

# Environmental Assessment Document

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## Initial Environmental Examination

Grant Number: 0093 NEP

May 2010

## Nepal: Rural Reconstruction and Rehabilitation Sector Development Program

## Bankatta-Bagai Road Subproject, Chitwan District

Prepared by the Government of Nepal

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Government of Nepal  
Ministry of Local Development  
Department of Local Infrastructure Development and Agricultural Roads  
**Rural Reconstruction and Rehabilitation Sector Development Program**  
[ADBGrant 0093NEP]

# **Initial Environmental Examination (IEE) Report**

Of

## **Bankatta-Bagai Road Subproject Chitwan District**

Submitted to:  
**Ministry of Local Development**  
Government of Nepal

Proponent:  
**District Development Committee/  
District Technical Office**  
Bharatpur, Chitwan

May, 2010

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Prepared By:  
**District Implementation Support Team (DIST)**  
GOEC Nepal Pvt. Ltd.

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## ABBREVIATIONS

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ADB	Asian Development Bank	IUCN	International Union for Conservation Nature
amsl	Above mean sea level	Km	Kilometer
AP	Affected Person	LDO	Local Development Officer
BG	Building Group	LEP	Labour based, Environment friendly and Participatory
Ch	Chainage	LEST	Livelihood Enhancement and Skill Training
CBO	Community Based Organization	LRMP	Land Resource Management Project
CDC	Compensation Determination Committee	M	meter
CDO	Chief District Officer	MoU	Memorandum of Understanding
CEA	Country Environmental Analysis	MoE	Ministry of Environment
CGI	Corrugated Galvanized Iron	ML	Milliliter
CF	Community Forest	MLD	Ministry of Local Development
CFUG	Community Forest Users Group	NGO	Non-Governmental Organization
CISC	Central Implementation Support Consultant	NRs	Nepali Rupees
CITES	Convention on International Trade in Endangered Species of Flora and Fauna	NTFPs	Non Timber Forest Products
DADO	District Agriculture Development Office	OFID	OPEC Fund for International Development
DDC	District Development Committee	OP	Operational Plan
DFID	Department for International Development	OPEC	Organization of Petroleum Exporting Countries
DFO	District Forest Office/Officer	PAM	Project Administrative Memorandum
DG	Director General	PCC	Plain Cement Concrete
DIST	District Implementation Support Team	PCU	Project Coordination Unit
DIT	District Implementation Team	RBG	Road Building Group
DoLIDAR	Department of Local Infrastructure Development and Agricultural Roads	RCC	Reinforced Cement Concrete
DPO	District Project Office	RCIW	Rural Community Infrastructure Works
DPCC	District Project Coordination Committee	REA	Rapid Environmental Assessment
DRSP	District Road Support Programme	RES	Rapid Environmental Screening
DSCO	District Soil Conservation Office	RIDP	Rural Infrastructure Development Project
DTO	District Technical Office	RP	Resettlement Plan
DTMP	District Transport Master Plan	RRRSDP	Rural Reconstruction and Rehabilitation Sector Development Program
EA	Environmental Assistant/Assessment	RS	Resettlement Specialist
EARP	Environmental Assessment and Review Procedures	SF	Social Funding
ES	Environmental Specialist	SA	Social Appraisal
EIA	Environmental Impact Assessment	SDC	Swiss Agency for Development and Cooperation
EMP	Environmental Management Plan	SM	Social Mobilizer
EMS	Environmental Management Section	SDS	Social Development Specialist
EPA	Environmental Protection Act	TA	Technical Assistance
EPR	Environmental Protection Rules	ToR	Terms of Reference
ESD	Environment Screening Document	TWS	Technical Walkover Survey
FGD	Focus Group Discussion	VDC	Village Development Committee
GoN	Government of Nepal	VICCC	Village Infrastructure Construction Coordination Committee
GIS	Geographical Information System	ZoI	Zone of Influence
Ha	Hectare		
HH	Household		
IEE	Initial Environmental Examination		

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## NAME AND ADDRESS OF THE PROPONENT

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### **Name of Proposal**

Rehabilitation (Upgrading) of Bankatta- Bagai Road Subproject, Chitwan District

### **Name and Address of Proponent**

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## EXECUTIVE SUMMARY IN NEPALI

### वनकट्टा-वगई सडकको प्रारम्भिक वातावरणीय परीक्षण प्रतिवेदन कार्यकारी सारांश

#### पृष्ठभूमि :

नेपाल सरकारले लामो दून्दले गर्दा क्षति भएका ग्रामीण पूर्वाधारहरूको पुनःनिर्माण र पुनःस्थापना को कार्य एशियाली विकास बैंक (ADB), ब्रिटिस सरकार (DFID), स्विस् सरकार (SDC) तथा ओपेक फण्ड (OFID) को आर्थिक सहयोगमा 'ग्रामीण पूर्वाधार पुनःनिर्माण र पुनःस्थापना आयोजना' नेपालको बिसवटा जिल्लाहरूमा संचालन गरिरहेको छ । चितवन जिल्लामा अवस्थित प्रस्तावित वनकट्टा-वगई (District Transport Master Plan No.35A003R) ग्रामीण सडकको पुनःस्थापना सोही कार्यक्रम अन्तर्गत संचालन गर्न लागिएको एक उप-आयोजना हो । उपआयोजना (प्रस्ताव) अन्तर्गत २३.५ कि.मी. लामो उक्त कच्ची सडकको कालोपत्रे स्तरमा पुनःस्थापना गर्न प्रस्ताव गरिएको छ ।

#### प्रस्तावक:

प्रस्तावित सडक उप-आयोजनाको प्रारम्भिक वातावरणीय परीक्षणको प्रस्तावक जिल्ला विकास समिति र जिल्ला प्राविधिक कार्यालय, चितवन हुन् । प्रस्तावकको प्रारम्भिक वातावरणीय परीक्षण स्विकृत गर्ने सम्बन्धित निकाय स्थानिय विकास मन्त्रालय हो ।

#### उद्देश्य

प्रारम्भिक वातावरणीय परीक्षण प्रतिवेदन अध्ययनको मुख्य उद्देश्य प्रस्तावित उप आयोजना निर्माण तथा संचालन बाट उक्त क्षेत्रको भौतिक, जैविक, सामाजिक, आर्थिक तथा सांस्कृतिक वातावरणमा पर्ने प्रभावहरू पत्ता लगाई नकारात्मक प्रभावको न्यूनीकरण र सकारात्मक प्रभाव बढाउने उपायहरू बारे सुझाव दिनु, वातावरणीय अनुगमन योजना बनाई कार्यान्वयन गराउनु, तथा प्रस्तावित सडक आयोजनाको लागि प्रारम्भिक वातावरणीय परिक्षण गरे पुग्छ, भन्ने कुराको यकिन गर्नु हो ।

#### प्रस्तावको सान्दर्भिकता

प्रस्तावित सडकले चितवन जिल्लाको सुदुर दुर्गम भेगका वासिन्दाहरूलाई सदरमुकाम संगको पहुँच बढाउनेछ भने स्थानिय स्तरमा उत्पादन हुने तरकारी, दुध, धान, मकै र गहुँलाई बजार संग जोडी स्थानिय आय आर्जनमा अभिवृद्धि गर्नेछ ।

#### अध्ययन प्रकृया

जुलाई, २००९ मा फिल्ड सर्वेक्षणबाट लिइएको तथ्याङ्क तथा अन्य उपलब्ध तथ्याङ्कहरूको साथै सामाजिक तथा प्राविधिक टोलीबाट पुनर्वास कार्यको सर्वेक्षणको सिलसिलामा संकलन गरेका तथ्याङ्कहरू केलाएर प्रारम्भिक वातावरणीय परीक्षण प्रतिवेदन तयार गरी निष्कर्ष तथा सुझावहरू दिइएको छ । यो प्रारम्भिक वातावरणीय परीक्षण प्रतिवेदन नेपाल सरकारको वातावरण संरक्षण ऐन २०५३, वातावरण संरक्षण नियामावली २०५४ अनुसार तथा स्थानिय विकास मन्त्रालयबाट मिति २०६६/०२/०४ मा स्विकृत गरिएको यसै प्रस्तावको कार्यसूची अनुसार तयार गरिएको छ । साथै, एशियाली विकास बैंकको Environmental Assessment Guideline, 2003 तथा Safeguard Policy Statement, 2009 को समेत अनुसरण गरिएको छ ।

#### आयोजनाको विवरण

प्रस्तावित सडकले चितवन जिल्लाको सुदुर दक्षिण-पश्चिम दुर्गम भेगका बस्तीहरूलाई जिल्लाको सदरमुकाम संग जोड्दछ यसको कूल लम्बाइ २३.५ कि.मि. छ । हाल उक्त ग्रामीण सडकको पुरै सडक खण्डमा गाडी चल्छ । यो सडक चारवटा गाउँ विकास समितिहरू क्रमश गर्दी, भगौडा, अयोध्यापुरी र कल्याणपुर भएर जान्छ । सडकको कुल चौडाइ ५ मि. हुनेछ भने मोडहरूमा आवश्यकता अनुसारको चौडाइ हुनेछ । यो आयोजनाको कूल अनुमानित लागत नेरु. ११९,७५१,५२१ रहेको र प्रति कि.मी अनुमानित लागत नेरु. ५,०८४,९९० लाग्ने देखिन्छ ।

#### विद्यमान वातावरणीय स्थिति

यो सडक गर्दी गा.वि.स. को रेवा खोला बाट समुद्री सतहदेखिको १४१ मी. को उचाईबाट शुरु भएर समुद्री सतहदेखिको २५३ मी. उचाईको वगई बजार भएर जान्छ । प्रायः एलुभियल तथा कोलुभियल प्रकारका बालुवा र पाँगो मिसिएको माटोहरू सडक खण्डमा पाइन्छन् । सडक खण्डमा पर्ने पानीका मुख्य श्रोतहरूमा रेवा, रिमाल, पतरा, वादरमुडे खोलाहरू पर्दछन् । प्रस्तावित सडक क्षेत्रको वायु तथा पानीको स्तर सफा रहेको देखिन्छ साथै ध्वनि प्रदुषणको समस्या छैन । यो सडक प्रायः खेती गरिएको जमीन तथा खाली जमीन र बस्तीहरू भएर जान्छ ।

यस सडक खण्डमा पाइने मुख्य रुखको प्रजातिहरूमा आँप, नरिवल, साल, खयर, सिसउ, मसला, सिमल, निम, बकाइनो, बांस आदी पर्दछन् । वनविरालो, गैडा, बाघ, मृग, चितुवा, जंगली हात्ति, ब्वासो, फ्याउरो, लोखर्के, दुम्लि, आदि वन्य जन्तुका साथै काग, भँगेरा, परेवा, ढुकुर आदि पक्षीहरू सडक छेउको वनमा पाईन्छ । यो सडक खण्डको प्रभावित क्षेत्र भित्र जम्मा घरधुरी संख्या ८०६८ र जनसंख्या ५०३७३ रहेको छ र सरदर परिवार संख्या ६.२४ छ । यहाँ चौधरी, सिंह, तामाङ, थारु, क्षेत्री, ब्रह्ममण तथा दलित (दमाई, कामी) जातीहरू बसोबास गर्दछन् ।

यहाँका बासिन्दाहरूको मुख्य पेसा कृषि र पशुपालन हो । यातायातको राम्रो सुविधा नभएकोले कृषि उब्जनीले मात्र पर्याप्त नहुने हुँदा यहाँका अधिकांश मानिसहरू श्रम रोजगारीका अन्य पेशामा काम गर्ने साथै उल्लेखनीय प्रतिशत मानिसहरू जीविकोपार्जनको सिलसिलामा हिउँदमा काठमाडौँ, नारायणघाट, भारत लगायतका ठाउँमा रोजगारीको लागि जाने गर्दछन् ।

### प्रमुख वातावरणीय प्रभावहरू

#### सकारात्मक प्रभाव :

आयोजना बाट तत्कालै हुने लाभमा स्थानीय स्तरमा रोजगारीको सिर्जना हुनेछ । आयोजना संचालनको लागी करिव २०६७७९ मानव दिन वरावरको अदक्ष र १४९०१ मानव दिन वरावरको दक्ष श्रमशक्तीको आवश्यकता पर्नेछ । आयोजना संग सम्बन्धित कार्यमा (रोजगारीमा) गरीब, तथा पिछडिएका स्थानीय जनताले प्राथमिकता पाउनेछन् । यस चरणमा हुने अन्य लाभहरूमा बन्द व्यापारको बृद्धि हुने अवसर, आयोजनाले प्रदान गरेको शीपमुलक तथा जनचेतनामुलक तालिममा तथा आयोजना निर्माण कार्यमा सहभागी भई स्थानीय जनताको शीप बृद्धि हुने अवसर पर्दछन् ।

सडक सञ्चालनका चरणमा सडकले प्रभावित क्षेत्रका बासिन्दालाई बजार, सामाजिक सेवा प्रदायक स्थान तथा देशका अन्य भागहरूसम्म पुग्न छिटो, छरितो तथा सुविधाजनक पहुँचको अवसर प्रदान गर्नेछ । सडक सुविधाको कारण मल तथा किटनाशक औषधीहरूको सस्तो तथा सुलभ आपूर्तिले कृषिको उत्पादकत्वमा अभिवृद्धि हुनेछ । यसले स्थानीय जनताको आय तथा खाद्य सुरक्षामा अभिवृद्धि हुनेछ साथै स्थानीय श्रोत साधनको उपयोग गर्ने साना कृषि उद्योगहरूको प्रवर्द्धन हुनेछ । पहुँच तथा यातायातको अवसर संगै शिक्षा, स्वास्थ्य, संचार, बजार, बैकिङ तथा अन्य आर्थिक तथा सामाजिक क्षेत्रहरूको विकास हुनेछ । यसले यस क्षेत्रका मानिसहरूको समग्र जीवनस्तर उकास्न मद्दत पुऱ्याउनेछ । सडकको सञ्चालनले स्थानीय जग्गा जमिनको मुल्य बृद्धि गर्न सहयोग पुऱ्याइ स्थानीय जग्गाधनीलाई लाभ पुऱ्याउनेछ ।

#### उप-आयोजना कार्यन्वयनबाट पर्न सक्ने नकारात्मक प्रभावहरू :

सडक निर्माणको क्रममा खन्दा निस्किएका माटो ग्रेगर थुपार्दा, निर्माण सामग्री भिक्नलाई खानी सञ्चालन गर्दा त्यस क्षेत्रमा असर पर्न गई भु-क्षय हुन सक्ने सम्भावना रहन्छ । फोहर तथा खन्दा निस्किएका माटो, ग्रेगर को उचित व्यवस्थापन हुन सकेन भने यसले भु-क्षय बढाउन तथा जल प्रदुषण गराउन सक्छ । सडक निर्माण क्रियाकलापबाट जीवजन्तुलाई असर पर्ने तथा सडक निर्माण कार्यमा खटिएका कामदारहरूले वनका जीवजन्तुलाई जिस्क्याउने तथा तिनको शिकार गर्नसक्ने सम्भावना रहन्छ ।

सडक निर्माण कार्यको दौरान श्रमिकहरू तथा स्थानीय जनताको स्वास्थ्यमा असर पर्ने अथवा अप्रिय दुर्घटनाहरू घट्न सक्ने सम्भावना रहन्छ ।

सडक किनाराका नाला बाट वगेको अनियन्त्रित पानीले सडक मुनिका खेतवारीमा असर पर्ने हुन सक्छ । सवारी साधनको बृद्धिले धुलो तथा ध्वनी प्रदुषण बढ्नेछ । त्यसैगरी सडकको सुधार संगै वन क्षेत्रसम्म भएको पहुँचको बृद्धिले वन सम्पदा तथा वन्य जन्तुमा चाप बढ्न गई वन सम्पदाको क्षय र जीवजन्तुलाई असर पर्न सक्छ । सडकको सुधार संगै बस्ती र बजारको अव्यवस्थित विस्तार हुने सम्भावना र सडक क्षेत्र मिच्ने प्रवृत्ति देखिन सक्छ ।

#### प्रभाव न्यूनिकरणका उपायहरू :

यस उप-आयोजनालाई वातावरण मैत्री बनाउनका लागी सकारात्मक प्रभावलाई बढावा गर्ने तथा नकारात्मक प्रभावहरूलाई नियन्त्रण या न्यूनिकरण गर्ने थुप्रै उपायहरू यस प्रतिवेदनमा प्रस्तावित गरिएको छ । सडक LEP (श्रम मुलक वातावरण मैत्री सहभागीता मुलक) तथा मेसीन तथा औजार प्रयोग गरी निर्माण गरिने छ । उप-आयोजना निर्माणको क्रममा जमिन काट्दा, खानी सञ्चालन गर्दा, खन्दा निस्किएका माटो, ग्रेगर थुपार्दा तथा अन्य कार्य गर्दा त्यस क्षेत्रको संवेदनशील वातावरणलाई सुरक्षित राख्न विशेष ध्यान दिनेछ । निर्माण कार्यमा कार्यरत श्रमिकहरूको बिमा गरिने छ तथा सुरक्षाका सम्पूर्ण सामग्री श्रमिकहरूलाई प्रयोगमा ल्याउन दिइने छ । वन, जीवजन्तुको संरक्षण गर्न तथा



सामाजिक अक्षुण्णतालाई कायम राख्न जनचेतनामूलक कार्यक्रमहरु तथा तालिमहरु सञ्चालन गरिनेछ । निर्माण स्थलहरुमा प्राथमिक उपचारको सामग्रीहरुको व्यवस्था गरिने छ । सडक सञ्चालनका क्रममा सडकमा देखिएका अस्थिरताहरुलाई नियमित रुपमा मर्मत संभार गरिनेछ । सडकमा तथा सडकको कारण नजिकैको खेतवारीमा पानी जम्मा हुन नदिन उचित निकासको व्यवस्थापन गरिनेछ । सडक दुर्घटना बाट बचाव गर्ने उपायहरु अवलम्बन गरिनेछ ।

#### वातावरण व्यवस्थापन योजना :

यस प्रतिवेदनमा वातावरण व्यवस्थापन योजना अन्तर्गत आयोजनाबाट पर्ने संभावित असरहरु, असरहरुको प्रभाव, न्युनिकरण विधि, अनुगमन विधि तथा कार्यतालिका प्रस्तावित गरिएको छ । यसका साथै न्युनिकरणका उपायहरुको तथा अनुगमन कार्यको कार्यान्वयन गर्ने जिम्मेवार निकायहरुको पनि पहिचान गरिएको छ । अनुगमनका लागी आवश्यक भौतिक, जैविक, सामाजिक-आर्थिक तथा सांस्कृतिक वातावरणका विभिन्न अनुगमन सुचाङ्कहरुको पनि पहिचान गरिएको छ । वातावरण व्यवस्थापन योजना कार्यान्वयन गर्न निम्नानुसार खर्च हुने अनुमान गरिएको छ ।

क्र. सं.	विवरण	रकम (ने.रु.)	कैफियत
१.	वातावरण सम्बन्धी जनचेतनामूलक तालिम तथा अन्य तालिम	२००,०००/-	आयोजनाको बजेटमा समावेश गरिने ।
२.	श्रमिकहरुको विमा	४००,०००/-	BoQ मा समावेश गरिने ।
३.	बायो-इन्जिनियरिङ्ग / सडक छेउ वृक्षारोपण	२,८५१,५५५/-	BoQ मा समावेश गरिने ।
५.	पुनर्निर्माण तथा अन्य	५००,०००/-	BoQ मा समावेश गरिने ।
६.	एच. आई. भी. रोकथाम तथा अन्य चेतनामूलक कार्यक्रमहरु जस्तै: युवा साक्षरता, स्थानीय विद्यालय सहयोग आदि	७,८२,९९०/-	सामाजिक योजना तथा आयोजनाको बजेटमा समावेश गरिने ।
७.	पेशागत स्वास्थ्य सुरक्षा तथा जानकारीमूलक सूचनापाटी	३५०,०००/-	BoQ मा समावेश गरिने ।
८.	अनुगमन तथा मुल्यांकन	२००,०००/-	आयोजनाको बजेटमा समावेश गरिने ।
	<b>जम्मा :</b>	<b>५,२८४,५४५/-</b>	

#### निष्कर्ष

परिचान गरिएका प्रायः वातावरणीय प्रभावहरु थोरै क्षेत्रमा तथा मुख्य गरी निर्माणकार्यका बखतमा सिमित रहेको पाइएको छ । प्रस्तावित न्युनिकरण विधिको पालना गरिएमा पहिचान गरिएका वातावरणीय प्रभावहरुको न्युनिकरण अथवा नियन्त्रण गर्न सकिनेछ । वातावरण व्यवस्थापन योजना अन्तर्गत उल्लेख गरिएको उपायहरुको कार्यान्वयन गरिएमा यस आयोजनाको कार्यान्वयनले आयोजना क्षेत्रको भौतिक, जैविक, सामाजिक - आर्थिक तथा सांस्कृतिक वातावरणमा उल्लेखनीय नकारात्मक प्रभाव नपर्ने देखिन्छ । यस प्रारम्भिक वातावरणीय अध्ययनको आधारमा यस प्रतिवेदनमा उल्लेख गरिएको वातावरणीय व्यवस्थापन योजनालाई पूर्ण रुपमा लागु गरी प्रस्तावित आयोजना कार्यान्वयन गर्न सिफारिश गरिन्छ । आयोजनाको वातावरणीय प्रभाव मुल्याङ्कन स्तरमा अध्ययन गर्न आवश्यक नरहेको सिफारिश समेत गरिन्छ ।

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## EXECUTIVE SUMMARY IN ENGLISH

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### Background

Government of Nepal has received financial assistance from ADB, DFID, SDC and OFID for implementation of the Rural Reconstruction and Rehabilitation Sector Development Program (RRRSDP). The RRRSDP aims for reconstruction and rehabilitation of rural infrastructures damaged in the twenty conflict affected districts of the country. The Proposed 23.5 km long Bankatta-Bagai Rural Road (District Transport Master Plan No.35A003R) in Chitwan District is one of the subprojects selected under the RRRSDP. It is an existing earthen road proposed for upgrading in bituminous standard.

### Project Proponent

The proponent of the proposed road Subproject for Initial Environmental Examination (IEE) is District Development Committee (DDC)/District Technical Office (DTO), Chitwan district. Ministry of Local Development (MoLD) is the authorized body for approving the IEE of the proposed Subproject.

### Objectives

The main objective of the IEE study is to identify the impacts from the construction and operation of the proposed Subproject on the physical, biological, socio-economic and cultural environment of the Subproject area. The objective of IEE study is to recommend site specific environmental mitigation measures for adverse impacts, benefit augmentation measures for beneficial impacts, prepare and implement environmental monitoring plan and make sure that IEE is sufficient for the proposed road sub-project.

### Relevancy of the Proposal

The proposed Subproject will provide access to district headquarter, living in rural area of Chitwan district. It will provide easier access to people to social services, and market access for local products like vegetables, milk, rice, maize and wheat. As a result, the Subproject will assist to promote economic activities, reduce poverty and increase socio-economic conditions of the people of the area.

### Study Methodology

The IEE study has been conducted through review of secondary information collected from relevant agencies, and primary information collected from the field survey in July 2009. The survey methods included walk-through survey along the proposed alignment with checklists, conduction of sample household survey, organizing focus group discussions (FGD) in the related VDCs, and information supplemented by the resettlement and technical team of the Subproject.

The IEE report has been prepared following the Environmental Protection Act, 1997 and Environmental Protection Rules, 1997 (second amendment 2007) of the Government of Nepal (GoN); and Environmental Assessment Guidelines, 2003, and Safeguard Policy Statement, 2009 of ADB. The report follows the Terms of Reference for IEE Study approved by MoLD on 04/02/2066 BS.

### Brief Description of the Subproject

The proposed road links with Far South-West part of the remote community of Chitwan district with the district headquarter, Bharatpur. The total length of the road is 23.5Km. The road alignment is already opened and motorable. The road passes four village development committees namely Gardi, Bhaghauda, Kalyanpur and Ayodhyapuri. The average width of the road is 5m and geometry will be improved as per design required. The total project cost is NRs 119,751,521 and per km cost is NRs. 5,084,990.

## Existing Environmental Condition

The road starts from Rewa Khola of Gardi VDC at 141m amsl and passes through Bagai at 253m amsl. Generally, alluvial, colluvial and ordinary soil are found along the road alignment. Rewa, Rimal, Patara, Badharmude Kholas are the major natural drainages along the road alignment. Ambient air and water quality of the proposed project area is observed to be good and there is no noise pollution. The road passes through cultivated land, barren and settlements.

The dominant vegetation found in the road alignment are (*Mangifera Indica*) Mango, (*Cocos nucifera*) Coconut, (*Shorea robusta*) Sal, (*Acacia catechu*) Khayar, (*Dalbergia sissoo*) Sisau, (*Eucalyptus camaldulensis*) Mashala, (*Bombax ceiba*) Simal, (*Azadirachta indica*) Neem, (*Melia azedarach*) Bakaino and *Dendrocalamus strictus* (Bamboo). (*Felis chaus*) Jungle Cat, Rhinoceros, (*Panthera tigris*) Tiger, (*Muntiacus muntjack*) Deer, (*Panthera pardus*) Leopard, (*Elephas maxiums*) Wild Elephant, Wolf, (*Vulpes vulpes*) Fox, (*Ratufa sp.*) Squirrel, and (*Hystrix indica*) Dumsi are the common wildlife and (*Corvus splendens*) Crow, (*Passer domesticus*) Sparrow, (*Columba livia*) Pigeon, (*Streptopelia spp.*) Dhukur are the birds found in the Subproject area. Total population of the Subproject area is 50373, total household number is 8068, and average family size is 6.24. Chaudhary, Singh, Tamang, Tharu, Chhetri, Brahmin and occupational caste (Damai, Kami) are the main castes living in the area.

Subsistence agriculture and livestock farming are the main occupation. Due to limited transportation facilities farming is not enough for subsistence level. Moreover, significant percentage of the economically active male population also migrates to various places including Kathmandu, Narayanghat and India seasonally during slack farming season for employment.

## Major Environmental Impacts

### Beneficial Impacts

The immediate benefit from this road Subproject is employment opportunities. The implementation of Subproject require about 206779 person days of unskilled and 14901 person days of skilled manpower. The project will give priority to the poor, ethnic minorities and disadvantaged local people for employment opportunity. Other beneficial impacts include enhancement of local business, development in skills of local people from skill developing training, awareness raising training and involvement in the construction of the project.

During operation stage of road, the people from the Zone of Influence (Zol)<sup>1</sup> will get easy and fast accessibility to markets, social services and other regions of the country. The fertilizers and pesticides will become cheaper with better transportation facility hence, agricultural production will increase. This will ensure better economic condition and food security of the people living in the Zol of the project area. Moreover this will promote the small agro based industries that uses local resources. Easy access and opportunity of better transportation system will develop other sectors like education, health, communication, market, banking and other socio-economic sectors. This will increase the overall living condition of the people living in Zol of project area. The better land network will result in increased land price which will be beneficial for land owners.

### Adverse Impacts

During the road construction disposal of soil and earth material, operation of quarries might result in soil erosion. Furthermore, spoils generated during construction can create the water pollution to the nearby water sources. During construction of road there might be possible impacts on wildlife as workers might harass/ hunt the wildlife in the nearby forests, however, such effects are very minimum.

During construction stage, labours and local people are prone to health effects and accidents relating to construction activities.

The flowing water on the side drain of the road might cause erosion of soil on adjacent agricultural land. Vehicular emissions will result in air and noise pollution. Because of easy accessibility to the

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<sup>1</sup> Zol is one and half hour walking distance from the road and areas of related VDCs.

forest areas will deplete forest resources and wildlife. New settlement, bazaar area will be expanse and this may increase encroachment of the RoW.

### Mitigation Measures

The various benefit augmentation measures and adverse impact mitigation measures have been proposed in the report to make this project environment friendly. The construction of road will be based on Labour-based, Environment friendly and Participatory (LEP) Approach and Machine Intensive Road Construction Approach. Necessary measures will be taken to reduce the adverse effects that might arise from site clearance, cutting of slopes, disposal of spoils and quarrying activities. Necessary trainings and awareness programs will be conducted. Necessary measures will be adopted for protection of flora and fauna. At construction site, the workers will be provided insurance, first aid facilities and safety equipments. Proper maintenance and proper drain system will be provided to prevent accumulation of water on the nearby agricultural lands during operation. Adequate road safety measures will be provided to minimize road accident.

### Environmental Management Plan

Environmental management plan is prepared to ensure the implementation and monitoring of mitigation measures for minimizing adverse impacts and maximizing the beneficial impacts. The necessary mitigation measures together with environmental monitoring process and responsible bodies for environmental monitoring have been identified. Similarly, for environmental monitoring various sections of physical, biological, socio-economic and cultural environment have been identified to generate useful information and improves the quality of implementation of mitigation measures.

The cost for implementing environmental management plan has been identified as follows:

SN.	Description	Amount (NRs.)	Remarks
1	Environmental awareness raising training and other training	200,000.00	To be included in project cost
2	Insurance of workers	400,000.00	To be included in BoQ
3	Bio-engineering/Roadside Plantation	2,851,555.00	To be included in BoQ
5	Restoration or relocation of affected infrastructures, Spoil management, Reinstatement of quarry, stockpiling etc.	500,000.00	To be included in BoQ
6	Social Cost (Health / HIV AIDS / STD prevention awareness; other awareness program such as adult literacy; support to local school etc.)	7,82,990.00	To be included in Social plan, project cost
7	Occupational health and safety, Information signboard	350,000.00	To be included in BoQ
8	Monitoring	200,000.00	To be included in project cost
	<b>Total</b>	<b>5,284,545.00</b>	

### Conclusion and Recommendation

The identified environment impacts will be seen in limited small areas and mainly during construction period. The implementation of proposed mitigation measures for identified adverse impacts will minimize as well as mitigate the adverse impacts on environment. The implementation of measures as described in environmental management plan will mitigate the negative impacts on physical, biological, socio-economic and cultural environment. Therefore, this IEE is sufficient for approval of the proposed sub-project, and recommended for implementation with incorporation of mitigation measures and environmental monitoring plan. Therefore, the proposed Subproject does not require Environmental Impact Assessment.

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## 1.0 Introduction

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### 1.1 Background

1. The Rural Reconstruction and Rehabilitation Sector Development Program (RRRSDP) covers 20 districts spread over the country, which focuses on immediate post conflict development priorities for accelerated poverty reduction and inclusive development, thereby enhancing the effectiveness and efficiency of the delivery of public services, and improving access of rural people to economic opportunities and social services. The RRRSDP is financed by the Government of Nepal (GoN), Asian Development Bank (ADB), Department for International Development (DFID), Swiss Development Cooperation (SDC), Nepal and OPEC Fund for International Development (OFID). Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR) under the Ministry of Local Development (MLD) is the executing agency (EA). The DDCs are the Project Implementing Agencies and the DTO of each respective DDC is responsible for technical and project management. The DTO will be supported by District Implementation Support Team (DIST) which includes engineering, safeguards and social mobilization. Chitwan District is one of the project districts under RRRSDP. The 23.5 km long Bankatta-Bagai Rural Road (District Transport Master Plan No.35A003R) in Chitwan District is one of the subprojects selected under the RRRSDP which is proposed for upgrading in bituminous standard.

### 1.2 The Name and Address of Proponent

2.

Name of Proposal:	Rehabilitation (Upgrading) of Bankatta-Bagai Rural Road Sub-project with Black - topping, Chitwan District, Nepal
Name of Proponent:	District Development Committee/ District Technical Office
Address of Proponent:	Bharatpur, Chitwan

### 1.3 Relevancy of the Proposal

3. The Project area is located at remote and underdeveloped south-western part of Chitwan district. The road is currently earthen and motorable during dry weather. The area has high potential in production of vegetable, milk, rice, maize and wheat. In this regard, the proposed rehabilitation of the road will enhance access of people to social services and market centers with significantly reduced travel time and cost, and will contribute in their socio-economic development. Access shall also attract other development infrastructures and open door to further development opportunities in the area.

### 1.4 Need and Objectives of the IEE Study

4. **Need:** An IEE study of the Proposal is a legal requirement according to the Environment Protection Act, 1997; and Environment Protection Rule, 1997 (Amendment 2007) of GoN; and according to the provisions of the Environmental Assessment Guidelines, 2003; and Safeguard Policy Statement, 2009 of ADB.

5. **Objectives:** The main objective of the IEE study is to identify the impacts from the construction and operation of the Proposal on the physical, biological, socio-economic and cultural environment of the Subproject area. The IEE study recommends practical and site specific environmental mitigation and enhancement measures, prepare and implement environmental monitoring plan and make sure that IEE is sufficient for the proposed road sub-project.

### 1.5 Methodology Adopted

6. The IEE study has followed the provisions of the EPA, 1997 and EPR, 1997, and the provisions of ADB. It follows methodology suggested in the approved Terms of Reference for IEE Study (please refer Annex I). For the collection of environmental features related to bio physical environment, maximum 100 meter distance observable from the centre of the road alignment was taken as an influence area and socio-economic and cultural environment was taken of ZoI (one and half hour walking distance from the centre line of the road) information of the Subproject area. The IEE study has been conducted through review of secondary information collected from relevant agencies, and primary information collected from the field survey in July 2009. This IEE report is prepared based on TOR approved on Field survey,

sample household survey, organization of Focus Group Discussions in the related VDCs was carried out and necessary information was collected. The DDCs officials, VDCs and Community Groups were also contacted to verify information to solicit their concerns. Based on the analysis of information the impacts have been predicted, mitigation measures prepared and monitoring plan has been developed.

## 1.6 Description of the proposal

7. The proposed 23.5 km long earthen Bankatta- Bagai road Subproject lies in the South-West part of Chitwan district in Central Development Region of Nepal which links the remote area of the district to its headquarter. The total length of the road subproject was 25 Km in approved ToR, but after detailed survey and design the total length of the road has changed to 23.5 Km. This Subproject starts from Rewa Khola of Gardi Village Development Committee (VDC) and ends at Bagai of Ayodhyapuri VDC. The road passes through Gardi, Baghauda, Kalyanpur and Ayodhyapuri VDC.

8. The road was opened in 2040 B.S and vehicles ply during dry season. The alignment requires widening, geometrical correction in bends, grade improvements and black - topping of road surface. The location and alignment of the road is given in **Figure 1.1 and 1.2**. The total project cost is NRs 119,751,521 and per km cost is NRs 5,084,990 as shown in **Annex III**.

### Salient Features of the Subproject

1. Name of the Sub-project	:	Bankatta-Bagae Road
2. Location		
2.1 Geographical Locations		
2.1.1 Start Point	:	Rewa Khola of Gardi VDC
2.1.2 End Point	:	Bagae of Ayodhyapuri VDC
2.2 Geographical Feature		
2.2.1 Terrain	:	Plain
2.2.2 Altitude	:	The Altitude Varies from 141m amsl to 253 m amsl
2.2.3 Climate	:	Sub-Tropical
2.2.4 Soil	:	Alluvial soil, colluvial soil
3. Classification of Road	:	District Road (Rural Road Class A)
4. Status of road	:	Upgrading to Bituminuos
5. Length of Road	:	23.5 Km
6. Standard of Pavement	:	Bituminous(20mm thick Premix Carpetting)
7. Construction Period	:	400Days
8. Traffic Forecast	:	200 vehicles per day
9. Design speed	:	40 km/hr
10. Major Settlements		
10.1 Major Settlements	:	Bankatta, Baruwa, Basantapur, Kalyanpur, Jeevanpur Govindabasti and Kharkatta.
10.2 No. of Household	:	8068 HHs
10.3 VDCs along the Road	:	Gardi, Baghauda, Kalyanpur and Ayodhyapuri.
11. Cross Section		
11.1 Right of way	:	5m each side (center line)
11.2 Formation width	:	5 m
11.3 Carriageway width	:	3 m
11.4 Lane	:	Single
12. Cross drainage Structure		
12.1 Slab Over Drain	:	2 nos
12.2 Pipe Culvert(600mm dia.)	:	88 RM
12.3 Pipe Culvert(900mm dia.)	:	32 RM
12.4 Pipe Culvert(1200mm dia.):	:	32 RM
13. Structures		
13.1 Gabion Boxes(1.5*1*1)	:	416 nos
13.2 Gabion Boxes (2*1*1)	:	696 nos
13.3 Gabion Boxes (2*1*.5)	:	592 nos
13.4 Stone Masonry works	:	4377.16 cum
13.5 RCC Causeways	:	5 nos
13.6 Dry Stone Causeways	:	2 nos
14. Earthwork Quantity		
14.1 E/W Excavation in Foundation :	:	2758.18 cum



14.2 E/W Excavation in Roadways :	39311.03 cum
14.3 E/W in Filling :	25280.4 cum
15. Pavement Works	
15.1 Subgrade Preparation Works :	141120.00 sqm
15.2 Sub Base work(15 cm thick) :	3867.00 cum
15.3 Base work(10 cm thick) :	7065.00 cum
15.4 Prime Coat :	70650.00 sqm
15.5 Premix Carpeting(20 mm thick) :	70650.00 sqm
15.6 Sand Sealing :	70650.00 sqm
16. Project cost	
16.1 Total Technical (Civil)Cost (NRs):	NRs. 112,161,175.00
16.2 Costs per km (NRs.) :	NRs. 4,762,683.00
16.3 Bioengineering/Roadside Plantation	: NRs. 2,851,555.00
17. Employment generation:	
17.1 Total employment :	
17.1.1 Skilled :	14901
17.1.2 Unskilled :	206779

### 1.7 Construction Approach and Activities

9. The construction approach will be Labour-based, Environment-friendly and Participatory (LEP) approach and Machine Intensive Road Construction Approach. The important features of the LEP approach are (i) phased construction with balanced cut and fill; (ii) manual work and use of hand tools and small equipment rather than heavy machinery; (iii) bio-engineering for slope stabilization; (iv) avoid blasting; (v) use soft engineering structures; and (vi) use of contractors only in the works that cannot be done through manual labor. Machine Intensive Road Construction Approach will be used in works that cannot be done manually through road building groups. In such works, the construction will be carried by using the equipment and machineries but it will be used in such a way to ensure the minimum environmental damage. Activities included during the road construction are: Site clearance, Pavement work, Earthwork, Retaining structures, Bioengineering, Cross drainage works and Side drain works.

### 1.8 Proposed Schedule for Implementation of Sub-project

10. Following table shows the proposed implementation schedule for Bankatta- Bagai road sub-project:

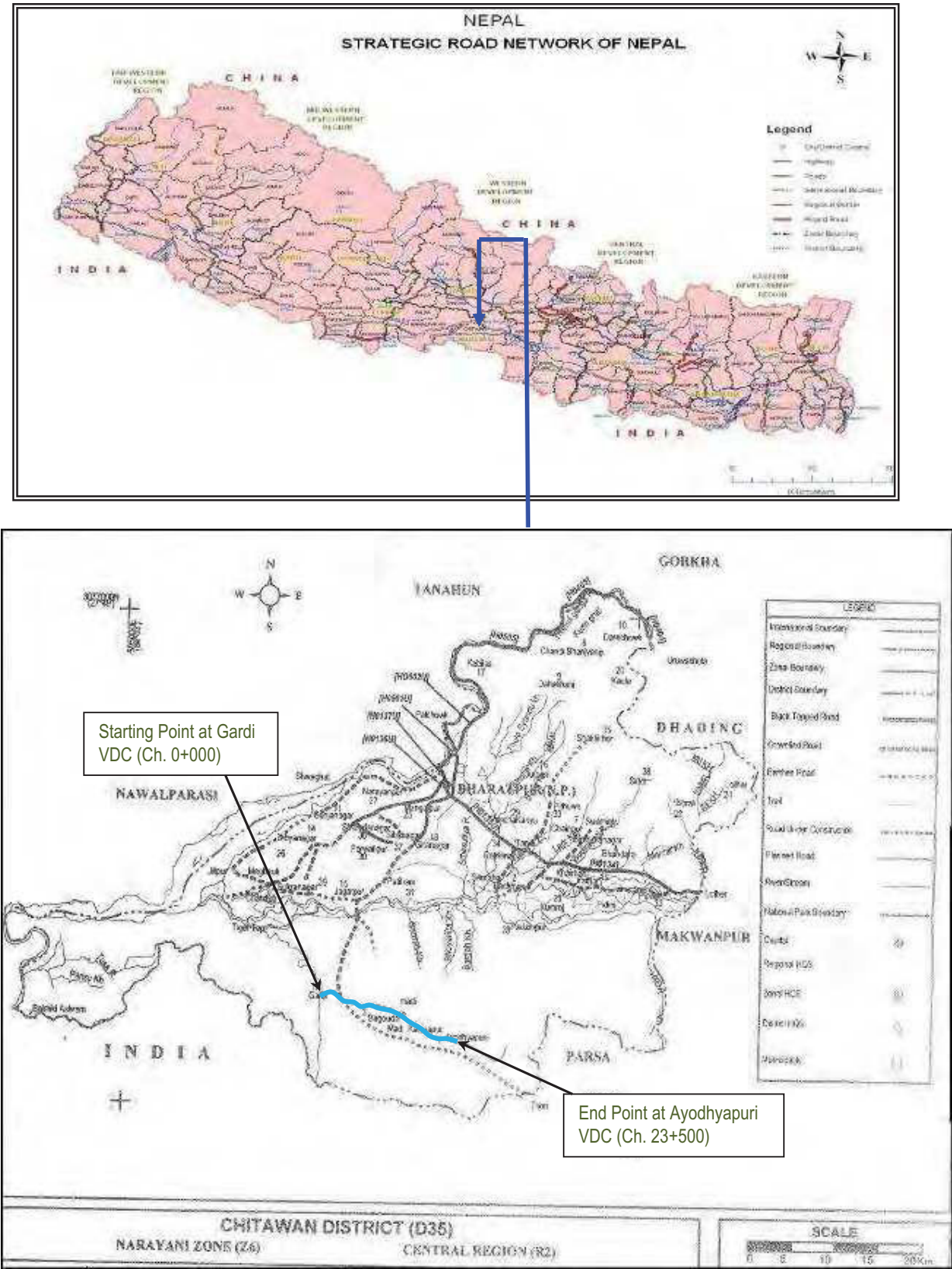
**Table 1.1: Sub-project implementation schedule**

SN	Activity	2008 IV	2009				2010				2011	
			I	II	III	IV	I	II	III	IV	I	II
1	Detailed survey, design and estimate											
2	Preparation of resettlement plan											
2.1	Life skill and income generation training--											
3	Environment Assessment and implementation											
3.1	IEE report preparation and approval from MoLD											
3.2	Implementation of EMP											
3.3	Environmental monitoring											
4	Work implementation											
4.1	Civil construction work by contractors											
4.2	Civil construction work by RBGs											

**Note:**

- I - July, February, March
- II - April, May, June
- III - July, August, September
- IV - October, November, December

**Figure 1.1 Map of Nepal showing the location of Bankatta- Bagai road Subproject in Chitwan District**





[illegible]

## 2.0 Public Consultation and Information Disclosure

### 2.1 Public Consultation

11. In order to ensure the involvement of concerned stakeholders, following procedures were followed:
- **Publication of Public Notice-** a 15 days public notice was published on 14th of Jestha 2066 in the Kantipur, national daily newspaper (see Annex V) seeking written opinion from the concerned VDCs, DDC, schools, health posts and related local stakeholders. A copy of the public notice was also affixed in the offices of the above mentioned organizations and Deed of enquiry (*muchulka*) was collected (see Annex VI and Annex VII).
  - **Interaction with local communities and related stakeholders** like District Forest Office, District Agricultural Development Office, Water Induced Disaster Control Division Office and others were carried out during field survey to collect the public concerns and suggestions (see Annex VIII). Focus Group Discussions were conducted in all the four VDCs to collect and solicit their suggestions on protection of bio-physical and socio-economic environment in the Zone of Influence (ZoI) of the road. Summary of minutes of meeting is given in Annex IX and following Table 2.1.
  - Draft IEE report was kept at information center of DDC, Chitwan and Gardi, Bhagauda, Kalyanpur, and Ayodhyapuri VDCs for public disclosure. Information was also disseminated through person to person contacts and interviews and group discussions. Recommendation Letters for implementation of the Proposal were also obtained from all the concerned VDCs (see Annex X).

**Table 2.1: Summary of FGD Meeting**

Location	Date	No. of Participants		Issues and Suggestions	Decision
		Male	Female		
Gardi	2066/04/12	15	4	1. FGD program disseminated information on the project to stakeholders. 2. Participants committed on providing land voluntarily for the road. 3. Project work should be careful to protect environment.	<ul style="list-style-type: none"> <li>• The project activities during road construction should not have any impact on the environment.</li> <li>• Proper mitigation measures should be taken to minimize and mitigate all the adverse impact on the environment.</li> </ul>
Bhagauda	2066/04/10	10	1		
Kalyanpur	2066/04/11	15	5		
Ayodhyapuri	2066/04/09	16	6		

### 2.2 Information Disclosure

12. Draft IEE was kept at information center of DDC Chitwan for public disclosure. Information was also disseminated through person to person contacts and interviews and group discussions. However, available institutions at the local level were informed through notice distribution or pasting at concerned VDCs, school, health posts and public places within the road alignment corridors. The approved IEE report will be accessible to interested parties and general public through websites of ADB, DoLIDAR and RRRSDP. Following offices will get the IEE report:

1. District Development Committee, Chitwan
2. District Technical Office, Chitwan
3. District Project Office, Chitwan
4. District Implementation Support Team, Chitwan
5. Gardi, Bhagauda, Ayodhyapuri and Kalyanpur VDCs
6. Ministry of Local Development, Environment Management Section
7. Department of Local Infrastructure Development and Agricultural Roads
8. Project Coordination Unit, RRRSDP
9. Asian Development Bank, Nepal Resident Mission

### 3.0 Review of Relevant Acts, Regulations and Guidelines

13. The IEE study has followed the provisions of following acts, regulations and guidelines of Government of Nepal and ADB to ensure conservation of environment during proposal implementation and operation.

**Table 3.1: Review of Environmental Acts, Regulations and Guidelines**

SN	Environmental Acts, Regulations and Guidelines	Description of Requirements
1	Three Years Interim Plan, 2007/08-2009/10, GoN	Requires all projects will be formulated and constructed based on methods that optimally utilize the local skill and resources and generate employment opportunities.
2	Environmental Protection Act, 1997, GoN	Any development project, before implementation, shall pass through environmental assessment, which may be either IEE or an EIA depending upon the location, type and size of the projects.
3	Environmental Protection Rule 1997 (amendment, 2007), GoN	The EPR and its schedules clearly provide various step-wise requirements to be followed while conducting the IEE study. It also obliges the Proponent to timely consult and inform the public on the contents of the proposal and IEE study.
4	Forest Act, 1993 (amendment, 2007), GoN	Requires decision makers to take account of all forest values, including environmental services and biodiversity, not just the production of timber and other commodities. It includes several provisions to ensure development, conservation, management, and sustainable use of forest resources based on approved work plan.
5	Forest Rules, 1995, GoN	Elaborates legal measures for the conservation of forests and wildlife. Expenses incurred for cutting trees and transportation shall be borne by proponent.
6	<i>Batabaraniya Nirdeśika</i> (Nepal; MLD), 2057, GoN	The directive is focused in the practical implementation of small rural infrastructures through the minimization of environmental impacts. This directive includes the simple methods of environmental management in the different phases of the project cycle.
7	National Park and Wildlife Conservation Act, 1973, GoN	Addresses for conservation of ecologically valuable areas and indigenous wildlife. The Act prohibits trespassing in park areas, prohibits wildlife hunting, construction works in park area, damage to plant and animal, construction of huts and house in park area without permission of authorized person. It lists 26 species of mammals, 9 species of birds, and 3 species of reptile as protected wildlife.
8	Local Self Governance Act (1999) and Regulation (1999), GoN	Empowers the local bodies for the conservation of soil, forest and other natural resources and implements environmental conservation activities
9	Land Acquisition Act, 1977 and Land Acquisition Rules, 1969, GoN	Specifies procedural matters on land acquisition and compensation
10	National Environmental Impact Assessment Guidelines, 1993, GoN	Provides 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.
11	APPROACH for the Development of Agricultural and Rural Roads, 1999, GoN	Emphasizes labor based technology and environmental friendly, local resource oriented construction methods to be incorporated actively in rural infrastructure process.
12	RRRSDP Environmental Assessment & Review Procedures (EARP),	For preparation of environmental assessments of future subprojects under Rural Reconstruction and Rehabilitation Sector Development Program (RRRSDP), this EARP includes: i) The process to be

	2007, GoN	adopted while preparing environmental reports, ii) the potential environmental impacts that could result from undertaking the Project based on the Initial Environmental Examinations (IEEs) of sample core subprojects; iii) the proposed mitigation measures to avoid the identified impacts; iv) institutional capacity assessment and strengthening arrangements; v) legal framework for environmental assessment, domestic and the Asian Development Bank (ADB) environmental assessment and review procedures; and finally vi) the approaches to be adopted during implementation of the Project in order to ensure that environmental aspects are dealt with in a comprehensive manner.
13	Reference Manual for Environmental and Social Aspects of Integrated Road Development, 2003, GoN	Suggests stepwise process of addressing environmental and social issues alongside the technical, financial and others.
14	Green Roads in Nepal, Best Practices Report: An Innovative Approach for Rural Infrastructure Development in the Himalayas and Other Mountainous Regions, 1999, GoN	Focuses on participatory, labor based and environment friendly technology with proper alignment selection, mass balancing, proper water management, bioengineering and phased construction.
15	Environmental Assessment Guidelines, 2003, ADB	Requires that environmental considerations be incorporated into ADB operations where environmental assessment is the primary administrative tool to integrate environmental considerations into decision-making of all types of development initiatives
16	Safeguard Policy Statement, 2009, ADB.	ADB's Safeguard Policy Framework consists of three operational policies on the Environment, Indigenous people and Involuntary resettlement. It requires that (i) impacts are identified and assessed early in the project cycle, (ii) plans to avoid, minimize, mitigate or compensate for the potential adverse impacts are developed and implemented and (iii) affected people are informed and consulted during project preparation and implementation.
17	The Interim Constitution of Nepal, 2063 (2007).	Has provision of right regarding environment - Every person shall have the right to live in clean environment.
18	The Labor Act, 1992	Regulates the working environment and deals with occupational health and safety.



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## 4.0 Existing Environmental Condition

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14. Baseline information on the existing physical, biological as well as socio-economic and cultural environment of the proposed Subproject is described in this chapter.

### 4.1 Physical Environment

15. This section describes the physical condition of the area that comes under the Zol of the road section.

#### 4.1.1 Topography

16. The elevation of the starting point of the road at Rewa Khola of Gardi VDC is 141 m amsl and at the end of road at Bagai is 253m amsl. The road alignment passes through the plain Terai. The grade of the road varies from 2% to 6%.

#### 4.1.2 Geology and Soil Type

17. Soil type along the alignment can be classified as alluvial, colluvial, residual, boulder mixed soil, and hard and soft rock. Following **Table 4.1** presents the geological features recorded along the road alignment.

**Table 4.1 Geological features along the road alignment**

Chainage	Location	Terrain slope	State of Land	Geological Problem
0+000 - 2+500 Km	Bankatta	Terrain	Dry	Flood
2+500 -10+000 km	Baghauda	Terrain	Dry	Flood
10+000 - 15+000 km	Kalyanpur	Terrain	Dry	Flood
15+000 - 23+500 km	Ayodhyapuri	Terrain	Dry	Flood

*Source: Field survey, July, 2009*

#### 4.1.3 Climate

18. Bankatta - Bagai road lies in the sub tropical climatic zone. Generally, rainy season starts from May and ends in August. The meteorological record shows unevenly distributed monsoon rain in the project area with the total average annual rainfall is about 1,997 mm. The maximum recorded temperature in Chitwan district is around 42.5<sup>0</sup> Celsius and minimum temperature is 7<sup>0</sup> Celsius (*Source: District profile of Chitwan, 2065*).

#### 4.1.4 Hydrology and Drainage System

19. There are natural drainages with rivers at 6+775, 11+914, 13+420, 15+730, 17+466, 17+990 and 21+700. The major rivers along the road alignment are Rewa Khola, Rimal Khola, Patara Khola, Badharmude Khola. Other rivers along the road alignment are Tunamuna Khola, Rabidade nala, Bagai Khola, Magaee khola and Ghagar Khola. The summary of the cross drainages along the road alignment is given in Annex XII.

#### 4.1.5 Soil Erosion and Sedimentation

20. There are not major landslide prone areas along the road. However roadside embankment erosion and water logging problems can be seen at 6+775, 11+914, 13+420, 15+730, 17+466, 17+990 and 21+700 where road alignment passes through rivers.

#### 4.1.6 Existing Road Condition

21. The road is earthen and motorable during dry weather. Average width of the road is 5m.

#### 4.1.7 Existing Traffic Situation

22. Five regular passenger buses ply on the road whereas number of Bus, Mini truck/Pick up are 20 and number of motorcycles are around 160 in winter season. In rainy season, no. of vehicles operating

in this road reduces by half. Vehicle used for transportation of milk always operates in the road except during heavy rainfall.

#### 4.1.8 Land Use

23. Land use pattern of the area through which the road passes have been classified into three types: cultivated land, Built up area and barren as shown in **Table 4.2**.

**Table 4.2: Summary of land use pattern along the road alignment**

Land use	Chainage	Length (M)	Existing width (M)
Cultivated land	0+485-8+600	8115	10
	14+100-18+500	4400	10
	10+093-11+386	1293	10
Barren and Pasture land	0+000-0+485	485	10
	8+600-10+093	1493	10
	11+386-14+100	2714	10
Built up area	18+500-20+500	2000	10
	20+500+23+500	3000	10

#### 4.1.9 Air, Noise and Water Quality

24. The air, noise and water quality are not tested, but are observed to be within acceptable limit. Dust emission during vehicle operation has become common phenomena in the existing road and it is more significant during dry and winter season.

## 4.2 Biological Environment

25. This subproject area lies adjacent to Chitwan National Park and road alignment is more than 1.5 km far from Chitwan National Park.

#### 4.2.1 Vegetation

26. The species observed in the road alignment and Zol are (*Mangifera Indica*) Mango, (*Cocos nucifera*) Coconut, (*Shorea robusta*) Sal, (*Acacia catechu*) Khayar, (*Dalbergia sissoo*) Sisau, (*Eucalyptus camaldulensis*) Mashala, (*Bombax ceiba*) Simal, (*Azadirachta indica*) Neem, and (*Melia azedarach*) Bakaino.

#### 4.2.2 Wildlife

27. *Felis chaus* (Jungle Cat), Rhinoceros, (*Panthera tigris*) Tiger, (*Muntiacus muntjack*) Deer, (*Panthera pardus*) Leopard, (*Elephas maxiums*) Wild Elephant, Wolf, (*Vulpes vulpes*) Fox, (*Ratufa sp.*) Squirrel, and (*Hystrix indica*) Dumsi etc are the common wildlife found in the surrounding forest along the road alignment and (*Corvus splendens*) Crow, (*Passer domesticus*) Sparrow, (*Columba livia*) Pigeon, (*Streptopelia spp.*) Dhukur are the birds found in the Subproject area.

#### 4.2.3 Aquatic Life

28. Fish species found in water bodies along the road alignment are Bam, Buhari, Rahu, Hile and Budune. These fish species are mainly found in Rewa Khola.

#### 4.2.4 Endangered and protected species

29. *Faunal species*: Among the fauna present in the forest area along the road alignment, (*Panthera pardus*) Leopard is listed in CITES Appendix-I. (*Elephas maxiums*) Wild Elephant and (*Panthera tigris*) Tiger are listed in CITES Appendix-I and protected wildlife under NPWC Act 1973. (*Ratufa sp.*) Squirrel is listed in CITES Appendix-II.

30. *Floral Species*: (*Shorea robusta*) Sal, (*Acacia catechu*) Khayar and (*Bombax ceiba*) Simal are protected plant species according to the Forest Rules 2051 B.S which is categorized into timber trees banned for felling, transportation and export for commercial purposes.

## 4.3 Socio-economic and Cultural Environment

#### 4.3.1 Population, Household and Ethnicity

31. The demographic profile Zol is presented in following Table 4.3. Major castes in the area are Chaudhary, Tamang, Tharu, Chhetri, Brahmin and occupational caste (Damai, Kami).

**Table 4.3: Demographic Profile of ZOI**

VDC	Population			HH	Average HH Size
	Male	Female	Total		
Gardi	5799	6000	11799	1891	6.24
Bagauda	6793	7590	14383	2305	6.24
Kalyanpur	4363	5640	10003	1603	6.24
Ayodhapuri	6862	7326	14188	2269	6.25
TOTAL	23817	26556	50373	8068	6.24

#### 4.3.2 Main Occupation

32. The main occupation of the area is agriculture & livestock (40.84%), business & commerce (15.49%), cottage industry (6.46%), labour & porter (21.19%), and services (16.02%). However, agriculture farming is not enough for subsistence due to small landholding size and low productivity. Therefore people also depend on seasonal labour in Narayanghat, Kathmandu and India.



#### 4.3.3 Market Centres and Business Facilities

33. Major settlements along the road alignment are Bankatta, Baruwa, Basantapur, Kalyanpur, Jeevanpur, Govindabasti and Kharkatta. Grocery shops, vegetables and fruit shops exist in almost all settlements. Major market centre are Basantapur in Bagauda VDC, Baruwa in Gardi VDC, Kharkatta in Ayodhyapuri VDC. According to survey data, 123 shops (Tailoring, Stationary, and Grocery etc.), hotel and lodges are present in the area.

#### 4.3.4 Local Economy

34. The economy of the area is predominantly agriculture based with practicing of a mixture of harvesting of forest products. Local people are gradually attracted towards cultivation of cash crops such as Mango and Banana. Dairy production and selling it to the market has been also another source of income for local farmers. Over 40 percent populations base upon agricultural activities for their livelihood. With growing closeness of the project area with Chitwan due to transportation facility, cultivation of fruits, vegetables in a commercial manner seems to gain momentum. Diversity in employment pattern has been also observed in recent years. Local people have increasingly engaged in business activities as well.

#### 4.3.5 Agriculture Pattern

35. Major crops that are cultivated in the project area are rice, wheat, maize, potato, beans etc. Local peoples are also found to be encouraged in cash crops in recent days. Major cash crops that are grown in the project area are mustard, vegetables etc. The area has appropriate climate and soil for farming of fruits like as mango, guava, pineapple, banana, lemon, nibuwa, etc.

#### 4.3.6 Livestock

36. Due to availability good number of fodder trees, the project area has also the immense potentiality of cow and buffalo farming for dairy production and goat farming for meat production. The diary productions like butter, ghee are increasing in the project area.

#### 4.3.7 Industry

37. Some local people are engaged in weaving of bamboo products, making of furniture, dairy products, sugar factory and tailoring. The area has the potentiality of agrobased industries such as dairy, food processing as well as furniture, bamboo products.

#### 4.3.8 Trade and Commerce

38. Goods of daily commodities are major imports in the project area, which includes salt, sugar, packed food items, spices, clothes and other items of daily uses. Similarly, major items exported from the project area are milk, vegetables, fruits, timber especially of Sal, Sisau, Mashala and bamboo products etc. whereas cereal crops such as rice, maize are export and import items both.

#### 4.3.9 Tourism Related Services

39. Some hotel, lodges are in operation in Bankatta. Since the Zol of the project and its surrounding area has potentiality of various types of tourism promotion, more lodge, restaurant and resorts are expected to be established in the area.

#### 4.3.10 Health and Sanitation

40. Major health problems associated with local people are gastric, water borne diseases, gaeneco related diseases, gout, respiratory diseases, skin disease, malnutrition, water borne diseases etc. Sanitation awareness among local people is on the rise trend and many of them have toilets in their home.

#### 4.3.11 Public Services and Infrastructures

41. **Education:** The proposed project area consists of a total of 16 educational institutions ranging from primary level to college level educational institutions. There is a higher secondary school in Basantpur settlement. Most of the families send their children to school. Female enrollment in schools is lower than that of male students. Literacy rate in the project area has been estimated around 70 percent.

42. **Health Facility:** There are altogether 8 health posts/sub health posts in various settlements.

43. **Communication:** All of the settlements have telephone good facilities with CDMA and MOBILE connection.

44. **Transportation:** Public bus service is available. Tippers generally carry vegetables, milk, maize and Rice other local products from the area.

45. **Electricity:** There is no any electricity facility.

46. **Water Supply:** Piped drinking water supply is available to all settlements.

47. **Irrigation:** No irrigation facility has been observed in Zol of the project area.

48. **Other Infrastructures/services:** There is a Suspension Bridge, Agricultural Service Sub-Centre, diary firms and Veterinary Service Sub Centre are also available in the project area.

49. **Industries:** Cottage and other industries are not well developed within the Zol. There are some rice and flour mill in various settlements. Many people have skills of weaving bamboo baskets; woolen cloths etc. and these skills can be commercialized to increase there income.

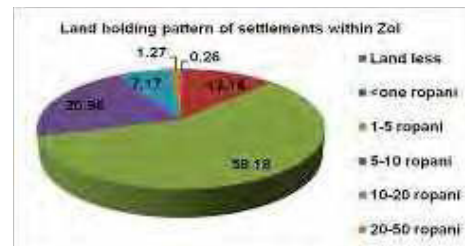
50. **Financial Institutions:** There is absence of bank and finance institution.

51. **Community Development Facilities/Organizations:** Community based organizations particularly, women saving and credit groups are found in three settlements. Play grounds, ghat (cremation site) and community centers are found in majority of the settlements.

52. **Public Services and Infrastructures affected during road construction:** There are no any public Infrastructure affected during road construction.

#### 4.3.12 Land Holding Pattern

53. Land holding pattern within the Zol of the road project demonstrates that (0.26%) households are land less, (12.16%) households have less than one ropani land (approximately 1 ha = 20 ropani), (58.18%) households have 1-5 ropani of land, while (20.96%) households fall under 5-10 ropani land holding category, (7.17%) of the households have 10-20 ropani land and (1.27%) households are having more than 20 - 50 ropani land.





#### 4.3.13 Food Security

54. Large percentage of the households is food deficit for varied time period. About (36.32%) have food sufficiency for three to nine months. Even few (6.86 %) have food sufficiency for less than three months & (10.74%) have sufficient food for three months, (28.56 %) of households have food sufficiency for whole year while (17.52%) households are reported as food surplus ones who are in the well off category of selling their surplus farm products.



#### 4.3.14 Migration Pattern

55. Permanent migration takes place in limited scale towards Bharatpur and other places like Kathmandu. However, people migrate to foreign countries like India for employment opportunity almost from all the settlements. Seasonal migration occurs during slack farming season from Mangsir to Poush mainly in various parts of India. This shows poor economic status of the people in the proposed road corridor. This could be reduced by providing employment opportunities at the local level.

#### 4.3.15 Settlement Pattern

56. Most of the settlements within Zol of the project are scattered type. Housing pattern of these settlements are mostly one or two storied, CGI sheet roofed buildings. Some of them are also thatch roofed buildings. Whereas some of them are also RCC buildings in market centres such as Bankatta and Kalyanpur etc.

#### 4.3.16 Potential for Development

57. The potential of the Subproject area are as mentioned in Table 4.4 below.

**Table 4.4: Development Potentialities in Various Sectors**

SN	Sector	Development potentiality
1	Agriculture	Rice, potato, vegetable farming, fruit farming within the whole Zol
2	Small and Cottage Industry	Bamboo products, furniture, dairy industry within the whole Zol
3	Trade and business	Development of several rural market centres at various places along the road alignment and main market centres at Bankatta, Basantpur, Baruwa, Gardi and Kharkatta Bazaar.

Source: Field Survey, July, 2009

#### 4.3. 17 Religious, Cultural and Historical Sites

58. There are no any religious, cultural and historical sites along the road alignment.

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## 5.0 Project Alternatives

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59. Assessment on alternatives of the Subproject is discussed as in the following subsections

### 5.1 No Action Option

60. This alternative assesses the consequences if the Proposal is not implemented. An earthen road currently exists, which is operable only in fair weather. The road connects a remote and poverty ridden area with high potential in dairy, vegetable, and Juice productions. People have been selling the products to the markets of Narayanghat and Bharatpur. However, travel time and cost is high due to seasonal nature and earthen standard of the existing road. Rehabilitation of the road will decrease the cost as well as provide better access facility with enhanced opportunity for development of the area without any additional significant adverse impacts. The no action option may avoid environmental impacts, but only at the cost of poverty and underdevelopment of the area. Development is must for attaining poverty reduction goal of the government, and access facility is the basic infrastructure that facilitates overall development. Thus, this option is not relevant for the Proposal.

### 5.2 Proposal Alternatives

61. Construction of railway, airport and road could be the options for achieving the transportation and access. Railway is the best alternative but which is very costly. Hence this alternative is not relevant for the Proposal. Air connection is not feasible due to short distance and high cost beyond of reach of local people. The proposed road project is the best alternative for cheap and efficient transportation.

### 5.3 Alternative Alignment

62. The alignment of the road is an existing motorable and fair weather earthen track with 5m width. The upgrading of existing road do not need to acquire additional land and clearing of trees. Hence, new alternative alignment is not studied and the existing alignment is proposed for upgrading.

### 5.4 Alternative Design and Construction Approach

63. The conventional road construction use contractors with heavy machineries and equipment, explosives, heavy concrete structures for retaining slopes, and bituminous surfacing. Labour based, Environment friendly and Participatory (LEP) method focuses on phased construction with balanced cut and fill; manual work and use of hand tools and small equipment rather than heavy machinery; bio-engineering for slope stabilization; avoid blasting; use soft engineering structures; use of contractors only in the works that cannot be done through manual labor. The proposed road has been designed considering combination of both the LEP approach for works possible through manual labor (earth excavation, bio-engineering, gabion structures), and Machine Intensive Road Construction Approach for works that require mechanized applications (pavement works or construction of RCC cross drainage structures).

### 5.5 Alternative Schedule

64. During the rainy season, the construction work will be stopped. Rehabilitation and construction work will be carried out during the remaining months. The construction period is more appropriate from October to June due to dry weather, and then the people are generally free from farming activities.

### 5.6 Alternative Resources

65. Stones and boulders, fine aggregates like sand for gabions and masonry are available in nearby quarries. The proposed construction will optimally use the local labour force and local materials.

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## 6.0 Identification of Impacts and Benefit Augmentation/Mitigation Measures

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66. The identification and assessment of impacts has been carried out by considering the proposed proposal activities examined in terms of its current condition and likely impacts during construction and subsequent operation phases. The impacts have been predicted in terms of their nature, magnitude, extent and duration. The possible impacts (positive and negative) in construction and operation phases are presented in the following sub-sections. Beneficial impacts maximization and adverse impacts mitigation measures are also suggested hereunder (see Table 7.2 in Chapter 7).

### 6.1 Beneficial Impacts and Benefit Augmentation Measures

#### 6.1.1 Construction Stage

##### ***Employment Generation and Increase in Income***

67. *Impacts:* Employment opportunity for local people during construction of the road, without gender biasness, is 221680 person days, with 14901 for skilled and 206779 for unskilled labor. Efforts will be made to employ more than 50% women workers. The amount of money earned as wages will directly support various economic activities of the people, and assist to empower women and indigenous people. It will assist towards enterprise development with multiplier effect if wage is used for economic investments. This is one of the direct and significant impacts of the project but it is of short-term and local in nature.

68. *Measures:* Work will be implemented manually through the local Road Building Groups (RBGs). Priority for employment will be given to local poor, dalit, vulnerable groups and women. They will be given training to do the job. Proponent will implement skill training, awareness, and income generation programs encouraging them to utilize their money earned through wage.

##### ***Skill Enhancement***

69. *Impacts:* Working in construction of the road is likely to enhance skills of local people in construction works. Trainings on construction and maintenance of structures will further enhance their skill. The skill and knowledge thus acquired will make them find employment opportunities in future projects. This impact is indirect, medium, local and long-term in nature.

70. *Measures:* Members of the Road Building Group will be given training on masonry, netting wires and construction of gabion wall, bioengineering works.

##### ***Enterprise Development and Business Promotion***

71. *Impacts:* During construction period, different types of commercial activities will come into operation in order to meet the demand of workers. Since they will have good purchasing power, they will regularly demand for different types of food, beverage and other daily necessary items. Development of several rural market centres at various places along the road alignment and main market centres at Bankatta, Basantpur, Baruwa, Gardi and Kharkatta Bazaar. This impact is direct, low significance, local and short term in nature.

72. *Measures:* Training in cooperatives, and promote use of local products by the construction crews.

##### ***Community Empowerment and Ownership***

73. *Impacts:* During construction various road construction coordination committees and road building groups will be constituted in order to facilitate in implementation of the road. In this process, they will be oriented and trained to build and safeguard community infrastructures which will result in community empowerment and feeling of ownership. This impact is indirect, low, local and short term.

74. *Measures:* The coordination committees will be constituted and training will be given to them.

##### ***Women and Indigenous People Empowerment***

75. *Impacts:* Women and indigenous people in particular may be benefited more from improved access to the market centers and various service providing agencies like health centers, banks, training institutes, women development office etc. Frequency of visit to such agencies will increase awareness level and empowerment. The impact will be indirect, significant, local and for long-term.

76. *Measures:* Assist to organize women groups, provide training and social mobilization, provide micro-finance and encourage cooperatives to undertake commercial scale farming activities.

### **6.1.2 Operation Stage**

#### ***Improvement in Accessibility and Saving of Time and Transportation Cost***

77. *Impacts:* Rehabilitation of road will enhance the access of people to social services, and quick transportation of goods. This road helps to connect the district headquarter with the parsu district and Indian boarder at Thori. Travel time and cost will be cheaper by 50 percent after upgrading of the road. This impact is direct, high, regional and long term.

78. *Measures:* Proponent will undertake regular maintenance of the road.

#### ***Increase in Trade, Commerce and Development of Market***

79. *Impact:* Improved access will increase economic activities and markets like Gardi, Bankatta, Baruwa, Basantapur, Kalyanpur, Govindabasti markets will grow. Production of potato, tomato, mustard, banana and mango will increase due to cheaper transportation and better market access. Sale of farm and livestock products will increase in the bigger markets of Chitwan district. This will support the economy of rural area. The impact will be indirect, significant, local and long term in nature.

80. *Measures:* DDC/VDCs shall manage planned growth with required infrastructure facilities in the market areas. Agriculture extension services, market linkages and networking for better market price will be coordinated with district agriculture office.

#### ***Appreciation of Land Value***

81. *Impacts:* Upgrading of road will increase the land values by twice of the current land value. Mainly the land value will increase in Gardi, Bankatta, Baruwa, Basantapur, Kalyanpur and Govindabasti. This will uplift the economy of local people. Financial institutions may accept their land as mortgage for lending. The impact is indirect, medium, local and for long term.

82. *Measures:* Promotion of land development activities and control of encroachment within RoW. Awareness program shall be organized on use of high value land to get bank loans for setting up enterprise ventures.

#### ***Enhancement of Community Development Services***

83. *Impacts:* Improved access will contribute in improvement of social services in the area such as education, health, government offices, saving and credits. Improved access will facilitate stay of extension workers, teacher, and doctor to their rural duty areas. This is indirect, significant, regional and long-term impact of the proposed project.

84. *Measures:* The access will be kept maintained so that other services will follow in the area.

## **6.2 Adverse Impacts and Mitigation Measures**

### **6.2.1 Construction Stage**

85. The proposed road will be constructed according to LEP approach where manual works are possible and Machine Intensive Road construction approach where the work cannot be done manually. The likely impacts on physical, biological, socio-economic and cultural resources of the proposed road area and respective mitigation measures are presented hereunder.

#### **Physical Impacts**

##### ***Change in Land Use***

86. *Impacts:* The widening/ upgrading works of road construction will be in existing RoW, therefore no additional land need to be acquired. However there will be temporary impact on the lands occupied by camp sites. The impact will be low, indirect, local and for short term.

87. *Measures:* Site selected for camp sites will be on land of lower values and where the effect will be temporary. The sites shall be rehabilitated soon after use or compensation will be given in private land.

#### ***Road Embankment Instability and Erosion***

88. *Impacts:* There are not any landslide prone areas along the road alignment but flood problem can be seen along road alignment where natural drainage crosses the road at chainages 6+775, 11+914, 13+420, 15+730, 17+466, 17+990 and 21+700. This further can result into roadside embankment

erosion and water logging problems. The likely impact is medium, site specific and medium term depending on cases.

89. *Measures:* The mitigation measures will be balance cut and fill adoption of bio-engineering techniques such as Grass plantation, Brushlayering. River embankment protection required /Gabion and Plantation. No construction work during rainy season; and use of soft engineering structures (dry wall) before disposing spoil.

### **Spoil Disposal**

90. *Impacts:* Unmanaged disposal of spoil may cause erosion, block drainages, damage farm lands, crops and forest, waterlogging. The impact from spoil disposal will be direct, low, local and long term in nature.

91. *Measures:* Spoil will be safely disposed and managed at designated site with minimum environmental damage. Engineer will give approval for disposal site of spoil. Balanced cut and fill and re-use of excavated materials will be given emphasis. Spoil will be used to reclaim land or eroded areas. Disposal site will be provided with proper drainage, vegetation and adequate protection against erosion. Necessary toe walls and retaining walls will be provided on spoil disposal sites. Compaction and trimming the slope of disposed spoils and use of Bioengineering measures (Grass, Shrubs, Tree plantation). Potential safe spoil management areas are given in Table 6.1.

**Table 6.1 Safe Spoil Disposal Sites**

S. No	Chainage	Location	Remarks
1	3+500	Baruwa	river area
2	6+775	Magai Khola	river area
3	9+825	Badarmudhe Khola	river area
4	11+950	Rimal Khola	river area
5	13+425	Patara khola	river area
6	21+925	Saghai khola	river area

*Source: Field survey, July, 2009*

### **Quarry/ Borrow Operation**

92. *Impacts:* Potential adverse impacts are accelerated disturbance in natural drainage patterns, water logging and water pollution. The likely impact will be direct, medium in magnitude, site specific in extent and short term in duration.

93. *Measures:* The mitigation measures will be quarry and borrow operation plan will be prepared and approved by Engineer; forest area, settlements, fertile farm land will be avoided for quarry / borrow operation; quarry sites will be rehabilitated by providing appropriate civil engineering structures and Tree plantation measures after the extraction is complete so, there will be no disturbance in river flow. Recommended quarry sites in the area are given in Table 6.2.

**Table 6.2: Recommended Quarry Sites**

SN	Chainages	Places of recommended quarry sites
1.	5+250	Stone quarry in a limited scale river
2.	12+300	Stone quarry is available approximately 200m from road alignment.
3.	22+100	Stone collection from river

*Source: Field Survey, July, 2009*

### **Air, Noise and Water Pollution**

94. *Impacts:* Although the air quality of the project area is not measured, the air does not appear to be polluted. Dust will be major problem during both the construction and operation of the road. Impact on air quality will be direct, low, local, reversible and for short term.

95. The project area at present does not experience higher levels of noise pollution. However, during construction, the increased construction activities may increase the noise level to some extent. The impact of road construction on the noise level will be direct, low, site specific, reversible and short term.

96. The water quality in the project area appears to be fairly clean and not polluted. During construction these waterbodies may be polluted by spoil and construction wastes. The impact will be direct, low, local, short term and reversible.

97. *Measures:* The mitigation measures will include use of face mask by the workers working in the areas of high dust generation; contractor will frequently sprinkle water during surfacing of the road; avoid

disposal of excavated materials in the water bodies; cover dry material or make it wet during transportation. Plantation of local species trees (Mango, Bakaino, Ashoka, Shirish) in 6000 numbers along the RoW on both sides of road which will act as sound and noise barrier.

### **Water Management**

98. *Impacts:* Water from the roadside drain outlets may cause embankment erosion affecting the stability of the road. Natural drainage may get blocked due to construction of road. The impact will be indirect, medium, site specific and medium term.

99. *Measures:* The mitigation measures will be to provide adequate numbers of drainage structures in order to have minimum interference with natural drainage pattern of the area; channelize surface water discharge from side drains; do not block or divert water away from natural watercourse; Details about necessary structures required to mitigate the water induced adverse impacts are as given in Annex XII.

### **Location of Camp Sites and Storage Depots**

100. *Impacts:* Camp will not be required if works are carried out by RBGs. However, contractor, if used, will establish camp if he bring labors from outside the area. Siting of camp may cause encroachment of forest, agriculture land, alteration of drainage, solid waste and waste water problems. Impact will be direct, medium significance, site specific and short-term.

101. *Measures:* The mitigation measures will be use of local labors to avoid camp; rent local house instead of camp to keep labors; siting camp away from productive lands and forest areas; pay compensation for using private farm or lands for storage or camp; fuel and chemical storage areas will be on paved surface with surrounding catch drain to protect soil from leakage. Camp sites will be provided with first aid facility and pit latrine; soak pit will be provided for water and solid waste management. Appropriate camp sites have been observed at 3+550 near Baruwa, at 9+800 near Badarmudhe, and at 23+000 near Govindbasti.

### **Crusher Plants**

102. *Impacts:* The sub-project area lies adjacent to Chitwan National Park thus sub-project will not operate its own crusher plant. Thus there will not be any impact.

103. *Measures:* The crushed aggregates shall be procured from private crusher industry rather than the sub-project operating their own crusher plant. The crushed aggregate will be procured from crusher plants at Magai khola, Rimal khola, Ghagar khola, Kharkatta khola located outside from our alignment. The tentative distance measured from road alignment to crusher plant area is 5 km.

### **Use of Bitumen and Construction Equipments**

104. *Impacts and Measures:* The Machine Intensive Road Construction Approach will use machineries and tools. Bitumen is required for black topping which needs heating before using. Contractors tend to use local fuel wood collected from nearby forest to heat bitumen. Spillage of bitumen also damage soil productivity. Impact will be direct, high significance, site specific and short-term. The following mitigation measures will be adopted

- Use kerosene for heating and strict prohibition to heat bitumen by using fuelwood.
- Appropriate storage of material.
- Use of appropriate safety gears such as masks, boot, gloves, hat.

**Table 6.3: Equipments Required**

No.	Equipment Type and Characteristics	Min. Number Required
1	Truck(5883cc) or Tipper(1 cum) or Tractor(3cum)	Three
2	Grader machine(4900 cc)	One
3	Pneumatic and steel Roller (8 -10 tone capacity)	Two
4	Bitumen Distributer(10000-12000 lit/trip)	One
5	Bitumen Boiler(5000 lit)	One
6	Level machine	One
7	Water Tanker(12000 lit.)	Two
8	Theodolite Machine	One
9	Concrete Mixture(1 bag)	One



## ***Chemical Issues***

105. *Impacts and Measures:* Storage of fuels and chemicals, and operation of vehicles and machineries result in the spillage of hazardous chemicals that can pollute nearby water sources and soil; and affects health of the workers. The mitigation measures will be to store fuels and chemicals on paved surface with surrounding catch drain to protect soil from leakage. Proper storage of hazardous chemicals and providing information signboards. Use of safety gears to workers during handling of chemicals and fuels. Close monitoring during operation of machineries.

## ***Biological Impacts***

### ***Loss or Degradation of Forests and Vegetation***

106. *Impacts:* The road is already existing road with 10 m of average width and no trees need to be cut down. Hence during construction, there is no impact on forest and vegetation.

### ***Impact on Wildlife Due To Loss of Habitat and Hunting***

107. *Impacts:* The proposed area is not a significant habitat of wildlife and bird species. However, there are forest areas around the Zol where common species of wildlife exists. The subproject being adjacent to national park, there are always high chances of encountering wildlife. Construction workers may disturb, harass or kill such wildlife that might wonder out of their habitat areas. The impact will be indirect, high, local and short term in nature.

108. *Measures:* The mitigation measures to be adopted will include limiting work within road width; shall be strictly discouraged from collecting fuelwood or hunting/harassing of wildlife. Workers will be given orientation and strict instructions not to harm wild flora and fauna, as well as ensure their own safety from wildlife attack.

### ***Impacts on Flora and Fauna (as listed in CITES and IUCN Red Data Book)***

109. *Impacts and Measures:* There will be no impact on flora and fauna.

## ***Socio-economic Impacts***

### ***Loss or Degradation of Farm Land and Productivity***

110. *Impacts:* There will be no need of acquiring additional land during road rehabilitation. Only for material storage and camp sites, additional land is required. There will not be loss of productivity as additional land is not required and camp sites will not be placed on fertile agriculture land. This impact is expected to be of low in magnitude, local in extent and short term in duration.

111. *Measures:* The storage and camp sites shall be rehabilitated soon after use or compensation will be given in private land. Plantation of local species trees (Mango, Bakaino, Ashoka, Shirish) in 6000 numbers along the RoW on both sides of road which will act as dust and noise barrier. Tree planted along RoW will protect settlement and crops from dust.

### ***Loss of Private Properties***

112. *Impacts and Measures:* The proposed road alignment will not damage any private properties.

### ***Impact on Community Infrastructure***

113. *Impacts and Measures:* There is no any impact on community infrastructure,

## ***Health and Safety Matters***

114. *Impacts:* During construction, workers will be exposed to respiration and eye diseases due to exposure to dust, risk of accident during work, polluted drinking water, unhygienic sanitary facilities, hearing loss due to high level of noise. Increased contact between local and migrated workers can cause spread of serious health risks like STDs and HIV/AIDS. This impact is direct, high in magnitude, short term and local.

115. *Measures:* Make mandatory the use of helmets, masks, gloves and boot by workers depending on nature of work; sprinkle water at high dust sites; provide clean drinking water at sites and camp; pit toilets at sites and camp; first aid facilities at sites and camp with training to use them; provide group accidental insurance for workers. Awareness generation to local people and workers on HIV/AIDS and other communicable diseases.

### ***Decline in Aesthetic Value***

116. *Impact:* Landscape degradation and scar on topography due to the road; quarrying operations; and indiscriminate dumping of spoil on open land. The likely impact will be direct, low in magnitude, local in extent and short term in duration.

117. *Measures:* Discourage indiscriminate dumping of spoil material; quarry sites will be properly closed to suit the local landscape and plantation of local species trees (Mango, Bakaino, Ashoka, Shirish) in 6000 numbers along the RoW on both sides of road.

### ***Impacts on Cultural, Religious and Archeological Sites***

118. *Impacts and Measures:* There are no any cultural, religious and archeological sites along the road alignment.

## **1.2.2 Operation Stage**

### **Physical Environment**

#### ***Road embankment and Management***

119. *Impacts:* Road embankment erosion, water logging can occur at chainages 6+775, 11+914, 13+420, 15+730, 17+466, 17+990 and 21+700. Destabilization of slope (quarrying stones or soil, animal grazing, irrigated cultivation, opening of branch roads), poor maintenance of road, blockage of drains can lead to road damage. The impact will be direct, medium, local and long term nature.

120. *Measures:* The mitigation measures to be adopted include Bioengineering (Grass plantation, Brush layering), clear drainages; restoration of rill and gully formation; and conservation of soil. For the Terai road the bioengineering works can be done in river side like chainage- 6+775, 17+990, 15+730, 13+420, 21+700 where embankment work will be done.

#### ***Impact Due to Air, Noise and Water Pollution***

121. *Impacts:* Dust will be generated from the gravel road and vehicles emit gaseous pollutants. Continued dust pollution may cause adverse health impact to the people living in the vicinity. As the road is of district road category and the vehicular movement is not expected to be very high. Thus, the impact will be direct, low, local and long term.

122. Noise during operation of road will increase. However, due to low traffic volume, the impact due to noise pollution will be direct, low, local and long term.

123. The disposal of spoil and household wastes, washing of vehicles in water bodies may degrade the water quality. The impact will be direct, low, local and long term.

124. *Measures:* Measures to be adopted will include plantation of local species trees along the RoW on both sides of road; restrict horn near forest, health posts, schools and settlements; provide speed limit for vehicle at sensitive areas.

### **Biological Environment**

#### ***Depletion of Forest Resources***

125. *Impacts:* The forest resources within ZoI of subproject area may deplete due to human pressure on forest to meet increasing needs of heating and cooking, illegal felling/cutting of trees for timber. The impact will be indirect, medium, local and long term.

126. *Measures:* The mitigation measures recommended are support District Forest Office and VDCs to encourage and support local community in controlling illegal harvesting of forest resources; awareness programs organized to educate local people on the importance of forest conservation. Improved access will facilitate easy transportation of LPG Gas and kerosene to replace use of firewood.

#### ***Disturbance to Wildlife and Illegal Hunting***

127. *Impacts:* The forest area in ZoI have some protected faunal species like (*Elephas maxiums*) Wild Elephant, (*Panthera tigris*) Tiger and (*Panthera pardus*) Leopard, they may be disturbed due to the frequent movement of vehicle and blowing of horn in the forest area. Poaching or illegal hunting of wildlife may occur due to easy access. The impact will be indirect, low, local and long term in nature.

128. *Measures:* Mitigation measure will be to erect appropriate sign boards informing drivers on prohibition of blowing horns in the forest areas. Community and authorities will remain vigilant and alert on illegal felling of timber and killing of wildlife.



## **Socio-economic and Cultural Impacts**

### ***New Settlement and Market Center Development***

129. *Impacts:* Expansion of settlement area and market can be observed at Basantapur, Kharkatta and Govindbasti. Encroachment of RoW may take place. This will reduce road capacity, increase road accidents, and adversely impact road. The impact will be direct, medium, local and long term in nature.

130. *Measures:* The mitigation measures to be adopted include regulation of settlement with proper planning; plantations of trees in the RoW so that it is not encroached; provide sewerage in market areas. Authorities and VDCs will control encroachment of road.

### ***Change in Social Behavior***

131. *Impacts:* Access facilities may bring social nuisance like increase in alcohol consumption, gambling, prostitution, and may increase girl trafficking. The impact will be indirect, medium, local and long term in nature.

132. *Measures:* Support awareness raising programs and strengthen communities against such nuisances.

### ***Issues on Road Safety***

133. *Impacts:* Movement of vehicles and inadequate road safety measures may invite accidents. The impact will be direct, medium, local and long term in nature.

134. *Measures:* The mitigation measures to be adopted will be applying appropriate road safety measures with the help of 3-Es i.e. Engineering, Enforcement and Education; and required safety signs will be used along the road.

## 7.0 Environmental Management Plan

135. The EMP is prepared to guide implementation of mitigation measures and monitoring requirements.

### 7.1 Institutions and Their Roles

**Table 7.1: Concerned Institutions and Their Roles**

Institution	Role	Responsibility in the Project	Remark
Ministry of Environment	Mandated to formulate and implement environmental policies, plans and programs at national level	Facilitate when needed on environmental safeguards	No direct responsibility in the project
Ministry of Local Development (MLD)	It is concerned line ministry, executive agency and concerned agency as per EPA/EPR. Environment Management Section is responsible to look into safeguard matters for the ministry.	<ul style="list-style-type: none"> <li>To review IEE ToR and Report, and give approval.</li> <li>Coordinate with project on safeguard issues</li> <li>Conduct environmental monitoring from central level.</li> </ul>	Executing Agency
Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR)	Department under MLD responsible to execute infrastructure projects under MLD. Provides back-up support to DDCs in technical matters through DTO.	RRRSDP is being executed under overall coordination and supervision of the Department for the Ministry. It is also supporting DDCs through DTOs to implement the project.	Executing Agency
RRRSDP- Project Coordination Unit	Project specific unit.	Technical Unit to support and coordinate all activities for implementation of RRRSDP. Review, comment, and forward IEE ToR and Report for review to ADB and for approval to MLD	First Class Officer / DDG of DoLIDAR has been heading the PCU.
District Development Committee / District Technical Office	DDC/DTO is Project Implementing Agency.	<ul style="list-style-type: none"> <li>Prepare IEE ToR and submit for approval to PCU/MLD</li> <li>Conduct IEE Study, Public Consultation, and prepare IEE Report</li> <li>Receive comments from PCU/ADB/MLD and modify accordingly. Get final approval from MLD.</li> <li>Conduct environmental safeguard monitoring</li> <li>Reporting</li> </ul>	District Technical Officer is the Project Manager
District Project Office	Project implementation office working directly under DDC/DTO.	Responsible for overall activities related to implementation of the works at field level.	Implementing Agency
Central Implementation Support Consultant (CISC)	Support consultants at central level	Technical and management support to PCU	Consultant
District Implementation Support Team (DIST)	Support consultants at district level	Technical and management support to DPO	Consultant

136. To support for smooth implementation of the project, there are various district level committees and groups including District Project Coordination Committee (a sub-committee of DDC), Village Infrastructure Construction Coordination Committee (to coordinate at VDC level). Road Building Groups are formed under participation of local people from Zol. They carryout the manual construction works. Contractor will be appointed for works requiring higher skill and mechanized support.

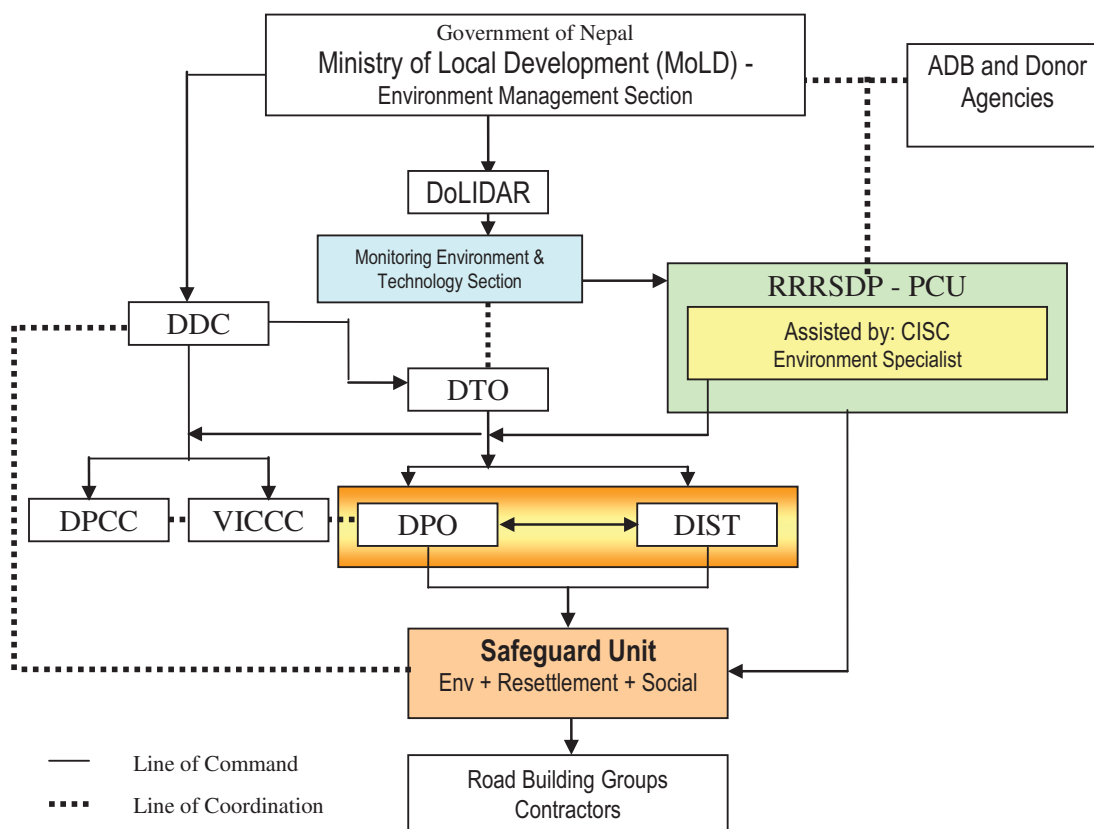
## 7.2 Reporting

137. Monitoring checklist will be developed as per the Environment Management Action Plan (EMP). The checklist will be used for regular monitoring. Trimersearly EMP compliance report will be prepared and submitted to the DDC, and DDC will forward it to PCU / DoLIDAR.

138. The monthly reports will be based on recurrent site inspections and will report on the effectiveness of the mitigation measures; the contractor's compliance with the environmental specifications; measures recommended in the events of non-compliance, and recommendations for any other corrective plan.

139. The trimester environment monitoring report will be submitted for the first year of operation of the road by the Proponent (DDC/DTO) to Executing Agency (PCU/DoLIDAR), who will forward the report to ADB. This is to ensure that post project monitoring is also carried out at least for one year.

**Fig. 7.1: Environmental Management Organization Structure**



## 7.3 Environmental Management Plan

140. The DDC/DTO with support of DPO/DIST at local level and PCU/CISC at central level will be responsible for conducting careful and routine monitoring of EMP compliance. Overall implementation of the EMP will be the responsibility of the Proponent. Framework for implementing environmental management plan is shown in Table 7.2.

**Table 7.2: Beneficial Impacts and Proposed Enhancement Measures**

Activity	Effect	Related Beneficial Impacts	Type of Impact *)				Benefit Augmentation Measures	Responsible Agencies		
			Nat	Mag	Ext	Dur		Executing Agency	Supporting Agency	
Construction Stage										
Construction of road	Employment Generation and Increase in Income	Increase in income level	D	H	L	ST	Maximize manual work through local, poor, vulnerable and women. Training in income generation and skill enhancement. Skilled14901 nos, unskilled 206779 nos	DDC/DTO/DIST	DPCC / VICCC / CISC/PCU	
On the job training to local labour	Skill Enhancement	Increase in income generating activities, employment opportunities	IN	M	L	LT	Priority to Affected Peoples (APs) and vulnerable groups, job training on various constructions works.	DPO/DIST	DDC/DTO / CISC/PCU	
Construction of road	Enterprise Development and Business Promotion	Enhancement in local economy	D	L	L	ST	Training in cooperatives, and promote use of local products by the construction crews.	Contractor/RGB	DIST/ CISC/PCU	
Construction coordination committee and RBG program	Community Empowerment and Ownership	Increase in income and ownership.	IN	L	L	ST	Coordination committees will be constituted and training will be given to them.	DPO/DIST	DDC/DTO / CISC/PCU	
Operation of Road	Women and Indigenous People Enhancement	Poor, indigenous and women will have easy and frequent access to social services (education, health, community development, bank, training, CBOs and networking)	IN	H	L	LT	Assist to organize women's groups, provide training in enterprise development, organize cooperatives, provide micro-financing to undertake production of commercial products, provide market services.	VDC / DDC	VDC / DDC	
Operation Stage										
Operation of Road	Improvement in Accessibility and Saving of Time and Transportation Cost	Saving in travel time and travel cost	D	H	R	LT	Proper maintenance (regular, emergency) , continuation of bioengineering	DTO/DDC	DoLIDAR	
Operation of Road	Increase in Trade, Commerce and Development of Market centers	Minor local markets like Gardi, Bankatta, Baruwa, Basantapur, Kalyanpur, Govindabasti markets will grow. Shifts towards improved commercial agriculture and increase in non-agricultural occupation	IN	H	L	LT	Manage planned growth with required infrastructure facilities in the market areas. Agriculture extension services, market linkages and networking for better market price.	DPO	DDC/VDC	
Operation of Road	Appreciation of Land Value	Improvement in local economic condition	IN	M	L	LT	Promotion of land development activities and control of encroachment within RoW. Awareness program shall be organized on use of high value land to get bank loans for setting up enterprise ventures.	DDC/DPO	DDC/VDC	
Operation of Road	Enhancement of Community Development Services	Ease of access to social service and raise in quality service	IN	H	R	LT	Keep road maintained to ensure access facility that will attract development of other social services facilities	Local people, DDC, VDC	DDC, VDC	

**Table 7.3: Adverse Impacts and Proposed Mitigation Measures**

Activity	Potential Negative Effects	Related Adverse Impacts	Type of Impact *)					Mitigation Measures	Responsibility for Mitigation Measure		
			Nat	Mag	Ext	Dur	Rev		Executing Agency	Supporting Agency	
Construction Stage											
Physical Environment											
Construction of Road, site clearance	Change in land use	No additional land need to be acquired. Impact on land occupied my camp sites.	IN	L	L	ST	IR	Camp sites will be on land of lower values. Rehabilitate land after use or compensation will be given in private land.	DDC/DTO	DIST	
Site clearance, excavation	Road embankment instability and erosion	Rills formation, embankment erosion and water logging.	D	M	SS	MT	Re	Civil structures with bio-engineering application (Such as Grass plantation, Tree/Shrub plantation, Brush layering, Palisades, Bamboo plantation, Live checkdam construction etc.) shall be used to stabilize the slopes. Drainage management (Catch drain, rip-rap drain, checkdam etc.)	DDC/DTO	DIST	
Construction of Road, earth excavation	Spoil Disposal	Gully erosion, landslide, disruption of road, damage to farmland, water pollution etc.	D	L	L	LT	Re	Proper site selection and management of spoil at designated areas approved by Engineer; provision of proper drainages, toe walls; Proposed spoil disposal sites are 3+500, 6+775, 9+825, 11+950, 13+425, 21+925,	DDC/DTO	DIST/VICCC/ VDC	
Construction of Road	Water Management, generation of large volume of surface runoff	Erosion, landslide, damage to farmland	IN	M	SS	MT	Re	Proper drainage structures and proper spoil disposal, Avoid blockage or diversion of natural channels due to construction of road and disposal of spoils.	DDC/DTO	DIST	
Construction works, operation of construction vehicles, material hauling and unloading etc. Slope cutting, spoil and waste disposal.	Air pollution due to dust from exposed surface, from construction equipments and vehicles	Affect on local people and workers health and affect on agriculture.	D	L	L	ST	Re	Use of face mask while working on dust prone areas, covering of dust sources. Plantation of local species trees (Mango, Bakaino, Ashoka, Shirish) in 6000 numbers along the RoW on both sides of road	DDC/DTO / RBGs	DIST	
	Noise pollution	Disturbance and annoyance.	D	L	L	ST	Re	Restrict horn near school, health posts, settlement, forest areas. Locate crusher plant away from these areas; cover material during transportation.	DDC/DTO / Contractor	DIST	
	Water pollution due to sediment level, spills and leakage of oils and chemicals to water bodies	Risk of water borne diseases	D	L	L	ST	Re	Proper spoil management, and prevention of leakage and spills of construction chemicals, restriction in urination and defecation in open areas	DDC/DTO/ Contractor/ RBGs	DIST/VICCC	
Cutting of slopes	Quarry/borrow operation and its potential effect on instability, landslide	Change in river regime, instability, land slide; damage to forest, farmland and property; water	D	M	SS	ST	Re	Proper selection and management of quarry sites, rehabilitation of quarry/borrow sites after completion of work. Recommended quarry sites are Ch 5+250,	DDC/DTO/ Contractor/ RBGs	PCU/CISC/DIST/ VICCC	

Activity	Potential Negative Effects	Related Adverse Impacts	Type of Impact *)					Mitigation Measures	Responsibility for Mitigation Measure	
			Nat	Mag	Ext	Dur	Rev		Executing Agency	Supporting Agency
		pollution						12+300, 22+100		
Construction of road	Location of Camp Sites, Storage Depots	Encroachment of forest, agriculture land, solid waste, and waste water may cause pollution	D	M	SS	ST	Re	Locate camp site away from productive land and forest area (potential sites at 3+550, 9+800, 23+000); use local labor and local houses as camp; pay compensation to land owner of camp area; proper storage of chemical and materials.	DPO assisted by DIST/ Contractor	DIST/VICCC
Construction of road	Use of Bitumen	Damage in soil productivity, air pollution due to heating of bitumen	D	H	SS	ST	Re	Use kerosene for heating and strict prohibition on firewood uses, safety gears to workers (Such as gloves, boots, masks etc), appropriate storage of materials	DPO assisted by DIST/ Contractor	DIST/CISC/PCU
Storage of Chemicals and operation of machineries	Spillage of fuels and chemicals.	Pollution to the nearby water sources and soil. Health hazards to the workers	D	M	L	ST	Re	Store fuels and chemicals on paved surface with surrounding catch drain to protect soil from leakage. Provide information signboards. Use of safety gears. Close monitoring during operation of machineries.	DTO/DIST/ Contractor	PCU/CISC/DIST
<b>Biological Environment</b>										
Construction activity	Impact on Wildlife Due To Loss of Habitat and Hunting	Killing and harrasing of wildlife; Loss of biodiversity and valuable species of wildlife	IN	H	L	ST	Re	Work only in day time, do not disturb wildlife, Workers will be given orientation and strict instructions not to harm wild flora and fauna, as well as ensure their own safety from wildlife attack.	DDC/DTO/ DFO	DFO/CFUGs/DIST
<b>Social-economic Environment</b>										
Occupational health and safety aspects	Health and safety matters	Injury, fatal accidents, outbreak of epidemics and diseases, decline in capacity to work	D	H	L	ST	IR	Occupational health and safety regulations, first aid facility at sites with health treatment arrangements, contingency planning; Proper drinking water and toilet facility for construction crew	DDC/DTO / Contractors	DIST/CISC
Construction of Road	Decrease in aesthetic value	Disturbances in working areas and scar on topography.	D	L	L	ST	Re	Cover the road alignment by planting local species tree (Mango, Bakaino, Ashoka, Shirish) on both sides of road in 6000 numbers; manage working areas.	DPO in assistance by DIST / Contractors	PCU / CISC / Users Committee / VDC
<b>Operation Stage</b>										
<b>Physical Environment</b>										
Quarrying, operation of construction	Road embankment and Management	Destabilization of slope, embankment erosion, water	D	M	L	LT	Re	Regular maintenance of slope protection structures, Selection of healthy upland farming techniques.	DDC/DTO/	DoLIDAR , DFO, Water Induced

Activity	Potential Negative Effects	Related Adverse Impacts	Type of Impact *)					Mitigation Measures	Responsibility for Mitigation Measure	
			Nat	Mag	Ext	Dur	Rev		Executing Agency	Supporting Agency
equipments		logging. Disturbance to traffic flow, pollution of water bodies, impacts on agriculture land, loss of vegetation.						Bioengineering at 6+775, 17+990, 15+730, 13+420, 21+700.	VDC	Disaster Control Division Office (WDCDO)
Operation of vehicles, Inadequate drainage	Air, Noise and Water Pollution	Disturbance to students, patients, wildlife, effect to nearby agriculture land and crops	D	L	L	LT	Re	Speed limit for vehicles, no horn signs, use vegetation barrier; Regular maintenance of drainage.	DDC/DTO	DoLIDAR/Local administration
<b>Biological Environment</b>										
Road operation	Depletion of Forest Resources	Loss of timber, forest resources and benefits	IN	M	L	LT	IR	Enforcement of law, vigilance and monitoring, participation of community	DFO/CFUGs/VD Cs	DDC/CDO
Road operation	Disturbance to the Wildlife and Illegal Hunting	Loss of biodiversity	IN	L	L	LT	IR	Warning traffic signal, Awareness training to driver to limit speed and horn use	DTO/CFUGs	DDC/CDO / DFO
<b>Social-economic Environment</b>										
Easy Access by road operation	New Settlement and Market Center Development	Encroachment of Row, increased accidents, delay in traffic movement, depletion of local resources, water pollution	D	M	L	LT	IR	Awareness program, enforcement of law, planning of land development, plantation of trees.	DDC/DTO	CDO / VICCC
Operation of Road	Change in Social behavior	Social and cultural conflicts	IN	M	L	LT	IR	Awareness, Enforcement of law and order, Provision of training for skill.	DTO	DDC/DoLIDAR
Operation of Road	Road Accidents	Increase in accidents	D	M	L	LT	IR	Appropriate road safety measures, Safety signs along the road.	DTO	DDC/DoLIDAR

\* Legend Value in parenthesis is level of significance:  
Nature- IN= Indirect ; D= Direct  
Magnitude- L= Low; M= Medium; H= High;  
Extent- SS= Site Specific ; L= Local; R= Regional; N= National; CB=Cross-boundary  
Duration- ST= Short Term; MT= Medium Term ;LT= Long term  
Re=Reversible; IR= Irreversible

## 7.4 Mitigation Cost

141. The estimated cost for benefit augmentation measures like awareness raising program, skill training, promotion of small scale industries, and income generation activities will be covered by the Community Empowerment Component and Livelihood Enhancement Skills Training (LEST) program of the RRRSDP. Costs for income generation and awareness program activities for Affected Persons (APs) are included in Social Action Plan. The design and cost estimate for most of the suggested mitigation measures such as slope stabilization, quarry site management, spoil disposal, supply of safety gears, accidental insurance of RBGs, bio-engineering measures, tree plantation, land slide rehabilitation will be incorporated in the project cost. Therefore, most of the mitigation measures suggested would be a part of main project cost. All proposed mitigation measures will be integrated in the project design so that these measures may automatically form part of the construction and operational phases of the project. The indicative cost for environmental enhancement and mitigation is presented in the **Table 7.4**.

**Table 7.4: Cost Estimate for Environmental Enhancement and Mitigation Measures**

SN.	Environmental Protection Measures	Estimated Budget (NRs.)	Remarks
<b>1. Benefits Augmentation Measures</b>			
1.1	Training to DDC/DTO/DPO/DIST to conduct environmental monitoring and reporting	50,000.00	To be included in project cost
1.2	Training to Naika of RBGs	50,000.00	To be included in project cost
1.3	Enhancement in Technical Skills (Bio-engineering)	100,000.00	To be included in project cost
<b>Sub-Total (1)</b>		<b>200,000.00</b>	
<b>2. Adverse Impacts Mitigation Measures</b>			
2.1	Bio-engineering/ Roadside Plantation	2,851,555.00	To be included in project cost
2.2	RBG Insurance	400,000.00	To be included in project cost
2.3	Information Signboard (6 nos)	50,000.00	To be included in BoQ
2.4	Restoration or relocation of affected infrastructures, spoils disposal site management and rehabilitation, reinstate of quarry etc.	500,000.00	To be included in BoQ
2.5	Health / HIV AIDS / STD prevention awareness; other awareness program such as adult literacy; support to local school etc.	7,82,990.00	To be included in Social plan, project cost
2.6	Occupational health and safety; First aid boxes, campsite sanitation (Pit latrine); solid waste management, Safety measures for workers (Helmets, gloves, masks, boots, etc.)	300,000.00	To be included in Project cost
<b>Sub-Total (2)</b>		<b>4,884,545.00</b>	
<b>Total</b>		<b>5,084,545.00</b>	

## 7.5 Implementation of Mitigation Measures

142. The mitigation measures will be integrated into project design and tender documents so that the mitigation measures will automatically become part of the project implementation and operation. Mitigation measures will be included as separate items in the Bill of Quantities, and monitoring will be done based on these. The Proponent and the contractor will be bound by the parameters identified in the



IEE Report and specific mitigation measures spelled in the contract. The final acceptance of the completed works will not occur until all the environmental clauses have been satisfactorily implemented.

143. The contract agreement document will explicitly mention the penalising action to be taken against failure to comply with EMP requirements.

## 7.6 Environmental Monitoring

### 7.6.1 Monitoring Responsibility

144. The Proponent will develop in-built monitoring mechanism to safeguard environment during construction and operation stages. The DPO will be supported by DIST in the district, and PCU will be supported by CISC at center to ensure effective monitoring and undertaking corrective actions, as required. A Safeguard Unit will be established in DPO. The social, resettlement and environment specialists / officers from DPO/DIST will work in cooperation under the Safeguard Unit. They will undertake Subproject level monitoring under supervision and coordination of Specialists from PCU/CISC.

145. MoLD/DoLIDAR will be responsible for central level monitoring of EMP compliance. A provision of NRs. 50,000 will be allocated for the periodic monitoring by the center.

146. The Safeguard Unit at Subproject level shall submit monthly monitoring report to the PCU, who will forward a copy to ADB, NRM. Total cost of environmental monitoring (field visits, observation, review of reports and report preparation), excluding the cost of personnel, is estimated at NRs.200,000.00 as given in Table 7.5.

**Table 7.5: Environmental Monitoring Cost**

S. No.	Detail	Unit	Quantity	Rate	Total (NRs.)
1	Environmental Management Specialist	Man-month			Included in the Cost of DIST
2	Sociologist / Public Relation Expert	Man-month			Included in the Cost of DIST
3	Stationary and Computer		LS		70,000.00
4	Printing and Photocopies		LS		30,000.00
5	Transportation		LS		50,000.00
6	Cost for Monitoring by MoLD/DoLIDAR		LS		50,000.00
	<b>TOTAL</b>				<b>200,000.00</b>

Thus, total environmental monitoring and management cost is NRs 5,284,545.00 including cost of bio-engineering.

### 7.6.2 Types of Monitoring and Monitoring Parameters

147. There will be basically two types of monitoring:

- Compliance Monitoring – that verifies whether the EMP provisions are properly implemented in the field. The framework for compliance monitoring is given in the Table 7.6.
- Impact Monitoring - that confirms the result of implementing mitigation measures. The framework for impact monitoring is given in the Table 7.7.

**Table 7.6: Compliance Monitoring for Bankatta-Bagai Road Construction Works**

Parameters/Issues	Responsible Implementing Agency	Verifiable Indicators	Verification Methods	Schedule	Responsible Monitoring Agency
Final alignment selection as per IEE /EMP recommendation	DPO / DIST	Alignment incur minimum requirements to acquire land from forest, agri. land, and minimum nos. of trees to clear.	Look the alignment on topo map with landuse resources; verify it by walkthrough along final road alignment	Preconstruction phase	PCU / CISC; DoLIDAR
Land and property acquisition and compensation Voluntary land acquisition	Proponent with assistance of DIST	Cadastral records, Land and properties acquisition procedures; Procedures followed during voluntary donation of Land; Preparation of inventory of structures likely to be affected Payment of compensation	Public consultation, photos; geo-referencing;  Check inventory against cadastral records and discuss with land owners Check record of pending compensation	Pre-construction phase before construction begins	CFC / PCU (CISC) / DOLIDAR / MoLD
Compliance to Environmental Protection Measures, including pollution prevention, water and soil management, cut and fill, waste management, spoils, sensitive habitats and critical sites, protection of fauna and flora	Contractor /RBG	Arrangement specified in the Code of Practice and in Manuals relating to environmental protection; EMP detail in IEE Document; records and observations on pollution, waste management, spoil deposit. Protection of wildlife and sensitive habitats, forests; and Use of fuelwood for heating and cooking.	Site inspection; Discussion with local people; Records; Photos; Sampling and laboratory tests.	During construction period and include in monthly report	DPO / DIST at district and PCU/CISC at center
Protect environment from air & noise pollution	Contractor / RBGs	Dust level and noise level at work sites, major settlements and sensitive spots like health centres and schools; Crusher operated during night	Visual observation, Observation of good construction practices and discussion with residents and workers; DIST to measure air/noise level at sensitive spots.	Once in a month during construction; measurement once during peak construction	DPO / DIST at district and PCU/CISC at center
Protect water bodies from pollution	Contractor / RBG DPO / DIST	Visual observation, observation of open defecation and pit toilets at work sites/waste management/spoil disposal around water sources; Parameters like pH, hardness, DO, Turbidity for drinking water.	Site inspection, test of site-selected samples of local streams water using standard field kit, record of waterborne disease	Observation once in a month during construction; Upon demand for testing with field kit	DPO / DIST at district and PCU/CISC at center
Use of local labour, particularly vulnerable groups and women	DPCC / VICCC / RBGs / Contractor	Percentage of employment of local labour, especially vulnerable groups and women and their wage rate.	Verification from records	During the entire period where labour work is contracted	DPO / DIST at district and PCU/CISC at center
Awareness and orientation training on road construction locally employed labourers	DPO / DIST	Training programmes for skill development, occupational safety and environmental protection associated with road construction works; employment generation skill	Training records, assess feedback from participants	Beginning of construction and during construction	DPO / DIST at district and PCU/CISC at center (DTO)

Parameters/Issues	Responsible Implementing Agency	Verifiable Indicators	Verification Methods	Schedule	Responsible Monitoring Agency
Compliance to occupational health and safety matters	DPO / DIST; Contractor (if involved)	Health and safety regulations, first aid and medical arrangements, contingency plan, number and type of safety equipments such as mask, helmet, glove, safety belt.	Spot checks at work sites, accident records, safety equipment at site; discussion with workers	throughout construction stage	DPO / DIST at district and PCU/CISC at center
Measures to avoid pressure on forest and wildlife	Contractor / RBG / DIST	Use of firewood or fossil fuel by construction crew, events of hunting and poaching of wildlife	Record verification, interview with local people and CFUGs	Once a month during construction	DPO / DIST at district and PCU/CISC at center / CFUGs
Clean up and reinstatement of the construction sites (camps, quarries, borrow pits)	Contractor	Decommissioned sites indicate no adverse/residual environmental impacts, and are rehabilitated to the satisfaction of the supervisor and land owners	Site observation; Comparing photos; Consultation with land owners	At end of construction period	DPO / DIST at district and PCU/CISC at center
Proper storage of chemicals; prevent pollution of soil and water.	Contractor	Storage of chemicals on paved surface. Provision of safety gears during chemical handling by workers. Spillage during operation of machineries.	Site inspection; consultation with workers.	During the construction stage	DTO/DIST/Contractor

**Table 7.7: Impact / Effect Monitoring for Bankatta-Bagai Road Construction Works**

Parameters /Issues	Verifiable Indicators	Verification Methods	Location	Schedule	Responsible Implementation and Monitoring Agency
Road embankment stability and erosion	Embankment erosion & their causes; Fresh gullies and erosion; Success/failure of bio-engineering solutions	Site observation, photos discussion with people and technicians	At landslide areas and sites where bio-engineering failed	Continuously during construction and operation	DIST during construction; Proponent / DPO / Soil Conservation Office during operation
Disposal of Spoils and construction wastes	Damage to forest and agriculture land, blocked drainage, hazard to downhill residents and agricultural lands	Site observation and interviews, photos	At specific locations where such sites occur	During construction at monthly basis	DPO / DIST at district and PCU/CISC at center
Quarrying of construction materials	Erosion, changes in river regime, bank cutting, landslide due to quarrying on slope	Site observation, photos	Quarry site areas	During construction at monthly basis	DPO / DIST at district and PCU/CISC at center
Disruption of drainage system	Blocked drainage, waterlogging, slope cutting and erosion by water	Observation, photos	Site specific areas	During construction at rainy season	DPO / DIST at district and PCU/CISC at center
Loss of farmland , houses and properties	Decline in productivity; Quality of life of compensated people	Observation, and interview with stakeholders	Construction areas	During construction in quarterly basis	DPO / DIST at district and PCU/CISC at center / VWRCC
Water quality	Water borne disease; adverse impact on aquatic life	Record of disease, measurement of water sample using standard field kit; impact to fish in streams	Construction sites; local streams	During construction at quarterly basis	DPO / DIST at district and PCU/CISC at center
Air quality	Dust level increase	Discussion with people at sensitive locations	At construction sites and at sensitive spots (schools, health post, market and settlements)	During construction at dry season	DPO / DIST at district and PCU/CISC at center
Change in economy	Nos. of new houses built; shops opened; New enterprises by local people	Discussion with local people	Project Area	Yearly during construction phase	DPO / DIST at district and PCU/CISC at center
Occupational safety and hazard	Type and number of accident occurred during construction	Records and interview with labourers	Project Area	During construction	DPO / DIST at district and PCU/CISC at center
Social conflict and nuisance	No of social conflicts between project and people; new 'Bhatti' and prostitution proliferation.	Observations, interview with local people	Project Area	During construction	DPO / DIST at district and PCU/CISC at center/VDC
Ribbon settlement	RoW encroachment	Records, observations	Project Area	During operation	DDC/CDO
Chemical pollution	Spillage of chemicals during storage; and operation of machineries. Events of health hazards due to chemicals.	Inspections, Records	Project Area	During Construction	DPO/DIST/Contractor

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## 8.0 Conclusion and Recommendation

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### 8.1 Conclusion

148. The IEE study of the proposed Bankatta-Bagai road sub-project does not pass through any environmentally sensitive area and have minimal detrimental effects for material storage. Most of the adverse impacts predicted are of low significance and short term as well as of reversible nature. The beneficial impacts with the facility of access to market centers and location of social services will enhance productivity in rural area and improve the quality of life of the people. In addition, local people will get direct employment as workers which will contribute significantly in improving their livelihood. These 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.

149. The IEE has shown that none of the anticipated environmental impacts of constructing the proposed road is significant enough to need a detailed follow-up EIA or special environmental study. Therefore, this IEE is sufficient for approval of the sub-project.

### 8.2 Recommendation

150. The proposed road project is recommended for implementation with incorporation of mitigation measures and environmental monitoring plan.

151. A key consideration in selecting the road alignment is to minimize the acquisition of valuable agricultural land for material storage, camp sites. No agricultural and built up areas will have to be acquired for construction of the proposed road.

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## **ANNEXES**

श्री जय कृष्ण  
 श्री गुरु नानक  
 गुरु नानक जय २०१७

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S. A. Grier  
02/21/90

स्थानीय पूर्वाधार विकास तथा कृषि सड़क विभाग,  
जाबलाखेल ।

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(विजयराज सुवेदी)  
शाखा अधिकृत

स्वीकृत मिति :- ०६६/२/४

**Terms of Reference (ToR)**  
for  
Initial Environmental Examination (IEE)  
of  
**Bankatta – Bagai**  
**Road Sub-Project**

Submitted to:  
**Ministry of Local Development,**  
**Government of Nepal**



Proponent:  
**District Development Committee (DDC)/**  
**District Technical Office (DTO)**  
**Chitwan**

Telephone No. – 056-527820  
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April 2009

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### FIGURE

FIGURE 1. MAP OF NEPAL SHOWING CHITWAN DISTRICT
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FIGURE 2. TOPOGRAPHIC MAP OF CHITWAN SHOWING ROAD ALIGNMENT
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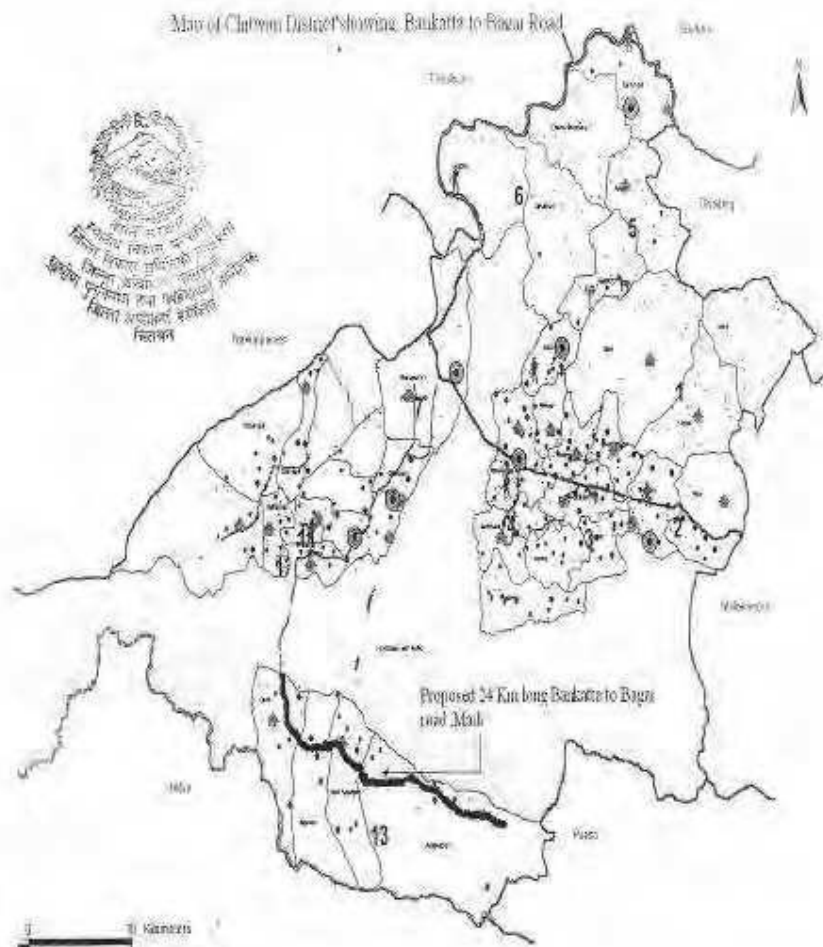
## ABBREVIATIONS

ADB	Asian Development Bank
Ch	Chainage
CF	Community Forest
CISC	Central Implementation Support Consultants
CITES	Convention on International Trade in Endangered Species of Flora and Fauna
DDC	District Development Committee
DG	Director General
DIST	District Implementation Support Team
DoLIDAR	Department of Local Infrastructure Development and Agricultural Roads
DPO	District Project Office
DPCC	District Project Coordination Committee
DTO	District Technical Office
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management Section
EPA	Environmental Protection Act
EPR	Environmental Protection Rules
FGD	Focus Group Discussion
GoN	Government of Nepal
IEE	Initial Environmental Examination
IUCN	The World Conservation Union
Km	Kilometer
LEP	Labour based, environment friendly and participatory
MLD	Ministry of Local Development
NGO	Non-Governmental Organization
PAM	Project Administrative Memorandum
PCU	Project Coordination Unit
REA	Rapid Environmental Checklist
RRRSDP	Rural Reconstruction and Rehabilitation Sector Development Project
SF	Social Funding
SDC	Swiss Agency for Development and Cooperation
SDS	Social Development Specialist
SM	Social Mobilizer
TA	Technical Assistance
ToR	Terms of Reference
VDC	Village Development Committee
ZoI	Zone of Influence

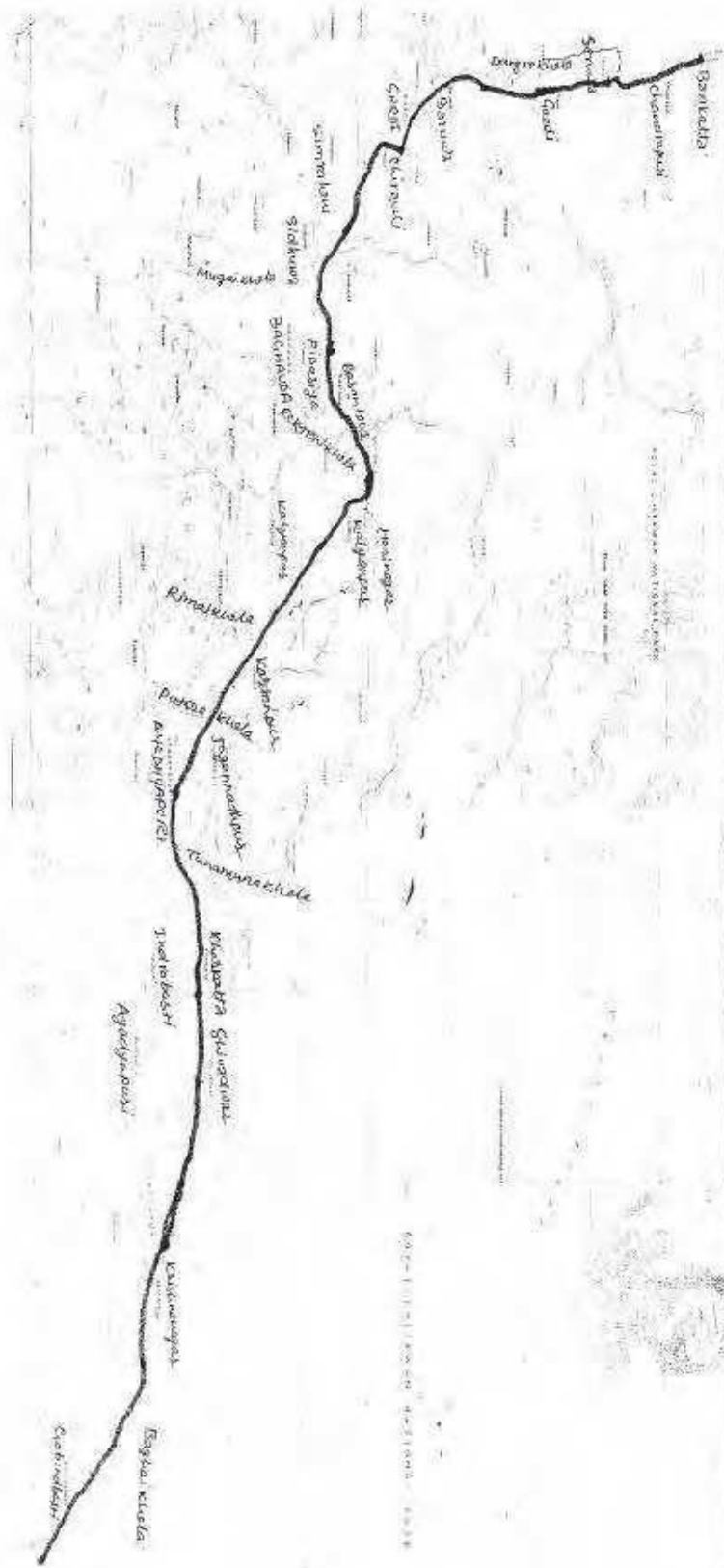
## Map of Nepal Showing Chitwan District







KRISHNANAGAR



## 1.0 NAME AND ADDRESS OF THE PROPONENT

The District Development Committee (DDC), Chitwan is the implementing agency at the district level and the proponent of the Initial Environmental Examination (IEE) study for the rehabilitation and construction of Bankatta - Bagai road sub-project. The Ministry of Local Development (MLD) is the concerned authority for the approval of IEE study report.

### Address of the Proponent

District Development Committee, Chitwan, Bharatpur  
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## 2.0 INTRODUCTION

### 2.1 GENERAL INTRODUCTION

The RRRSDP program is financed by the Government of Nepal (GoN), Asian Development Bank (ADB), Department for International Development (DFID), OPEC Fund for International Development (OFID) and Swiss Agency for Development and Cooperation (SDC) to improve the connectivity, enhance economic and employment opportunities, increase access to market and social services of rural communities. The coordinating government department is the Department for Local Infrastructure Development and Agricultural Roads (DoLIDAR) under the Ministry of Local Development (MLD).

The project goal is to reduce rural poverty in the different districts of Nepal affected by the conflict. The purpose is to achieve sustainable increased access to economic and social services, and enhanced social and financial capital for people in the project area, particularly poor and disadvantaged groups. Labour-based, environmentally friendly, and participatory approaches (LEP) will ensure that the investment in construction and rehabilitation of infrastructure results in sustainable, improved access to economic and social services, and enhanced social and financial capital.


Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR) is the executing agency. The implementing arrangements are as following:

DoLIDAR has established a project coordination unit (PCU) in Kathmandu, headed by a project coordinator to coordinate all project activities. The PCU will be responsible for guiding and monitoring district development committees (DDCs) as they implement project components. At the district level, project implementation will be the responsibility of the district project office (DTO) within the district technical office of each DDC. A local engineering consultant to cover technical issues will support the DTO.

This Terms of Reference (ToR) is prepared to conduct an IEE of Bankatta - Bagai road sub-project in Chitwan District. This road has been selected after the walkover survey of Bankatta - Bagai roads from the sub-list on the basis of prioritization criteria. This is a high priority road in DTMP of Chitwan district and is proposed for construction under RRRSDP.

(IEE ToR of Chitwan)

  
आयोजना संयोजक



## 2.2 BACKGROUND OF THE SUB-PROJECT

The proposed road is the shortest possible corridor that links Chitwan District with Parsa district through about 25 km distance from Bankatta to Bagai. The road was previously made accessible on support of a construction company partly under labour effort of the local people. The proposed alignment starts along the bank of Riu Khola which is about 1 km from Bankatta check Post. The constructed road is of Gravel type and should be maintained for all season use. Other part of the road needs to be fixed and then constructed. Bankatta- Bagai sector is about 25 km, in length. It provides services to the people of different VDCs like Gardi, Barua, Bagauda, Ahodyapuri, and Kharkatta. About 50% people of these VDC will be directly benefited by this road. This road also helps the people of Bharatpur municipality which are living near these VDCs.

## 2.3 OBJECTIVES

The objectives of the proposed IEE study includes 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,
- identify any environmental problems/difficulties that are existing now due to the existing road, and assess nature/extent/significance of the problems/difficulties,
- identify the significant environmental issues/ concerns (physical, biological, and socio-economic, cultural) that can arise from the proposed rehabilitation and construction activities,
- recommend practical and site specific environmental mitigation and enhancement measures, prepare and implement environmental monitoring plan for the sub-project, and
- Recommend whether the IEE is sufficient for the proposed road or whether EIA will be required as a result of the environmental issues that may arise due to the project implementation.

## 2.4 RELEVANCY OF THE SUB-PROJECT

The Bankatta – Bagai road links boundary Parsa District with Chitwan which is about 50 kms far from District Headquarter of Chitwan (Bharatpur). This road is considered as an important road for the people of Chitwan district especially people of South region such as Bagauda, Ahodyapuri, Kallanpur and Kharkatta. This road is given high Priority in DTMP of Chitwan District.

An IEE of the proposed road is necessary in order to assess the environmental consequences of the proposed rural road rehabilitation and construction activities and suggest appropriate, practical and site specific mitigation and enhancement measures. An IEE of a district road is a legal requirement according to Environmental Protection Act, 1996 (EPA, 1996) and Environmental Protection Rules, 1997 (EPR, 1997). Preparation of IEE report by concerned District Development Committee (DDC) and approval of IEE report by the Ministry of Local Development (MLD) according to Nepal legal provision is considered sufficient by the ADB.



### 3.0 REVIEW OF RELEVANT LAWS, RULES AND GUIDELINES

Government of Nepal has adopted various acts, regulations and guidelines to ensure the integration of development and conservation of environment. The IEE study will be guided by the requirements and provisions of the following acts, rules and guidelines as applicable:

- Environment Protection Act, 1996 and Environment Protection Rules, 1997 (amended 1999)
- Batabaraniya Nirdasika (Nepal; MoLD), 2057
- National Environmental Impact Assessment Guidelines, 1993
- APPROACH for the Development of Agricultural and Rural Roads, 1999 (DoLIDAR)
- REFERENCE MANUAL for Environmental and Social Aspects of Integrated Road Development, 2003 (Department of Road)
- Green Roads in Nepal, Best Practices Report – An Innovative Approach for Rural Infrastructure Development in the Himalayas and Other Mountainous Regions. GTZ, SDC, 1999.
- Forest Act, 1993 and Forest Rules, 1995
- National Park and Wildlife Conservation Act, 1973
- Local Self Governance Act, 1999 and Local Self Governance Rules, 2000
- Land Acquisition Act 1977
- DFID/RAP Initial Environmental Examination Guideline (Draft), 2001

### 4.0 PROCEDURE TO BE ADOPTED WHILE PREPARING THE REPORT

The IEE approach, methodology and procedure should generally follow the provisions of the EPA and EPR. Following approach and methodology will be adopted during the IEE report preparation.

#### 4.1 DESK REVIEW

The following steps will be followed during the desk review:

- Collection and review of secondary sources of information from various sources
- Initial interaction and consultation with the local community and district level stakeholders
- Delineation of geographical boundary of the influence area on the topographical map
- Preparation of project specific checklist

#### 4.2 PUBLIC CONSULTATION

The role of public consultation and participation is to ensure the quality, comprehensiveness, effectiveness of IEE as well as to ensure that the public view's are adequately taken into consideration in the decision making process. It is done during the preparation of an IEE. In order to ensure the public involvement, the following procedures will be followed during IEE report preparation:

- Publication of notice- a 15 days public notice will be published in a national level daily newspaper seeking written opinion from concerned VDCs, DDC, school, health

- posts and related local organizations. A copy of the public notice will be affixed in the above mentioned organizations and deed of enquiry (*mushuka*) will be collected.
- Recommendation letter from concerned VDCs and/or municipality will also be obtained.
  - IEE team will also carryout interaction with local communities and related stakeholders and will also collect the public concerns and suggestions.

#### **4.3 FIELD WORK**

The IEE team will walk through along the road alignment visiting the significant environmental features in the probable influence corridor, and make necessary measurements, inspect/ observe and discuss it with the local stakeholders. The information collection will be made covering physical, biological, socio-economic and cultural aspects of the environment.

#### **5.0 ALTERNATIVES FOR THE IMPLEMENTATION OF THE PROPOSAL**

Alternative analysis has been considered as an integral part of IEE study, which involves an alternative ways of achieving the objectives of a proposed sub-project. The aim of alternative analysis is to arrive at a development option, which maximizes the benefits while minimizing the unwanted impacts.

The study team will conduct alternative analysis considering the following issues

- No action option
- Project alternatives
- Alternative alignment
- Alternative design and construction approach
- Alternative schedule and process
- Alternative resources, and
- Any other alternatives

#### **6.0 REQUIREMENT OF THE IEE STUDY**

This includes time schedule, estimated budget and appropriate manpower (experts) for conducting IEE study.

#### **6.1 TIME SCHEDULE**

IEE report will be completed within eight weeks after the approval of ToR. An indicative time frame for conducting IEE is given in the table 2 below:





Table 2. Proposed work schedule for conducting IEE study

S N	Activities	Weeks							
		1	2	3	4	5	6	7	8
1	Orientation training to the team	■							
2	Desk study and review		■						
3	Public notice publication			■					
4	Field visit for survey and consultation with community			■	■				
5	Collection of suggestions and recommendations from stakeholders					■			
6	Analysis and interpretation					■	■		
7	Draft report preparation						■	■	
8	Comments on Draft Report							■	■
9	Final Report Preparation and Submission								■
10	Approval of the Final Report								■

## 6.2 ESTIMATED BUDGET AND STUDY TEAM

Most commonly an IEE of an infrastructure sub-project in the district need expert inputs from the following sectors:

- Landslides, slope stability and erosion
- Forestry and wildlife
- Geology
- Road engineering
- Social, economic and culture.

The IEE team will consists of DIST Engineer and Social Mobilization Coordinator and they will be trained to provide the above needed expertise for IEE preparation. IEE report preparation work will be supported by CISC environmental team under the supervision of DTO. Since, the IEE report will be prepared by the DIST team with the support of the CISC environmental team, no separate budget and manpower is required.

## 7.0 ENVIRONMENTAL BASELINE

This will describe environmental setting of the project location and surrounding areas and will contain information on relevant bio-physical, socio-economic and cultural factors and features. The updated, processed and analyzed information and data on each of the relevant bio-physical, socio-economic and cultural aspects will be presented in the IEE.

study. As far as possible, other environmental features such as, sensitive area, population and settlements, forests, geological features will be shown in the map.

## **8.0 ANALYSIS AND INTERPRETATION**

Both secondary and primary information and data collected will be analyzed and interpreted. The bio-physical information will be tabulated to the extent possible. The socio-economic, cultural and religious information will be cross checked and analyzed.

## **9.0 IDENTIFICATION, PREDICTION AND EVALUATION OF IMPACT**

The identification and prediction of impacts shall be carried out by considering the proposed project actions/activities in terms of rehabilitation and construction of the road project. The impacts of the activities shall be on bio-physical, socio-economic and cultural resources in a defined immediate zone of influence (i.e. About 2 hours walking distance from the road alignment). The impacts shall be classified in terms of extent (site specific, local and regional), magnitude (low, medium and high) and duration (short term, medium term and long term) as well as reversible, irreversible, severe, moderate and significant. The likely impact shall be assessed covering both adverse and beneficial ones. The methodology adopted for impact identification and prediction will be checklists and matrix method. The likely impacts of the proposed road construction as well as operation are described in the following sections.

### **9.1 BENEFICIAL IMPACTS**

Beneficial impacts due to the rehabilitation and construction of the road shall be assessed by the study team in terms of impacts on physical, biological, socioeconomic and cultural systems of the project area. The impacts shall also be assessed in the category of extent, duration and magnitude. Based on the identification and prediction of the impacts, the suitable enhance measures to maximize the project benefits shall be explored and designed.

### **9.2 ADVERSE IMPACTS**


The likely adverse impacts during construction and subsequent operation and maintenance in terms of physical, biological, socioeconomic, cultural and religious aspects due to project actions shall be identified, predicted and evaluated. Based on the identified impacts, appropriate mitigation measures shall be recommended.

#### **9.2.1 Construction Stage**

Though the sub-projects will apply LEP approach during the implementation, it may not be possible to avoid all likely impacts; the study shall take into account the following issues:

##### **9.2.1.1 Physical environment**

The issues and concerns generally related to physical environment typically include, but not necessarily limited to:

- 
- Slope instability and soil erosion due to various activities including slope cutting, spoil disposal, concentrated flows due to water diversions and inappropriate drain outfalls
  - Quarry site operation
  - Impacts on water resources (irrigation, drinking water and other water bodies) and drainage pattern
  - Degradation of air quality (particularly dust) and increase in vibration/noise and its impact to the local people
  - Change in land use including development or expansion of roadside settlements
  - Impact of road safety

#### 9.2.1.2 Biological environment

The issues and concerns generally related to biological environment typically include, but not necessarily limited to:

- Loss or degradation of forests and vegetation. This includes all forest areas including state or community or leasehold or religious or private forest
- Impact on wildlife including birds due to loss or degradation of habitat, increased hunting and other form of human pressure.
- Impacts on flora and fauna (as listed in CITES and IUCN Red data book)
- Impacts on the local ecology and ecological balance/functions.

#### 9.2.1.3 Socio-economic and cultural environment

The issues and concerns generally related to socio-economic and cultural environment typically include, but not necessarily limited to:

- Loss or degradation of farm land and productivity directly or indirectly (such as due to occupation of land, disposal of spoils, diversion of water/ drain waters, or disruption of hydrology, natural drainage, quarrying, burrow pits etc.)
- Loss or degradation of private properties such as houses, farm sheds, and other structures, crops and fodder/ fruit trees
- Impact on community infrastructure such as irrigation, water supply, schools, health post, trail and trail bridges.
- Impacts on cultural, religious and archaeological sites
- Impacts on social structures, employment opportunities, economy, cultural values
- Impacts on health and sanitation.

#### 9.2.2 Operation and maintenance stage

The following issues will be taken into account during operation and maintenance stage:

##### 9.2.2.1 Physical environment

- Road slope stability and management
- Impact on water resources
- Impact due to air pollution
- Impact due to noise pollution
- Road safety measures

##### 9.2.2.2 Biological environment

- Impact on forest resources
- Illegal poaching and impact on wild life