal sites.
- Chute drains will be provided to drain surface runoff and prevent erosion from slopes.
- Large construction/labour camps will be avoided along the road alignment and will be located away from settlements and river sides.
- Construction labourers will be preferably recruited from the local community. Sewage from labour camps will be managed in such a way that it will not pollute streams water and other public and private areas.

iv. Solid waste Disposal

Following mitigation measures will be adopted:

- The solid waste will be segregated at source level and collected in a separate containers or buckets.
- The biodegradable wastes will be dumped into a pit located away from the water body and non-degradable waste will be recycled to some extent.
- The construction debris will be disposed at designated spoil site only far away from water resources.
- Open burning of solid wastes (plastic, paper, organic matters) will be prohibited.

v. Hazards caused by Combustible and toxic materials

Preventive Measures:

- Oblige the Contractor to present a plan for combustible and toxic materials. An appropriate and approved management plan for safe handling and storage of hazardous material must be compulsory and approved by the Resident Engineer.
- Oblige the Contractor to include in his management plan an emergency plan in case of major accidents associated with improper handling or spill of hazardous materials.
- The contractor must include fire-fighting training for labourers in his work routine

Mitigation Measures:

- Hazardous materials will not be stored near surface water bodies;
- All used lubricants and oil will be collected and recycled or disposed off site in appropriate manner by not causing environmental degradation;
- Hazardous materials will be stored only on impervious (concrete or plastic sheeting as approved by Engineer) floor with drainage and collection sump so as to retain leaks and spills;
- Apply sealing or binding material in case of major spills of (liquid) hazardous materials;
- 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.

vi. Vibration

The following mitigation measures will be adopted to reduce the vibration impact;

- Photographic records of the existing private and public infrastructures along the corridor of impact will be maintained for verification of any infrastructure damaged during construction.
- Precaution will be taken while using the machines and equipment, especially nearby public and private infrastructures.
- The contractor will inform the concerned municipality/VDCs and community in due time about operations that bear the risk of nuisance and accidents, especially when blasting operations are underway.

vii. Stockpiling of Construction Materials

Following mitigation measures will be adopted.

- Construction materials will be covered with tarpaulin during stockpiling to prevent rain water and dust emission generating from the stockpiling site. It will be encircled with side barriers and covered so that incidence of mix up with deleterious materials is imminent.
- Stockpiles will be kept wet by sprinkling water or covered so that erosion by wind causing dust will not occur
- Construction materials will be placed in barren land as far as possible to protect the ground vegetation
- For large stockpiles, it should be enclosed with side barriers and also covered when not in use.

viii. Change in River Flow 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 accidental) disposal of spoil.
- Provide appropriate passage through 34 hume pipes, 2 culverts, 1 causeway for channeling of the water inundated upstream of the river.

ix. Impact due to Spoil Disposal from Construction and Labor Camp

To mitigate the impact due to spoil disposal from Construction and Labor Camp, following mitigation measures will be applied.

- The spoil material will be safely disposed and managed with minimum environmental damage.
- Wherever possible, surplus spoil will be used to fill eroded gullies, quarries and borrow pits, depressed areas etc.
- Contractor will identify and select suitable and safest locations for the dumping or land fill sites with sufficient capacity and approvals will be obtained from relevant Local Authorities.
- Spoils will not be disposed on fragile slopes, farmland, marshy land, forest areas, natural drainage path, canals and other infrastructures.
- After the disposal, the site will be provided with proper drainage, vegetation and adequate protection against erosion.
- The Contractor will prepare a detailed management plan including suitable disposal locations for spoil/waste and that will be approved by the Supervision Consultant Engineer/ES.

- Locations for disposal will be selected with the consent of local community, VDC representatives, and the sites will 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.

x. Impacts due to Quarrying of Materials and Borrow Pit Operation

Following mitigation measures will be adopted against the impacts of quarrying:

- Before selecting and operating the quarry site, as a procedural respect, concerned contractor need to prepare a Quarry and Borrow pit Operation Plan (Field Identification, Extraction and Safe Closure) and submit it to and secure approval from the Resident Engineer (including from the owner as and if required) and for material testing, contact with material engineer and get approval from the material engineer.
- Authorization from the local authority office is necessary before opening the new quarry.
- Unstable sites, erosion prone area, dense forest area, settlements, fertile farm land will be avoided for quarrying operation.
- After the extraction is completed, the quarry site will be rehabilitated to suit the local landscape.
- Blasting has to be avoided for quarrying.

xi. Impact due to Air, Noise and Water Pollution

Following mitigation measures will be adopted to minimise dust nuisance during upgrading activities.

- Use of face mask by the workers to minimize air pollution due to dust generation
- Quarries, crushers and asphalt plants must be located at least 500m away from residential or other public sensitive areas
- Spray water before loading and transportation of soil and sand particularly during windy conditions.
- Dust causing materials will be covered during transportation
- Dust emissions will be minimized at working areas, excavated areas, quarry sites and crusher sites by spraying of water regularly.
- Ground surface of sites where the crusher plant located will be covered by tarpaulin layer to minimize the dust generation during vehicle movement.
- Upgrading materials will be stored in covered places or must be covered with a suitable covering to prevent dust emissions from wind.

Following mitigation measures will be applied to reduce and/or avoid impact of noise arising through various activities during construction. These include:

- Location of construction equipment, machines, haulage roads, hot-mix plant, crusher, borrow and quarry sites, etc. will be fixed considering the sensitive receptors likely to be affected by the proposed activities.
- Temporary construction facilities such as labour camps, vehicle maintenance workshop and earth moving equipment will be located away from settlements and other sensitive areas as far as possible.

- Noise sources such as stone crushers, vehicles movements and work at stone quarry and borrow pit will be re-located to less sensitive areas to take advantage of distance and shielding.
- Silencers will be installed to construction equipment and machinery and maintained properly.
- Equipment and machinery with lower sound power levels will be selected for the use.
- Protection devices such as ear plugs/ or ear muffs will be provided to the workers during period of operating high noise generating machines.
- Construction activities will be carried out only between 6 A.M. to 6 P.M. to avoid disturbance to nearby communities at night.

The following mitigation measures will 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
- Avoid vehicular cleaning activities on/close to the water bodies especially on river, streams and lakes
- Prevention of soil slippage at toe of the stockpile areas by installing barriers at the perimeter
- Awareness raising programs on waste management will be conducted for the workers;
- Seepage and leakages from construction materials will be regularly monitored and will be controlled immediately if occurs;
- To avoid contamination from fuel and lubricants, the vehicles and equipment will be properly maintained and re-fueled in dedicated locations; and
- Adequate catch drains will be constructed to drain out surface runoff waters quickly as possible

xii. Irrigation canal

In the project road design, provision has been made to extend existing 15 number (300 mm diameter) of irrigation pipes to a length of 10 m hume pipes and install two (2) new 300 mm pipes and replace 17 number of damaged 300 mm and smaller pipe for irrigation crossing.

xlii. Flood/rainfall

The following mitigation measures will be adopted:

- Adequate numbers of drainage structures will be provided in order to have minimum interference on natural drainage pattern of the area
- Avoid any blockage or diversion of natural channels due to (intended or incidental) disposal of spoil.
- Consent will be taken from irrigation canal user group during implantation.

xiv. Drain scouring

The following mitigation measures will 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.

xv. Pressure on Existing Facilities

Impact on existing social service facilities can be mitigated by:

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

xvi. Construction Hazard

The following mitigation measures will be carried out:

- Make mandatory the use of helmets, safety belts, masks, gloves and work boot by workers depending on nature of work.
- The supervisor will have to check whether the provisions made in the plan are implemented according to plan or not.
- Workers will be provided with first aid and health facilities.
- There will be provision for group accidental insurance for the workers.
- First aid training will be provided to field staffs like overseer, social mobilizers and supervisors.
- Impose strict rule for non-complying safety condition such as payment withholding and/or termination of contract
- Respective provisions will be included in the contract document with contractor.

xvii. Social Conflict and Disputes

The following mitigation measures will be carried out:

- Strict law and order situation will be maintained
- The contractor's labour force will comply with the code of conduct set by the contractor

xviii. Workers Sanitation and STI-HIV/AIDS Issues

The following mitigation measures will be carried out:

- Sprinkle water at high dust prone sites;
- Provide clean drinking water at sites and camp;
- Provide pit toilets at sites and camp;
- Provide first aid facilities at sites and camp with training to use them;
- Provide group accidental insurance for workers; and
- Aware workers and staffs about HIV AIDS and other communicable diseases.

xlx. Occupational Health and Safety including awareness of dust , noise, and bitumen heating issue

Following mitigation measures are recommended:

- The Contractor will 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 will 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 will keep at site a full time Safety and Environment Monitoring Officer and a Medical Officer. Safety Officer will ensure proper safety measures undertaken at camps and work sites. Regular safety drill will be conducted and safety signs will be kept at work areas.
- The Contractor will arrange all personal protective equipment (PPEs) for workers, including first aid facilities at construction sites. An emergency plan will 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 will be restricted.
- Workers will 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 will be established at the campsite to treat simple/minor injuries or illness. Arrangement will 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 will periodically make a visit to the site office for health check-up of workers
- The Contractor will 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 will be made to ensure traffic management and safety.
- Regular safety audit on safety measures will be conducted during construction. The audit will 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.

xx. Road Safety

Following safety measures and restriction on speed will be adopted.

- Required delineators, safety signs, road bumps etc. will be used as appropriate along the road.
- Road safety awareness programs will be conducted, including the propagation of educative material in local language(s).

- The material will be propagated in schools and be available at all municipality/VDCs.
- It is also recommended to place illustrated sign boards at accident-prone spots and bus bays.

C. Operation Stage

i. Impacts due to Slope Instability

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 (bio-engineering)
- Soil conservation will be promoted in the right of way and vulnerable areas beyond the road alignment

ii. Impacts due to Poor Drainage

In order to avoid such impacts, the following mitigation measures will be adopted:

- To minimize the impact it is recommended to close the side drains especially near settlements/market areas and maintain regularly to avoid blockage and stagnation of water
- 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 will be done to avoid any blockage of drainage.

iii. Change in Land use

Respective Municipality/VDCs shall make local communities aware of the importance of the road ROW. They must develop strategies for controlling new settlements along the road corridor and these efforts will help to establish planned settlements only upon adequate provision of basic services as water supply, sewerage, electricity, telephone etc.

iv. Air and Noise Pollution

Mitigation measures to address possible air quality deterioration during operation stage include:

- Roadside pollution absorbent tree species (*Eucalyptus species*, *Azadirachta indica*, *Jacarando mimosifolia*, *Melia azadirach*, *Albizzia procera*, *Grevelia robusta* etc) especially at settlement areas will help to reduce pollution due to dust.
- DoR will coordinate with relevant agencies on the implementation of the Nepal Vehicle Mass Emission Standard, 2056 (2000).
- Air pollution from dust will be controlled with provision of paved shoulders, especially in the sensitive/built up areas.
- DoR will provide informatory road signs reminding the motorist to properly maintain their vehicles to economize on fuel consumption and protect the environment.

- DoR will partner with development organizations (NGO, INGO and CBOs) to motivate the local communities to maintain greenery in the project area by planting fodder, fuel wood and fruit trees including flowering plants.

Mitigation measures to address possible noise pollution during operation stage include:

- Effective traffic management and good riding conditions will be maintained to reduce the noise level throughout the stretch and speed limitation and honking restrictions will be enforced near sensitive locations.

6.2.2 Biological Environment

A. Construction Stage

i. Loss of forest land

According to the Work Procedure for Providing the Forest Land for Other Use, 2063 of Government of Nepal, project has to carry out plantation equivalent to the forest area lost (4.40 ha) from the construction of the road or pay for the plantation and protection cost for five years to the concerned District Forest Offices. Concerned CFUGs will carry out compensatory plantation in their community forests with project support. The forest products from the community forests will be distributed by the CFUGs according to their operational plans.

ii. Cutting of trees and clearing of shrubs and herbs of the forest areas which eventually causes loss in biodiversity of the project area

The project will coordinate with the concerned authority for proper felling and stacking of trees at designated location. The Project will coordinate with the concerned authority (Municipality, VDC, DDC, and District Forest Offices) for proper tagging, felling, stacking and transporting logs at designated location.

iii. Loss of forest and vegetation

The Project will make arrangement with respective District Forest Office for compensatory afforestation and take care for 5 years to ensure the growth of the planted seedling. Concerned District Forest Offices will plan the plantation area keeping in view of the local area ecological requirement and need. Hence further discussions in later phase are required once the IEE requirement of the Government of Nepal is approved by the concerned agency. Estimated mitigation cost for the compensatory afforestation as per the Forest Guideline, 2006 is NRs. 15, 96,285.00. Compensatory plantation of 16,803 saplings will be done in the ratio of 1:25 for 611 trees to be felled down. Necessary budget has been allocated for compensatory afforestation.

iv. Disturbances in wildlife activities

The construction activities near forest area and areas of wildlife habitat will be properly managed so that least disturbance to the wildlife is incurred. Following mitigation measures will be adopted:

- Workers will be educated through an awareness program about the importance of wildlife for maintaining the ecosystem.
- It is recommended to work during day light hours to minimize the disturbances to the wildlife.

- Posting of environmental signboards (illustrated and in local language) have to be displayed in more wildlife occurrence zone
- The Contractor will be obliged to instruct the work personnel and enforce action for preventing access of laborers to nearby sensitive areas, as identified by the Consultant.
- Harassment to wildlife by the workforce will be strictly restricted.

v. Disturbances on aquatic lives and fish activities

Following mitigation measures will be adopted:

- Culvert crossings will be designed with the needs of migratory aquatic species in mind;
- Baffles might be installed to slow the flow enough to allow fish and other aquatic species to swim against the current and culvert bottoms will be set below the level of stream bed.
- No excavation and deposition work will be performed within the river channel.
- No workers will be allowed fishing in the adjoining rivers and water bodies.

vi. Disturbances on ecosystem

Impacts under this and recommended mitigation measures have already been described under Loss of Forest Vegetation and Disturbance to Wildlife and Bird Habitat. Apart from these, there are no other significant impacts identified on the local ecology and ecological balance.

vii. Disturbances on the corridor of the wildlife movement

Wildlife and birds will be disturbed due to the vehicle movement. Appropriate sign boards will be erected informing drivers about:

- Prohibition of blowing horns in the dense forest areas;
- Potential areas for wildlife crossing

viii. Impact on forest resources (Source of Energy/Fuel)

There will be involvement of local people as well as construction crews of contractors during construction works. Local labor groups will go back to their home after work every day.

- For the construction crews stationed at the camp, contractor will provide LPG or kerosene as source of energy for cooking and heating;
- Respective provisions will be included in the contract agreement document;
- Restrict use of fuelwood for heating bitumen and workers camp;
- Provide kerosene for heating bitumen.

ix. Possible illegal hunting and poaching of wildlife

There may occur illegal hunting during construction period by building group members and project staff. The following mitigation measures will be adopted:

- The construction activities near forest area will be appropriately managed so that there will be least disturbance to the wildlife and birds.

- Restriction to work during night time
- Do not allow haphazard entry of workers in the local forest
- Restriction to wildlife harassment by the workers
- 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.
- The project will organize wildlife conservation awareness program for the construction workers.

B. Operation Stage

i. Increased wildlife Disturbance and Poaching

Wildlife and birds will be disturbed due to the vehicle movement. Appropriate sign boards will be erected informing drivers about:

- Prohibition of blowing horns in the dense forest areas
- Potential areas for wildlife crossing

ii. Impacts on Forest Resources

The pressure on forest resources during road operation is likely to occur. The mitigation measures recommended are:

- Promote the installation of improved stoves (provide awareness training to encourage them to use it), micro hydro, solar and biogas to minimize the consumption of firewood
- Encourage and support local communities and authorities in controlling illegal harvesting of forest resources.
- CFUGs will be supported to conserve and manage their CFs according to operational plans
- Encourage and support local community for controlling illegal harvesting of forest resources.

iii. Disturbances on the corridor of the wildlife movement

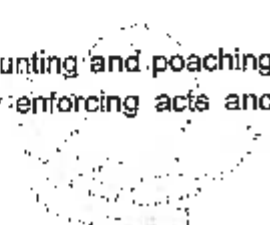
As proposed road upgrading gain its momentum and road surface become better, increased and faster traffic become nuisance to wild life population, requiring restriction regulation on ruthless driving but enforced them to respect speed limit and sensitive spot where wild animals crosses the road frequently.

As and where wildlife moves about, speed humps at regular intervals as well as other restriction measures including 'no horn honking', 'posting speed limits' etc needs to be affected during operation stage.

iv. Possible illegal hunting and poaching of wildlife

The following mitigation measures will 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.



6.2.3 Socio-economic and Cultural Environment

A. Pre- Construction Stage Activities

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

A separate Resettlement Plan has been prepared to address land and property acquisition as well as compensation issues. A budget of NRs. 653,000.00 has been allocated for standing crops loss and NRs. 166,339,262.00 for land acquisition. However, final compensation amount will be determined by compensation fixation committee.

Table 6.2: Estimated Compensation Cost for Loss of Standing Crops

S. No.	Affected Agricultural Land Area (ha)	Estimated Production (kg)	Value of Lost Crops in Local Market (NRs.)
1	9.5	26,122.00	653,000.00
	Total		653,000.00

Source: Resettlement Plan, Dhadingbesi-Arughat-Gorkha Road, 2016

Table 6.3: Estimated Compensation Cost for Land Acquisition

District	Name of Municipality/VDC	Types of Land	Total Affected Area (Sq. m.)	Estimated Average Rate (NRs./ Sq. m.)	Total Estimated Cost (NRs.)
Dhading	Nilkantha NP/ Muralibhanjyang	Cultivable House yard	47931.50	1465.00	70,219,647.50
	Jyamrung VDC	Cultivable	21498.20	855.00	18,380,961.00
Gorkha	Baguwa VDC	Cultivable/ Barmen	22000.00	1182.00	26,004,000.00
	Ashrang VDC	Cultivable	1817.00	789.00	1,433,613.00
	Taple VDC	Cultivable House yard	36315.00	675.00	24,512,625.00
	Gorkha Municipality/Phinam	Cultivable	27287.00	695.00	18,964,465.00
	Gorkha Municipality/Raniswara	House yard	6499.00	1050.00	6,823,950.00
Total			163347.70		166,339,262.00

Source: Resettlement Plan, Dhadingbesi-Arughat-Gorkha Road, 2016

ii. Population displacement

About seven (7) households needs to be displaced. The displacement and transportation allowance will be provided which covers the housing displacement and business displacement allowances. Households whose houses need to be relocated will receive one time housing displacement allowance. Owners of commercial enterprises requiring relocation will receive a business disruption allowance. A budget of NRs. 290,700.00 has been allocated for displaced households as business disruption allowance, material transportation allowance and rehabilitation/displacement allowance.

Table 6.4: Relocation and Transportation Assistance

S.N.	Assistance	Unit	Quantity	Amount (NRS)
1	Business disruption allowance	No	5	76,500.00
2	Material Transportation allowance	No.	7	107,100.00
3	Rehabilitation / displacement allowance	No.	7	107,100.00
	Total			290,700.00

Source: Resettlement Plan, Dhadingbesi-Arughat-Gorkha Road, 2016

iii. Land and Property acquisition, resettlements

The resettlement principles and assistance have been designed to cover compensation for lost assets and restore or enhance livelihoods of all categories of affected people. The Subproject in coordination with concerned authorities will acquire few road side structures built illegally within the COI owned by GoN. In addition to this, temporary shops and food stalls belonging to road side vendors will require removal and resettled out of ROW as per the Resettlement Plan (RAP).

The acquisition and compensation will be carried out as per RAP entitlement matrix by: i) identification of affected persons ii) verification of affected structures iii) compensation determination by compensation determination committee iv) publication of notice for compensation v) distribution of compensation.

B. Construction Stage

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

A separate Resettlement Plan has been prepared to address land and property acquisition as well as compensation issues. These impacts will be mitigated during pre-construction stage.

ii. Population displacement

Displaced households will be dealt as per Resettlement Plan. A budget of NRs. 290,700.00 has been allocated for displaced households as business disruption allowance, material transportation allowance and rehabilitation/displacement allowance.

iii. Land and Property acquisition, resettlements

The acquisition and compensation process will be carried out as per RAP entitlement matrix by: i) identification of affected persons ii) verification of affected structures iii) compensation determination by compensation determination committee iv) publication of notice for compensation v) distribution of compensation.

iv. Impacts due to Loss of Structures/Infrastructures

The acquisition will be done with compensating the affected households as per the Resettlement Plan, such that they do not incur any loss.

v. Pressures on social service facilities

During construction activities, there will be exerted pressure on public utilities by the huge mass of labour resulting impairment in existing environmental condition. To mitigate this

impact, drinking water facility, communication facility, cooking fuel and other daily requirements for the camp must be provided for the labour by the contractor.

Impact on existing social service facilities can be mitigated by:

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

vi. Loss of agricultural products

A budget of NRs. 653,000.00 has been allocated for standing crops loss and duly mitigated during pre-construction stage.

vii. Workforce camp operation

Probable locations for workforce camp are km. 06+500 to 07+140, km. 07+740 to 08+400, 13+950 to 14+050, 18+300 to 18+500, 24+000 to 25 +070 for Dhadingbesi-Ankhu khola section (00+000 – 26+774) and 55+200 to 55+540, 56+300 to 56+540, 57+740 to 57+770, 59+160 to 59+250, 65+800 to 66+320, 68+940 to 69+050 and 73+950 to 74+000 for Ghyampesal-Gorkha section (54+300 – 76+887).

The following mitigation measures will be adopted:

- Efforts will be made to establish construction camps at such sites so as to utilize the existing house/infrastructures as far as possible;
- Contractor will prepare a detailed plan for construction camp including location, housing facilities and other essential amenities including sanitation services and take approval from the Supervision Consultant;
- Basic facilities such as fire extinguisher, lavatories, potable water supply, clean eating area, adequate lighting, safe access, LPG/kerosene and others will be provided in the camp;
- Appropriate facilities for women and children will be provided in the construction campsites.
- First aid facilities will 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 will be prepared.
- The Contractor will 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 will be organized regularly.
- The Contractor will be responsible to control open space defecation and pollution of stream sites and public places by workers.
- The Contractor will ensure that sufficient and good quality of food stuff at reasonable price including adequate and safe drinking water has been supplied to the workers.

C. Operation Stage

i. Road side safety issue with peoples living near to the road side due to vehicular movement

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

- Required delineators, safety signs, road bumps etc. will be used as appropriate along the road.
- Road safety awareness programs will be conducted, including the propagation of educative material in local language(s).
- The material will 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 will be placed at the town limits and settlement areas.

ii. RoW Encroachment

To address the undesired and induced development alongside upgraded roads requires a fair amount of good governance, a realistic and feasible land-use plan and staff that is capable to implement such plans. In addition, enforcement mechanisms need to be in place that can carefully tackle the problem of removing encroachers while taking into full account the needs and constraints of poor people who are likely to form the bulk of encroachers.

In order to mitigate such incidents following measures will be adopted.

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

iii. Population pressure and impact due to new settlements along the road alignment and possible ribbon settlements development

The mitigation measures are:

- Plantation of trees in the RoW so that it is not encroached;
- Awareness raising programme through local organizations to plan proper settlements.
- Regulate settlement growth with proper planning

iv. Health (HIV/AIDS)

NGOs/CBOs are expected to work with locals in raising awareness about communicable diseases including STDs.

v. Cultural conflicts due to in-migration of peoples from outside the area

- Strengthening local communities through awareness
- Opportunities to local workforce during road maintenance



vi. Displacement of local and poor people by rich peoples from outside attracted due to enhanced access

Awareness raising programme through local organizations to plan proper settlements.

6.2.4 Chemical Environment

A. Pre- Construction Stage Issue

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

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

B. Construction Stage

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

Following mitigation measures will be adopted:

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

ii. Use and Storage of Chemicals like bitumen etc.

Following mitigation measures will be adopted:

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

C. Operation Stage

i. Effect on water quality

For control of water quality, the Municipality/VDCs along the road alignment will control haphazard cleaning/washing 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 will 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.

6.3 Issues raised by Public

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

vi. 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.

vii. Compensatory plantation for trees required to be cut

A budget of NRs. 15,96,285.00 for compensatory plantation has been allocated in the Project's cost estimate for the compensatory plantation.

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

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

ix. Provide adequate compensation for private and public properties losses

To address this issue, adequate fund has been allocated in the Resettlement Plan.

x. To implement the project as soon as possible

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



CHAPTER 7

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

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

- MoPIT
- DoR (including GESU)
- ADB, Project Directorate
- Project Design and Construction Supervision Consultant
- Contractor – construction / bio-engineering works

The summary of the role and responsibility for implementing the EMP is as follows.

Table 7.1: Role and Responsibility for implementing the EMP

Institution /	Role	Responsibility in the Project
Ministry of Physical Infrastructure and Transport (MoPIT)	It is concerned line ministry, executing agency for managing the construction and maintenance of the proposed road.	Coordinate with project on safeguard issues Conduct environmental monitoring from central level.
DoR Project Directorate (ADB)	It is concerned implementing agency for managing the construction and maintenance of the proposed road.	Acquisition of all necessary buildings, structures and temporary shops within COI, if any. Review and approval of detailed road 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).
DOR	Department under MoPIT responsible to execute EEAP projects	Ultimate responsibility for the supervision of proposed road upgrading including environmental

Institution	Role	Responsibility in the Project
		safeguards fully respected.
GESU(Geo-Environment and Social Unit)/DOR	Unit under DOR responsible for reviewing IEE	Review, comment, and forward IEE ToR and Report for review for approval to Ministry
Asian Development Bank	Role in decision making for the execution of work The Asian Development Bank is responsible for overseeing of project management in accordance with loan conditions, the detailed road design and EMP, including periodic site visits to ensure compliance.	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.
Design consultant	All environmental work related to feasibility and design period	Get approval from Ministry of Physical Infrastructure and Transport. Conduct IEE Study, Public Consultation, and prepare IEE Report. Receive comments and modify accordingly.
Supervision Consultant	Role in checking compliance of environmental measures in road construction work as per EMP	Oversee the overall implementation of the EMP (for overall package), Provide expertise knowledge, suggestions and recommendations when and where necessary to minimize/avoid/prevent any adverse environmental impacts
Construction contractor	Role of complying environmental measures into the Road construction work	The contractor/s must implement all the mitigation measures described in the EMP during the construction period to mitigate all environmental impacts associated with the construction activities

7.1 Environmental Management Roles and Responsibility

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 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).

A Site Specific EMP (SSEMP) is to be prepared by the contractor based on the generic EMP provided in the IEE. The contractor will submit SSEMP for Engineer's endorsement. The Contractor will not be able to start the construction works before the approval of SSEMP from the Engineer. 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 Construction 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.
- 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 Project, as described below.

7.2.1 Pre-construction Stage

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/spoil 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 will discuss and agree upon the factors listed above and document accordingly. The supervising Consultant will 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 Project implementation cost.

7.2.2 Construction Stage

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 will 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 will 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 will document these and specify corrective measures in the Monthly Report.

The supervising Consultant will provide a copy of the Monthly Report to the Contractor of the inspection for action. The cost for supervision is included in the Project implementation cost.

7.2.3 Post-Construction Stage

The supervising Consultant will 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.

7.2.4 Operation and Maintenance Stage

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

The DoR, GESU will 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.

7.3 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.

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 stage, ADB will carry out external monitoring while MoPIT and DoR/GESU will carry out internal compliance monitoring.

7.4 Monitoring and Evaluation

For road projects, MoPIT will 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 will 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.

7.5 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, Rule 13 (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).



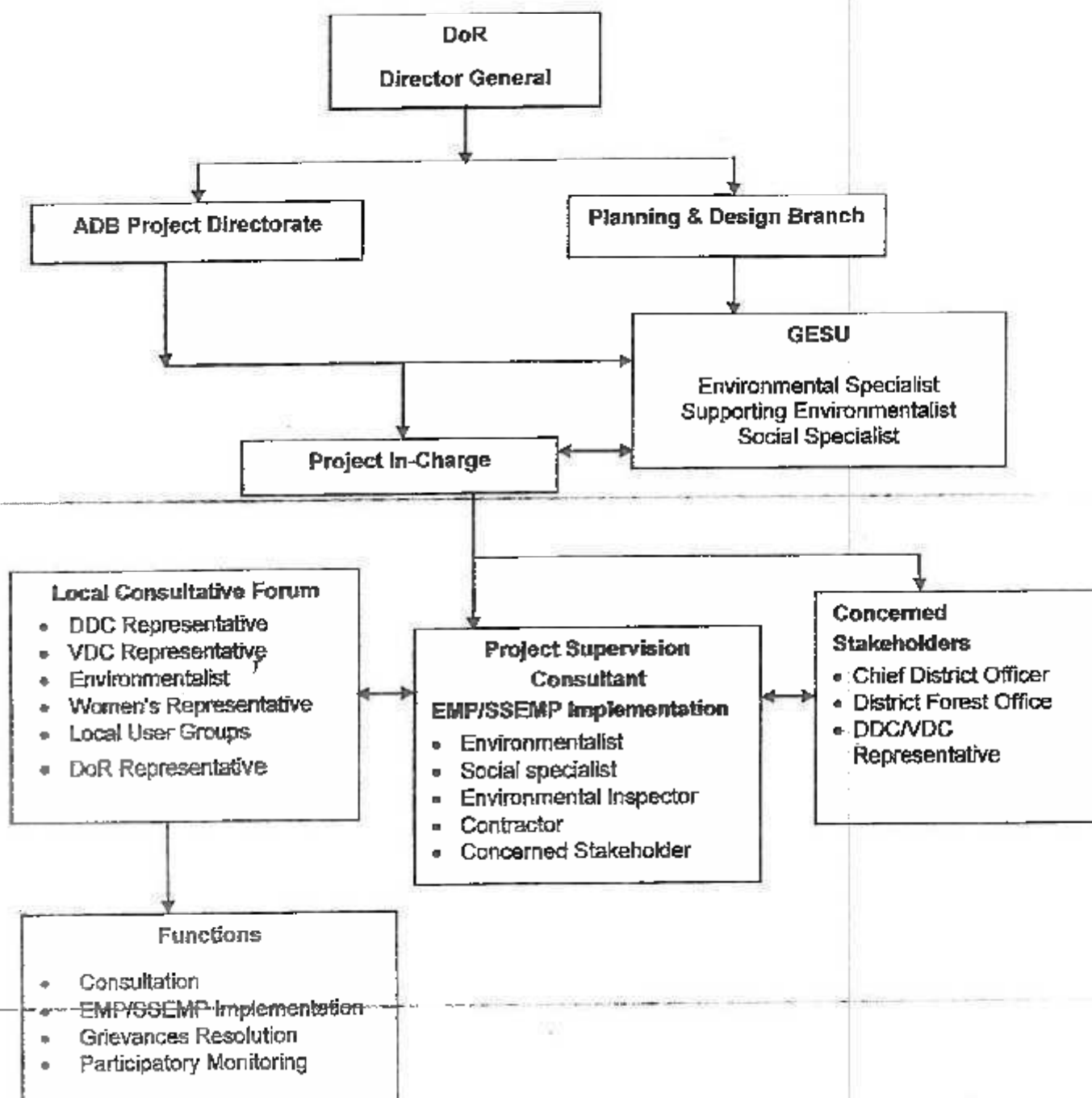


Figure 7.1: Environmental Management Organization Structure

Table 7.2: Compliance Monitoring for Dhading-Arughat-Gorkha Road Upgrading Works

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 stage	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 stage	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 stage	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 stage	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 stage	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 stage	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	Contractor	No cases of material extraction reported from unauthorized sites	Walk through survey, interaction	During construction stage	PIU/ SC/GESU/ MoPIT

Parameters/Issues	Responsible Implementing Agency	Verifiable Indicators	Verification Methods	Schedule	Responsible Monitoring Agency
borrow pits			with local peoples		
Control of dust emission	Contractor	Dust level at construction site, water sprinkling practice observed	Use of sprinkler tank, interview local about dust problem	During construction stage	PIU/ SC/GESU/ MoPIT
Spoil dumped 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 stage	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 stage	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 stage	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 stage	PIU/ SC/GESU/ MoPIT
Disturbing, illegal killing, poaching	Contractor	Cases of disturbances, illegal	Interaction with CFUG,	During construction	PIU/ SC/GESU/

Parameters/Issues	Responsible Implementing Agency	Verifiable Indicators	Verification Methods	Schedule	Responsible Monitoring Agency
of wildlife		and hunting and poaching	locals, inspection of labor camp area	stage	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
Final alignment selection as per IEE/EMP recommendation	Consultant	Incorporation of IEE/EMP 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 7.3: Impact monitoring for the road Upgrading Works

Parameter	Verifiable Indicators	Verification Methods	Location	Schedule	Responsible Agency	
					Implementation	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

Parameter	Verifiable Indicators	Verification Methods	Location	Schedule	Responsible Agency	
					Implementation	Monitoring
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	Designated quarry site areas	During construction	Contractor	PIU/ SC/GESU /MoPIT
Disruption of Drainage System	Status of rehabilitation Service status of irrigation canal and water supply system	Observation and interviews, photos, fisheries data, wildlife records	Disrupted aquatic system, irrigation canal	During construction	Contractor	PIU/ SC/GESU /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/GESU /MoPIT
Air Quality	Total Suspended Solid, Particulates	Visual inspection, measurement	At upgrading sites and at sensitive spots (schools, hospitals)	During construction	Contractor	PIU/ SC/GESU /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/GESU /MoPIT
Wild life	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	Contractor, DFO	PIU/ SC/GESU /MoPIT
Worker's sanitation	Types of diseases in the labor camp	Discussion with laborers, health workers,	Project Area	Monthly during construction stage	Contractor	PIU/ SC/GESU /MoPIT
Occupational Health and Safety	Type and number of accident occurred during upgrading, Adequacy of occupational safety measured provided Compensation	Observations, photos, spot checks, Contractors' and health centre records	Project Area	During upgrading	Contractor	PIU/ SC/GESU /MoPIT
	provided in case of fatal accidents or invalidity	interview with labourer				
Ribbon Settlement	Congestions to road users Nos. 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 7.4: Environmental Management Plan (EMP) for Dhadingbesi-Arughat-Gorkha Road

Environmental Impacts	Environmental Mitigation Measures	Approximate Location	Mitigation Cost (NRs.)	Institutional Responsibility	
				Implementation	Supervision
[O] Pre-Construction Stage (Upon issuance of Notice to Proceed)					
The Contractor will complete the following activities no later than 30 days upon issuance of Notice to Proceed:					
1) Submit appointment letter and resume of the Contractor's Environmental Focal Person (EFP) to DoR Project Directorate					
2) EFP will engage SC-Environment Specialist and DoR/PD to a meeting to discuss in detail the EMP, seek clarification and recommend corresponding revisions if necessary					
3) EFP will request SC-ES copy of monthly monitoring formats and establish deadlines for submission.					
4) EFP will submit for SC-ES approval an action plan to secure all permits and approvals needed to be secured during construction stage which include but not limited to: i) operation of crushers and hot mix plants, ii) transport and storage of hazardous materials (e.g. fuel, lubricants, explosives), iii) waste disposal sites, iv) temporary storage location, v) water use, and vi) emission compliance of all vehicles. Arrangements to link with government health programs on hygiene, sanitation, and prevention of communicable diseases will also be included in the action plan.					
5) EFP will submit for approval of SC-ES the construction camp layout before its establishment.					
[A] Benefit Augmentation Measures					
i. Construction Stage					
1. Increase Income	<ul style="list-style-type: none">Employ local people if, and where they are available and willing to work	Throughout the road corridor	Construction contract	Contractor	SC, GESU/ PD/ DOR
2. Skill Enhancement	<ul style="list-style-type: none">Facilitate opportunities for hands-on skills gain in civil works if, when and where labor force willing to	Throughout the road corridor	Construction contract	Contractor	SC, GESU/ PD/ DOR
3. Employment of Women and Disadvantaged Groups	<ul style="list-style-type: none">Give more emphasis to women (at least 40%), ethnic minority and dalit (occupational caste).	Throughout the road corridor		Contractor	SC, GESU/ PD/ DOR
ii. Operation Stage					
1. Improved Access and Reduced Travel Costs	<ul style="list-style-type: none">Proper maintenance of the road	Throughout the road alignment		Contractor during DLP period and Construction period/ Division Road office after DLP period	Division Road Office
[B] Adverse Impact Mitigation Measures					

Environmental Impacts		Environmental Mitigation Measures	Approximate Location	Mitigation Cost (NRs.)	Institutional Responsibility Implementation	Supervision
iii. Physical Environment						
(A) Pre-Construction Stage						
1. 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 will not be located on/near water courses, schools, hospitals or public standpipes; and will not affect locals and their properties. Obtain written permission from landowners and local bodies for stockpiling on their land. Stockpiles subject to erosion by wind or water will be covered with tarpaulins. For large stockpiles, it will be enclosed with side barriers and also covered when not in use. Clean area properly after completion. 	Location of identified stockpiling sites.	Construction Contract	Contractor	SC, PD/DOR
(B) Construction Stage						
1. Landslide and Erosion slope destabilization		<ul style="list-style-type: none"> Survey and peg the extent of unstable area. Re-vegetation of cut and fill slope or exposed areas as soon as possible by using native plant species. Adoption of bio-engineering techniques 	Ch. 13+720, Ch. 55+030, Ch. 84+140	8,517,563.00	Contractor	SC, GESU/ PD/ DOR
2. Sedimentation		<ul style="list-style-type: none"> Contract bid document covers measures to be taken to manage spoils and wastes in an environmentally acceptable 	Throughout the road alignment	Construction contract	Contractor	SC, GESU/ PD/ DOR

Environmental Impacts	Environmental Mitigation Measures	Approximate Location	Mitigation Cost (NRs.)	Institutional Responsibility	
				Implementation	Supervision
	<ul style="list-style-type: none"> The Contractor will orient workers not to dispose excavated spoils and debris into streams water. Silt fencing and/or brush barrier will be installed for collecting sediments before letting them into the water body. Silt/sediment will be collected and stockpiled for possible reuse as surfacing of slopes for re-vegetation. 				
3. Solid waste and spoil disposal	<ul style="list-style-type: none"> 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. Obtain permission from local stakeholders, Municipality, DDC, VDC where required as appropriate. Measures will be taken to prevent earthworks and gabion works from impeding rivers, streams, water canals, or drainage system. No hazardous materials allowed to store near surface waters. 	Location of identified disposal sites	Construction Contract	Contractor	SC, GESU/ PD/ DOR
4. Hazards caused by combustion and toxic materials		Location of campsites, storage yards, worksites.	Construction contract	Contractor	SC, PD/ DOR

Environmental Impacts	Environmental Mitigation Measures	Approximate Location	Mitigation Cost (NRs.)	Institutional Responsibility	
				Implementation	Supervision
5. Solid waste disposal	<ul style="list-style-type: none"> • Collect and re-cycle used lubricants and oils or dispose it off safely. • Overlay plastic sheeting under hazardous material storage area • Collect and retain hazardous material leaks and spills laid over the plastic sheet. • Capture contaminated runoff from storage areas in ditches or ponds with an oil trap at the outlet. • Pack contaminated and worn plastic sheeting into drums and disposed it off site. 	Designated campsites	Construction Contract	Contractor	SC, GESU/ PD/ DOR
	<ul style="list-style-type: none"> • Disposal of sanitary wastes and excreta will be into septic tanks. • Kitchen wastes will be disposed into soak pits. Wastewater from campsites will be discharged and disposed in a kitchen sump located at least 15 meters from any water body. Sump capacity will be at least 1.3 times the maximum volume of wastewater discharged. The bottom of the pit will be filled with coarse-gravel and the sides shored up with board, etc. to prevent erosion and collapse of the pit. • Solid wastes generated in the construction site will be reused if recyclable, inert materials will 				

Environmental Impacts	Environmental Mitigation Measures	Approximate Location	Mitigation Cost (NRs.)	Institutional Responsibility	
				Implementation	Supervision
3. Vibration	<ul style="list-style-type: none"> wildlife activities at night Photographic records of the existing private and public infrastructures along the corridor of impact will be maintained for verification of any infrastructure damage during construction 	Throughout the road corridor	-	Contractor	SC, GESU/ PD/ DOR
9. 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 will not be located on/near water courses, schools, hospitals or public standpipes; and will not affect locals and their properties. Obtain written permission from landowners and local bodies for stockpiling on their land. Stockpiles subject to erosion by wind or water will be covered with tarpaulins. For large stockpiles, it will be enclosed with side barriers and also covered when not in use. Clean area properly after completion. 	Throughout the road alignment	Construction Contract	Contractor	SC, GESU/ PD/ DOR
10. Change in River Flow Pattern	<ul style="list-style-type: none"> Do not divert water away from natural water course unless it is absolutely necessary. In such case provision must be included to allow by-pass for migrant fish. Avoid any blockage or diversion of natural channel 	Throughout the road alignment	-	Contractor	SC, GESU/ PD/ DOR

Environmental Impacts	Environmental Mitigation Measures	Approximate Location	Mitigation Cost (NRs.)	Institutional Responsibility	
				Implementation	Supervision
6. Water Pollution	<ul style="list-style-type: none"> be disposed off in landfill sites and combustible materials will be buried if it is not hazardous. Disposal of soil, sludge and other waste directly into water bodies will be avoided Avoid vehicular cleaning activities on/close to the water bodies especially on the river, stream and lakes Prevention of soil slipping at toe of the stockpile areas by installing barrier at the perimeter. Adequate catch drain will be constructed to drain out surface runoff waters quickly as possible 	All rivers/streams crossed by the road	350,000.00 for air, noise & water quality monitoring	Contractor	SC, GESU/ PD/ DOR
7. Noise Pollution	<ul style="list-style-type: none"> 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. Noise levels (1 hr Leq dB(A)) will be monitored regularly during construction. Conforming WHO standards. Construction activities will be carried out only between 6 A.M to 6 P.M to avoid disturbance to nearby communities and 	Major settlement areas	350,000.00 for air, noise & water quality monitoring	Contractor	SC, GESU/ PD/ DOR

Environmental Impacts	Environmental Mitigation Measures	Approximate Location	Mitigation Cost (NRs.)	Institutional Responsibility	
				Implementation	Supervision
11. Impact due to spoil disposal from construction and labor camp	<p>due to disposal of spoil.</p> <ul style="list-style-type: none"> Wherever possible, the surplus spoil will be used to fill eroded gullies, quarries and borrow pit, depressed area etc. After disposal, the site will be provided with proper drainage, vegetation and adequate protection against erosion. 	<p>Probable locations for workforce camp are km. 06+500 to 07+140, km. 07+740 to 08+400, 13+950 to 14+050, 18+300 to 18+500, 24+000 to 25+070 for Dhadingbesi-Ankhu Khola section (00+000 – 26+774) and 55+200 to 55+540, 56+300 to 56+540, 57+740 to 57+770, 59+160 to 59+250, 65+800 to 66+320, 68+940 to 69+050 and 73+960 to 74+000 for Ghyampesal-Gorkha section (54+300 – 76+887).</p>	Construction contract	Contractor	SC, GESU/ PD/ DOR
12. Impact due to Quarrying of material and Borrow Pits operation	<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. Unstable site, erosion prone area, dense forest area, settlement, fertile farm land will be avoided for quarrying operation. After the extraction is completed, the quarry site will be rehabilitated to suit the local landscape. 	Construction	Construction Contract	Contractor and SC	SC, PD/ DOR

Environmental Impacts	Environmental Mitigation Measures	Approximate Location	Mitigation Cost (NRs.)	Institutional Responsibility	
				Implementation	Supervision
13. Impact due to Air and Noise pollution from cutting and filling	<ul style="list-style-type: none"> Quarries, crushers and asphalt plants must be located at least 500m away from residential and public sensitive area. Spray water before loading and transportation of soil and sand particularly during windy condition Dust causing materials will be covered during transportation. 	Construction	350,000.00 for air, noise & water quality monitoring	Contractor	SC, PD/ DOR
14. Impact on Irrigation canal	<ul style="list-style-type: none"> Provision made to extend existing 15 number (300 mm diameter) of irrigation pipes to a length of 10 m hume pipe and install two (2) new 300mm pipe and replace 17 number of damaged 300mm and smaller pipe for irrigation crossing. 	Chainages: 14+930, 15+220, 15+300, 15+380, 15+775, 15+930, 16+450, 16+620, 16+680, 17+820, 17+980, 18+140, 18+300, 18+310, 20+087, 20+100, 20+230, 20+340, 22+600, 22+600, 24+450, 24+465, 24+580, 24+620, 24+800, 55+940, 56+960, 57+900, 57+980, 59+285, 61+830, 67+060, 68+850, 70+460)	Construction contract	Contractor	SC, GESU/ PD/ DOR
15. Construction hazard	<ul style="list-style-type: none"> Use mandatory the use of helmets, safety belts, masks, gloves and work boot by workers depending nature of work. Works will be provided with first aid and health facilities. Provision for the group accident insurance for the workers. 	All the construction sites	NRs. 31, 20, 144.00 for safety gears/facilities Contractor's employee and labours' insurance NRs. 13,04,000.00	Contractor	SC, GESU/ PD/ DOR
16. Workers sanitation and STI-HIV/AIDS issues	<ul style="list-style-type: none"> Provide clean drinking water at site and camp. Provide pit toilet at site and camp. 	All the contractor campsites		Contractor	SC, GESU/ PD/ DOR

Environmental Impacts	Environmental Mitigation Measures	Approximate Location	Mitigation Cost (NRs.)	Institutional Responsibility	
				Implementation	Supervision
	<ul style="list-style-type: none"> Aware workers and staffs about HIV AIDS and other communicable diseases. The contractor will keep at site a full time safety and environment monitoring officer and a medical officer. The contractor will arrange all personal protection equipment. General medical center with a bed will be established at the camp site to treat minor injuries and illness 	All the construction sites	NRs. 31,20,144.00 for safety gears/facilities		
17. Occupational health and safety including awareness of dust, noise and bitumen heating issues	<ul style="list-style-type: none"> Required delineators, safety signs, road bumps etc. will be used as appropriate along the road. Road safety awareness programs will be conducted, including the propagation of educative hand-out material in local language(s). The material will 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 	Throughout the road alignment	-	Contractor	SC, GESU/ PD/ DOR
21. Road safety				Contractor	SC, GESU/ PD/ DOR
Operation Stage					
1. Impacts due to slope instability	<ul style="list-style-type: none"> Minor landslide and mass wasting will be immediately cleared and slope restored with appropriate technology (bio-engineering) 	Throughout the road alignment	Maintenance budget	Division Office	DOR

Environmental Impacts	Environmental Mitigation Measures	Approximate Location	Mitigation Cost (NRs.)	Institutional Responsibility	
				Implementation	Supervision
2. Impact due to poor drainage	<ul style="list-style-type: none"> • Soil conservation will be promoted in the right of way and vulnerable area beyond the road alignment. • It is recommended to close the side drain especially near settlement/market area and maintain regular to avoid blockage and stagnation of water • Regular cleaning of roadside channel to avoid any blockage of drainage 	Throughout the road alignment	Maintenance cost	Division Office	DOR
3. Air and Noise pollution	<ul style="list-style-type: none"> • Plantation of pollution absorbent tree species, especially at the settlement area will help to reduce pollution. 	Throughout road corridor	Maintenance cost	DOR Transport Management Department	DOR, GESU, TESU
I. Biological Environment					
Pre-Construction Stage					
1. Loss of Forest and vegetation	<ul style="list-style-type: none"> • Mark out extent of clearing within approved worksite areas taking care to avoid religious trees -- bar, pipal trees if any. • Undertake vegetation / trees clearance only with prior approval of local stakeholders. DoF, FUG, VDC, and DDC etc. as appropriate. • Stockpile cleared shrub/foliage where possible within ROW as appropriate. 	Forest areas along the road alignment	Construction contract	Contractor	SC, GESU/ PD/ DOR
II. Construction Stage					
1. Loss of forest land	<ul style="list-style-type: none"> • Project has to carry out plantation equivalent to the 	All 11 community forests along the road corridor	NRs. 15,96,285.00	Contractor	SC, GESU/ PD/ DOR