Government of Nepal
Ministry of Physical Infrastructure and Transport
Department of Roads

Environmental and Social Assessment (ESA) Report
Of
Kakarbhitta – Pathalaiya Road Corridor, including Kamala -Dhalkebar – Pathalaiya Road Segment, of Mahendra Highway (MRM)

CONTRACT IDENTIFICATION NUMBER: NIRTTP-DOR-S-QCBS-2

Submitted to:
Department of Roads,
Foreign Cooperation Branch, NIRTTP
And
Geo-Environment and Social Unit (GESU), Chakupat, Lalitpur
Kathmandu, Nepal

Prepared by: JV of
Environment & Resource Management Consultant (P) Ltd.; Group of Engineer's Consortium (P) Ltd. And Udaya Consultancy (P.) Ltd.

January 2020

Table of Contents

Acronyms vi

List of Figures vii

List of Tables viii

Executive Summary ix

CHAPTER 1: Introduction 1

1.1 Project Background 1

1.2 Purpose of this Document 2

1.3 Structure of the Report 3

1.4 Methods adopted to prepare the ESA Report 3

CHAPTER 2: Regulatory and policy network for ESA process in Nepal 4

2.1 Legal requirements in Nepal 4

2.2 Legal and institutional framework for EIA and IEE process in Nepal 5

2.3 International agreements and treaties 7

2.4 World Bank Environment and Social Framework 8

World Bank ESF Policy, Directives and Standards – Extent of Relevance 8

2.5 Analysis of legal and institutional issues and gaps in implementation of social and environmental plans 14

CHAPTER 3: Project Description 17

3.1 Motivation of the Project 17

3.2 Site Description 18

3.3 Project Area of Influence 18

3.5 Description of the Project Area 18

CHAPTER 4: Baseline Conditions 20

4.1 Physical Environment and Selected Valued Environmental Components (VECs) 21

4.1.1. Topography and Geomorphology 22

4.1.2. Natural Drainage and Watershed Management 23

4.1.3. Soils 25

4.1.4 Land Use 27

4.1.5. Atmosphere (Air and Noise, Solid Waste Management etc.) 27

4.2 Biological Environment and Selected Valued Environmental Components 30

4.2.1. Environmentally Sensitive Areas 30

4.2.2. Terrestrial Habitat 41
4.2.3. Aquatic Habitat 46
4.2.4. Threatened and Endangered Species 48
4.3 Socio-economic and Cultural Environment and Selected Valued Social Components (VSCs) 53
4.3.1. Land and Resource Use 53
4.3.2. Population, Infrastructure and Services 55
4.3.3. Economy and Well-being 57
4.3.4. Community Life 58
CHAPTER 5: Analysis of Alternatives 61
5.1 Existing Issues and Predicted Impacts in the Project Area on Valued Components 61
5.2 Alternative 1: "Do Nothing" 62
5.3 Alternative 2: Upgrades of Existing Road to 4-lane Highway 64
5.4 Site-specific Alternatives 69
5.4.1. New Bridge Construction 69
5.4.2. By-pass Area in the Populated Urban Centers 70
5.4.3. Alternative Roads in Environmentally Sensitive Areas 70
5.4.4. Coordinated Linear Structure Plans and Mitigation Measures 70
5.4.5. Summary of Additional Adjustments to Design 71
CHAPTER 6: Significant Environmental Impacts 78
6.1 Beneficial Issues 78
6.1.1. Construction Stage 78
6.1.2. Operation Stage 79
6.2 Adverse Issues 82
6.2.1. Physical and Chemical Environment 82
6.2.2. Biological Environment 90
CHAPTER 7: Social Impacts 105
7.1 Socio-economic and Cultural Environment 105
7.2 Adverse Impacts on Socio-economic Environment 106
7.3 Management Issues 109
7.5 Enhancement and Other Issues 110
CHAPTER 8: Assessment OF CUMULATIVE Impacts 111
8.1 Specific assessment of the Road Segments along the KP Corridor 111

8.2 Scenario-based Analysis of Environmental and Social Impacts 111

CHAPTER 9: Environmental and Social Management Plan 124

9.1 Management Strategy/Plan 123

9.2 Objectives of Environmental and Social Management Plan 125

9.3 Summary of Potential Environmental and Social Impacts 126

9.3.1 Construction Phase 126

9.3.2 Operations Phase 127

9.3.3 Environmental and Social Safeguards 127

9.4. Mitigation Measures 127

9.4.1. Design Phase 128

9.4.3. General Environmental and Social Management Requirements 128

9.4.3.1. Environmental Management 129

9.4.3.2. Protection of Natural Resources and Places of Cultural Value 129

9.5 Recommended Special Specification Causes for Environmental and Social Protection during Construction 130

9.5.1. Contractor's Environmental and Social Management Plan (CESMP) 130

9.5.1.1. Objectives of Site-Specific CESMPs 130

9.5.1.2. Preparation of the Site-specific CESMPs 131

9.5.2. Organization and Staffing 132

9.5.3. Communication and Reporting 132

9.5.4. Environmental, Social, Health and Safety Management Provisions 132

9.5.5. Training and Orientation 136

9.5.6. Implementation of Site-specific CESMPs 137

9.5.7. CESMP Monitoring and Reporting Requirements 137

9.5.8. Standards and Required Equipment 139

9.6 Environmental and Social Monitoring Plan 157

CHAPTER 10: Stakeholder Engagement 160

Stakeholder involvement in forest restoration activities 160

Stakeholders and the level of their participation 161

Stakeholder engagement process 161

10.2 Roles of Involved Agencies 162

10.2.1. Executing Agencies 162

10.2.2. Supervising Agencies 163

10.2.3. Monitoring and Evaluation Agencies 164
10.3 Reporting and Follow-Up 164
10.4 Public Complaints 164
10.5 Implementation Schedule 164
10.6 Stakeholder Engagement for Conservation and Management of Biological Environment .. 166
10.6.1. Stakeholder involvement in forest restoration activities 166
10.6.2. Stakeholders and the level of their participation 166
10.6.3. Stakeholder engagement process 168
CONCLUSIONS AND RECOMMENDATIONS 170
Annex 1: Air and Water Quality 172
Annex 2: Affected forests along the alignment 173
Annex 3: National Ambient Air Quality Standards for Nepal 179

Acronyms

ADB	Asian Development Bank
AIDS	Acquired Immunodeficiency Syndrome
CBOs	Community Based Organization
CFUG	Community Forest User Group
CIA	Cumulative Impact Assessment
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DDC	District Development Committee
DFO	District Forest Office
DHM	Department of Hydrology and Meteorology
DIZ	Direct Impact Zone
DoR	Department of Road
EIA	Environment Impact Assessment
EPA	Environmental Protection Act
EPP	Emergency Preparedness Plan
EPR	Environmental Protection Rules
ESF	Environmental and Social Framework
ESIA	Environment and Social Impact Assessment
ESMP	Environment and Social Management Plan
ESO	Environmental and Safety Officer
ESS	Environmental Social Standards
EWH	East West Highway
GBV	Gender Base Violence
GESU	Geo-Environmental and Social Unit
GLOF	Glacial Lake Outburst Floods
GoN	Government of Nepal
HH	Households
HIV	Human Immunodeficiency Virus
IEE	Initial Environmental Examination
INGO	International Non-Governmental Organization
KDP	Kamala-Dhalkebar Pathllaiya
KP	Kakadbhitta-Pathlaiya
LMP	Labor Management Procedure
MoF	Ministry of Finance
MoFALD	Ministry of Federal Affair and Local Development
MoPE	Ministry of Population and Environment
MoPIT	Ministry of Physical Infrastructure and Transport
NFDIN	National Foundation for the Development of Indigenous Nationalities
NGOs	Non-Governmental Organization
NPC	National Planning Commission
NTFP	Non-timber Forest Product
OHS	Occupational Health and Safety
RAP	Resettlement Action Plan
RoW	Right of Way

List of Figures

Figure 1:Map Showing the Parsa National Park on KDP section xii
Figure 2: Map of the project territory at the landscape scale with highlighted road network 1
Figure 3: Map of KDP section with boundary of Municipality 2
Figure 4: Current state of EWH in Terai Region 17
Figure 5: Methodological steps in application of Valued Components 21
Figure 6: Fragile bank slopes and soil erosion 22
Figure 7: Siwalik range border Terai Plain 23
Figure 8: Abundant water resources provide opportunities for livelihood of local communities 24
Figure 9: Siltation may cause improper work of drainage structures 25
Figure 10: Fertile soils in Terai region provide favorable conditions for agriculture 26
Figure 11: Dust and solid wastes are typical features along operating EWH 29
Figure 12: Map Showing the Parsa National Park in Green Colour 33
Figure 13: Calf of Nilgai in Parsa National Par.k 33
Figure 14: Grasslands and flooded plains provide habitats for many animals 34
Figure 15: Betana wetland serve for recreation and conservation purposes 36
Figure 16: Threatened Indian Softshell Turtle in Betana Wetland 36
Figure 17: One of the roosting trees in Flying Fox colony 37
Figure 18: Wildlife road mortality is a common feature in the environmentally sensitive areas 38
Figure 19: Sal forest cutting in the project area 39
Figure 20: Some animals like Rhesus Macaque and Gray Terai Langur are attracted to road by opportunity to find a food in remained wastes 40
Figure 21: Human-wildlife conflict and hybridization of wild buffalo with domestic cattle are indirect impacts of habitat fragmentation and isolation in Koshi-Tappu Wildlife Reserve and its buffer zone.. 41
Figure 22: Forests provide multiple services to local communities in Terai region 42
Figure 23: Forests and wetlands provide habitats for many species 45
Figure 24: Aquatic habitats provide many services for people and serve as fish habitats 47
Figure 25: Gangetic Dolphin is an umbrella indicator in Sapta-Koshi River 47
Figure 26: Wild Water Buffalo and Lesser Adjutant represent threatened species in the area that can be affected directly and indirectly 49
Figure 27: Elephants are important components of the landscape in the project area, which need sufficient movement corridors 51
Figure 28: Market area along the highway in Terai Region 53
Figure 29: Urbanization is a process, which going fast in the Terai Region 54
Figure 30: Safety issue are important along existing highway 56
Figure 31: Road construction work will provide employment and training opportunity for local people 57
Figure 32: Construction of new road will provide more business opportunities for local communities 59

List of Tables

Table 1: Permissions and Clearance Required 6
Table 2: International Conventions signed by Nepal and their relevance to ESA process 7
Table 3: World Bank ESF Policy, 2016 and World Bank Groups' EHSGs 2007 8
Table 4: SWOT analysis of gaps in implementation of social and environmental plans 15
Table 5: Land Use and requirement in alignment 27
Table 6: Noise Quality Data (Average 6 hours) 29
Table 7: Projected losses of trees and carbon stock in the Patlaiya – Kakarbhitta Section 43
Table 8: Tree species, indicating impacts of the road upgrades on forest 44
Table 9: Indicator or VECs species selected from the set of threatened and endangered fauna occurring in the project area 50
Table 10: Comparison of Predicted Impacts on Valued Components in 2-Alternatives Scenario 72
Table 11: Forest area affected in the project area will be updated 93
Table 12: Affected forests and management regimes 93
Table 13: Distribution of affected forest area (ha.) from forest management perspective 94
Table 14: Summary of loss and replacement plantation 96
Table 15: Wildlife corridors likely to be disturbed 98
Table 16: Environmental and Social Management Plan (ESMP) 140
Table 17: Environmental and Social Monitoring Plan 158
Table 18: Potential Stakeholder of Local Level authorities for KDP road 160
Table 19: Water Quality Data 172
Table 20: Replacement plantation, area and cost for replenishment plantation 175

Executive Summary

Introduction

The Mahendra Rajmarga (MRM) also known as the East West Highway (EWH) is the main trade and physical mobility corridor of Nepal, India and Bangladesh. The overall accessibility and economic activities of Nepal, in particular, are directed by this highway. The total length of the highway, which was constructed 50 years ago, is about 1028 km with single lane bituminous carriageway width. It has been rehabilitated and upgraded to double lane highway during the periods 1998-2005. The existing condition of the Mahendra Rajmarga is poor, and majority of the bridges (most of which are more than 40 years) require replacement. With increase in country's population, associated increase of vehicle number and frequency of travel, the Department of Roads (DoR) is proposing to upgrade MRM into a four-lane standard in a phased manner. The upgrading and improvement of the highway, including bridges, will be carried out through the proposed Strategic Roads Connectivity and Trade Improvement Project (SRCTIP) with funding support from the World Bank. Under SRCTIP, the 130-km Kamala-Dhalkebar-Pathalaiya (KDP) section of the MRM will be supported.

Project Description

The existing condition of the MRM is poor with many bridges, most of which are more than 50 years old, requiring rehabilitation and/or replacement. The improvements from 2-lane to 4-lane is proposed starting with the 130-km KDP road section of the 366-km Kakarbhitta – Pathalaiya (KP) corridor under SRCTIP that constitutes about one third of the Mahendra Rajmarga. The 366-km KP road corridor covers 10 districts of the Terai region of provinces 1 and 2. The 130-km KDP road segment of the KP corridor encompasses 5 districts viz: Dhanusha, Mahottari, Sarlahi, Rautahat and Bara all located in province no 2 of Nepal. The land use of existing KDP Road segment as well as locations of bridges is largely forests, agricultural lands, settlements and commercial areas.

The KDP road segment of the KP corridor is currently under preparation phase. The feasibility study of the KDP road segment has just commenced and the detailed engineering design including ESIA (Environment and Social Impact Assessment) will be conducted by an independent consulting firm after World Bank approval/during implementation of SRCTIP.

Environmental and Social Assessment

The objective of the upstream Environmental and Social Assessment (ESA) is to screen and preliminarily assess the key environmental and social issues of the KP Corridor that also includes the KDP Road segment. The upgrading of KDP Road is proposed for World Bank financing under SRCTIP in line with the Environmental and Social Framework (ESF-2018) of the World Bank and Government of Nepal (GoN) requirements. An ESA is deemed appropriate at this stage in project preparation since the feasibility study of the KDP road has just commenced and detailed design has

not been carried out yet. The outcomes of the ESA are aimed at informing the detailed Environmental and Social Impact Assessment (ESIA) of the KDP Road segment during the detailed design phase, which will be carried out post-Board approval of SRCTIP. The ESA is also aimed at analyzing key strategic environmental and social issues, including cumulative impacts during the upgrading works of KDP.

It is noted that this ESA was originally conducted for the 366-km Kakarbhitta-Pathalaiya corridor that also includes the 130-km KDP road segment. Risks and impacts analyzed and presented in this ESA cover all environmentally- and socially-sensitive areas for the entire 366-km KP road corridor, including Koshi-Tappu Wildlife Reserve, Parsa National Park, Betana wetland and different types of forests that harbor important biodiversity and species of global and national significance. However, in the context of KDP Road upgrading under SRCTIP, only the Parsa National Park will be directly affected. Koshi-Tappu Wildlife Reserve, Betana wetland and important bat roosting areas are more than 100km away from KDP Road and are thus not affected by works in KDP Road.

Environment and Social Baseline

The baseline environmental and social conditions of the KP corridor, including the KDP road segment are summarized below.

Physical Environment:

The KP road alignment passes through the area of the fluvial sediments of the Indo-Gangetic Plain, just south of Siwalik Ridge Whereas the KDP road traverses with the topography of the area mostly constitutes of plain landscape. Both KP and KDP area is situated within foothills of Churiya Region and Terai region. The soil type along the KP section is in alluvial nature. The whole KP section's elevation is ranges from 100 to 300 m above mean sea level.

Two types of climatic zones are found in KP and KDP sections of MRM. Lower tropical zone lies below 300 m and Upper tropical zone with the elevation ranges above 300 m.

The land use of the KDP section is dominated by Forest followed by agriculture land, settlements and barren lands. Similar land use is found on KP section also. Considering the 150 m as direct impact area on each side of the Road, the land use is forest with 136.5 ha area, cultivated land 41.76 ha, settlement 63.69 ha, and barren 18.19 ha for KDP section but the construction activities will be carried out within the existing 50-m ROW.

The air quality of the KDP section is within the limit of National ambient standard[1]. Likewise there is no such industrial corridor and other pollution sources within the KP section also. The water quality of KDP section seems under the prescribed standard. The DHM (DHM, 2017) refers that the water quality of the KP section is also within the national prescribed standard. Bagmati, Kamala and

1. Attached in Annex 6

Laakaiya are three perennial and originated from the Mountainous areas of Nepal and remaining all rivers including Anruwa, Jamuniya, Bageri, Shati, Pasaha, Bagmati, Aruwa, Jhanjha, ChandaniJhanjaHardi (Banke), Lakhandei, in this KDP section are ephemeral types. The KP section hasthe Saptakoshi a snow fed and Kankai is Mahabharat originated Perennial and others are ephemeral types.

Biological Environment:

The existing 366-km KP corridor has a number of environmentally-sensitive areas, including Parsa National Park, Koshi-Tappu Wildlife Reserve and Betana wetlands and different forest types. However, along KDP segment of KP corridor, only Parsa National Park will be directly affected by the roadworks. Koshi-Tappu wildlife reserve is 101-km away from KDP Road while Betana wetland is approximately 150-km away, thus will not be affected.

KDP section of MRM Highway traverses through the forest and agricultural areas. The climatic, topographical and soil types of the KP and KDP section result the similar types of forest along the KP surrounding area. Tropical and Subtropical forest (Vegetation) surrounds the KP along KDP section. Along the KP section mostly the timber tree species such as Sal (*Shorea robusta*,), Asna (*Terminalia alata*) and Sisoo (*Dalbergia sissoo*), are found in the forest area. Along the KDP alignment there are community Forest, Collaborative Forest, Government managed forest, and a National Park. The KDP section traverse through 21 community forests, one collaborative Forest, Government managed Forest and Protected Forest.

In KDP section, around 14 km alignment borders the southern part of the Parsa National Park boundary with private lands on the other side of the road. The Parsa National Park has recorded presence of one critically endangered species, the Chinese pangolin *(Manis pentadactyla*), and two endangered species, Asian elephants (*Elephas maximum*) and Royal Bengal tiger (*Panthera tigris tigris*). A critical habitat screening conducted as part of the ESA following the criteria outlined in ESS6, IFC PS6 and IFC PS6 thresholds indicated that these critically endangered and endangered species are widely distributed in South Asia and the Himalayas and given the small area considered as Ecologically Appropriate Area (EEA) (i.e., 300m Direct Impact Area of KDP Road), the upgrading of the existing road segment is not expected to affect the global population of these species. In addition, applying IFC PS6 thresholds in the screening indicated that Parsa National Park cannot be considered critical habitats under the project as the EEA/DIA is too small to affect the global population of critically endangered and endangered species. This will be further studied and validated in the Biodiversity Assessment as part of ESIA at the detailed design stage of KDP road. Other animals are also found in the park, including the more than 80 species of mammals. The population of resident elephants in the Park is about 40-50 animals. Elephants often cross highway, especially during monsoon season and then in August – November. There are around 500 bird species in the park, reptile and amphibian species. The existing KDP road segment has no wildlife crossings that allow wildlife movement from one side of the road to the other.

For the aquatic life, the alignment is dominated by the seasonal rivers except the perennial rivers Bagmati, Lalbakaiya and Kamala.As per the Literatures, Koshi river of KP section has dense populations of fishes, snakes, Turtles rather in Bagmati and Kamla the aquatic life is minimal. The

Koshi Tappu Wildlife Reserve and the Betana wetland are far from the KDP road and would not be affected by the road wrosk.

Eight Wildlife crossings/corridors have been identified in KDP Section, of which three are within the Parsa National Park and five outside but along the Community Forest, Collaborative Forest and Government Managed Forest area. These identified wildlife crossings will be installed with wildlife passes to ensure wildlife movement and transboundary migration is not impeded and to also avoid wildlife road kills.

The below map shows the Parsa National Park in the Road corridor of the KDP section (14km).

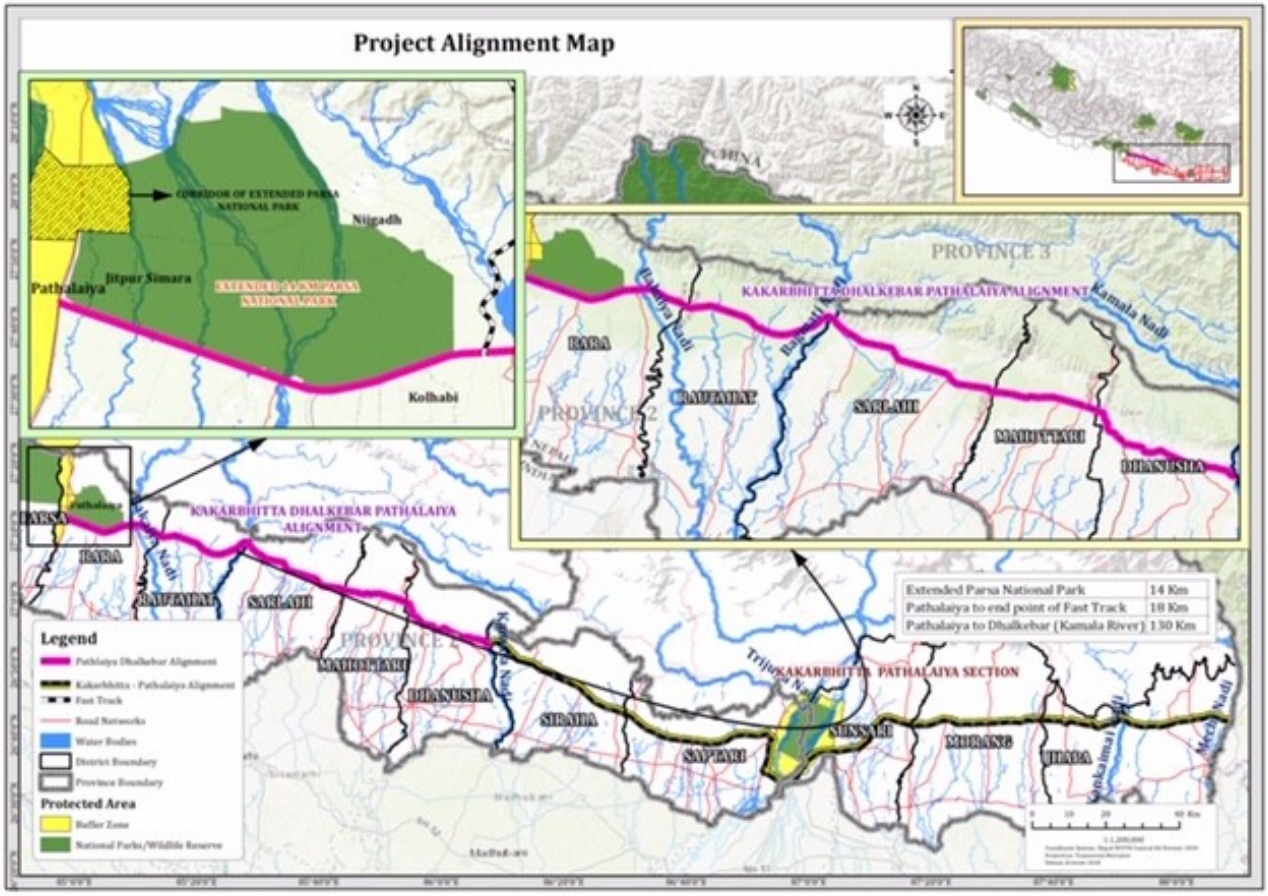


Figure 1:Map Showing the Parsa National Park on KDP section

Socio economic and Cultural Environment:

The KP sections cover the 10 districts of Provinace 1 and 2. The 5 districts are beyond the KDP section namely Jhapa, Morang, Sundari, Saptari and Siraha and remaining 5 are within the the KDP section of MRM as; Dhanusha, Mahottrai, Sarlahi, Rautahat and Bara. Fourteen Municipalities including a Sub Metropolitan city: Ganeshman charnath, Dhanusha Dham, Mithila, Bardiwas, Gaushala, Ishworpur, Lalbandi, Hariwan, Bagmati, Nijagadh Municipality and Jitpur Sub Metropolitan city falls under the KDP alignment.

Settlement patterns in the KDP section generally reflect the distribution of arable land and the development of market areas. Major settlement of KDP alignment are: Godar Bazar, Birendra Bazar,

Dhalkebar, Jamuniua, Lalgadh, Bardibas, Raniganj, Lalbandi, Nabalpur, Hariwan, Milanchok, Chandrapur, Nijagadh, Pathalaiya are market settlements in the project area. Moreover, Labatoli, Bharatpur, Yagyabhumi, Puspalpur, Phuljor, Hariharpur, Karmaiya, Paurahi, Piluwa are other settlements in the project area. The total population of the KP section is 7,344,635 with male population 3,682,617 and female population 3,716,018[2]. Total population of KDP road segment is 817,489 where the population of female is 412,651 and male is 404,838[3]. The average household size of project area is 5.4. The cast and ethnic composition of whole KP section is Madhesi, Bahun/Chhetri Dalit, Janajati and Muslim.

The project area (KDP road segment) is multi caste and ethnic composition such as (Brahmin, Chhetri, Madheshi, Dalit and Janajati. Among the surveyed total households (672 HHs) in the project area, (KDP Section), 31.18 % is Janajati whereas 26.3 % is Bramin/Chhetri and Madhesi 12.9% and *Dalit*[4] household is 12.8%. In Nepal, basically *Dalit* is known as disadvantage group. Few number of family of *Hayou*[5] (marginalized group) reside far from direct influnce area (150 meter far from road Bardiwas area). Religious and cultural heritage are not found near the alignment but some idols and Shrines are observed within the RoW.

Stakeholder Consultations

Stakeholder consultation is one of the best tools for sourcing information from local stakeholders. Consultation was carried out through informal interaction, group discussion, and key informant interview in different communities of affected wards. Stakeholder consultation includes: Local governments, local NGO's, teachers', women groups, vulnerable and disadvantage, local suppliers, and local user groups. The agenda for discussions were impacts on private/ public structure, common property and public utilities along with cultural heritage. In total 13 public consultation meetings were conducted. More than 203 individuals from different groups have taken part in the consultation. During consultations, the major queries raised about land acquisition and compensation, loss of private and public structure, safety measure throughout the alignment impact on public utilities, construction of embankment, river training and drainage management. Communities along the project area have shown their commitment to support project activities. Some of the local people are interested to engage themselves as skilled and unskilled worker during upgrading works. Moreover, local people suggested minimizing the loss of cultivated land and structures to the extent possible.

Analysis of Alternatives

The KDP Road is at an early feasibility and at this stage, three main alternatives are being considered: (i) Do nothing, which means keeping the existing conditions of the road without any improvements and upgrades; (ii) Upgrading of existing road to a 4-lane highway; and (iii) construction of new alignments.

---

[2] District Profile of Nepal (2014-2015)

[3] Feasibility Report, December 2019(based on secondary data of 13 M and 1 Sub-Metropolitan City)

[4] Dalit community known as disadvantage group

[5] Hauyou are indenger marginalized group of Nepal

The Do nothing alternative, while having no environmental and social impacts, is rejected as improvements and upgrades are needed to address the poor and deteriorating conditions of the road and the bridges that need urgent repairs and rehabilitation.

The option of constructing a new alignment is also not favored due to high cost involved and the adverse environmental and social risks and impacts considering that it is a greenfield road. This option was rejected early on and was not further developed.

The option of upgrading to 4-lane highway is the preferred option as this is the most financially viable and would have lesser E&S risks and impacts compared to constructing a new alignment. For this option, there are a number of site-specific options being considered as part of feasibility and detailed design to avoid impacting environmentally-sensitive areas, including settlements. These include:

- New bridge construction, including design and construction of layered bridge through Sapta-Koshi River;
- Consideration of by-pass areas in the urban centers of eastern Terai region;
- Alternative roads or shift of the road alignments to the "safe" distance in some environmentally sensitive areas;
- Coordination of road alignment locations with other linear structure projects that to avoid or decrease possible cumulative impacts or impact interaction between highway construction and those linear projects.
- The road extension will be on next side (southern side) of the existing road alignment within 14 km of Parsa National Park boundary (within RoW) to minimize the E&S risks at Parsa National Park.

The environmental and social risks and impacts of site-specific options, including final routing, construction technology, material sourcing, etc., will be assessed in greater detail in ESIA for the KDP road at detailed design phase.

E&S Risks and Impacts

The environmental and social risks and impacts of the proposed upgrading of the existing KDP road have been assessed based on available information and knowledge of the existing corridor. The upgrading of KDP road and bridges will cover the activities on 4-lane upgrading of the 130-km KDP section of the KP corridor of MRM.

The KDP road section is already an existing highway with 50m RoW already acquired by DoR many years ago. The upgrading works will be carried out within the existing RoW. However, there will still be a need for land acquisition related to widening of the road. As KDP Road is encroached upon already, there will be physical displacement of private and public structures, small shrines and utilities. There will be economic displacement of businesses encroaching along the RoW. The KDP Road, about 14 km of which also passes through the southern border of Parsa National Park, will also impact on wildlife along the wildlife crossing corridors, and the biodiversity of the park in general.

Potential E&S risks and impacts on KDP road improvements, which will be assessed in greater detail in the ESIA during the detailed design phase, are as follows:

Assessment and Management of Environmental and Social Risks and Impacts (ESS1): The upgrading of KDP Road will be done within the existing 50-m RoW. However, there will still be land acquisition mainly for workers' camps, construction site establishments and road widening works and some physical and economic displacement on encroachers along the RoW. There will also be impacts on health and safety of workers and communities at and closer to the project sites and along the road corridor. There will be risks and impacts to Parsa National Park since about 14 km of KDP road runs through the southern border of the park and traverses eight wildlife crossing points/corridors for its entire stretch. If not addressed and managed properly, there could be impacts on wildlife movement and transboundary migration and could contribute to the decline in local population of critically endangered and endangered species. For these reasons, the E&s risks and impacts of the upgrading of KDP road are assessed to be high. Other impacts during construction include increased traffic flow and traffic-related accidents and social issues related to increased labor influx such as gender-based violence and child labor, blockage of natural drainage, runoff water, siltation, pollution of water resources and soil.

Cumulative impacts of the upgrading of this road, when combined with past, ongoing and future development in the Mahendra Highway/East West Highway, are assessed to be significant as well. Potential cumulative impacts include land use change and land transformation in the general project area, blockage of natural drainage in Sunsary District due to effects from several linear projects, contribution to fragmentation of wildlife habitats in Parsa National Park, human-wildlife conflicts due to several linear projects, and decreased elephant and wildlife movement within the corridors.

Labor and Working Conditions (ESS2): The Labor and Working condition associates with three categories of workers: direct, contracted, and primary supply workers. Risk related to contracted workers is expected to be high in comparison to direct and primary supply workers. Basically the risks include poor working conditions and poorly-equipped acocomodationin terms of drinking water and sanitation, discrimination in wage rates; non-payment of standard wage rate, extra burden of work load, non-payment of of benefits (e.g. compensation, maternity benefits, leave, insurance etc.), child labor, and forced labor, human trafficking, and workers not equipped with safety gears, issues including workplace accident, communicable diseases including HIV AIDs/STIs and grievances related to workers and GBV.

Resource Efficiency and Pollution Prevention Management (ESS-3): ESS-3 covers risks and impacts on air, water and noise pollution, solid waste management and management of hazardous waste. The issue of muck disposal; blocking of seasonal streams; water logging stress on water sources ; emission from construction activitities, equipment and plants; dust from earth works, stock yard, transportation of materials, damage to structure due to vibration from movement of machine and equipment; increase in GHGs emission due to felling of trees, construction machines and equipment, vehicles and impacts from quarrying and borrowing activities. All these impacts are prominent during construction stage of road upgrading.

Community Health and Safety (ESS4): Transportation of construction materials can cause nuisance to local communities and road users as well can damage their local access roads during upgrading of

KDP road. In addition, use of vibratory equipment for cutting and filling, stockpiling of construction materials and debris cause the risk in health of local community along the KDP road. Traffic congestion, idling of vehicles and emission from vehicular movement during construcition time may cause disturbance to nearby schools, health centes/hospitals and nearby communities. Due to the migrant workers; there is risk in labor influx, spread in communicable diseases and HIV/AIDs. There may be high chance on competition on resources (public utilities and social service facilities), distress to local peole and can result conflict between community and outsiders. Due to the continuous movement of outsiders at the project are, there may be increase in gender-based violence.

Land Acquisition, Restrictions of Land Use and Involuntary Resettlement (ESS 5): KDP road upgrading works will involve land acquisition related to road widening and physical and economic displacement along the RoW due to some encroachments that have taken place and increased over the years. There will be impacts on public and private structures such as waiting sheds, local temples (idol & shrines), checkposts as well as private structures within the RoW. Land acquisition requirements and risks and impacts related to it will be assessed in greater detail during the ESIA and resettlement action planning at the detailed design phase of KDP road. That said, the option of upgrading the existing road as opposed to constructing new alignment was dictated by the need to avoid massive land acquisition and physical and economic displacement.

Biodiversity Conservation and Sustainable Management of Living Natural Resources (ESS-6): Of all the national parks, wildlife reserves and wetlands identified in the KP corridor (i.e., Koshi-Tappu Wildlife Reserve, Parsa National Park, Betana Wetlands), only the Parsa National Park is within the KDP segment of the KP road corridor. Specifically, about 14km of KDP Road is on the southern border of PNP, which separate the park from private lands from one side of the road to the other. As segment of KDP road is along the border of the park, there are risks and impacts of the road works on Parsa National Park. Specifically, eight wildlife crossing points/corridors are found in the entire stretch of KDP Road, three of these coridors are within the Parsa National Park. Thus, if road works are not planned, implemented and managed properly, there will be impacts on wildlife movement and transboundary migration, increased poaching during construction and could contribute to the decline in local (not global) population of critically endangered and endangered species. Vegetation clearing along the RoW and widened road could also contribute to habitat fragmentation in the park. As documented in the baseline, Parsa National Park has one critically endangered species and two endangered species. However, a critical habitat screening conducted revealed that these critically endangered and endangered species are widely distributed in South Asia and the Himalayas and given the small area considered as Ecologically Appropriate Area (EEA) (i.e., 300m Direct Impact Area of KDP Road), the upgrading of the existing road segment is not expected to affect the global population of these species.

Indigenous People (ESS7): The project area is dominated by multi ethnic groups Janajati, Muslim but also found some caste groups like Barhmin, Chhetri, Madhesi and *Dallit*. Some vulnerable and disadvantaged households (economically deprive, women headed house and disadvantaged groups/ IPs and differently able households) are also found in project area. The KDP road upgrading works may cause impact on traditional occupation and livelihood and ethnic minorities/indigenous peoples. This will be assessed in the ESIA at the detailed design phase of KDP Road.

Cultural Heritage (ESS8): The alignment of the KDP road does not have cultural heritage. There are some shrines and graves that maybe affected and will be accounted for as part of the ESIA, including intangible cultural heritage. Chance Find Procedures will also be included in the ESMP, bidding documents and work contracts.

Financial Intermediary (ESS 9): Since no financial intermediary is involved in this project, ESS9 is not relevant to the project.

Stakeholder Engement and Public Consultation (ESS10): The key stakeholder identified along the KDP road are: Local governments, local NGO's, teachers', women groups, vulnerable and IPs, local suppliers, and local user groups. The issues raised during the consultations were land acquisition and compensation, loss of private and public structure, safety measure throughout the alignment, impact on public utilities, construction of embankment, river training and drainage management.

Management Strategy/Plan

This ESA is a first step to screen and preliminarily assess environmental and social risks of the proposed upgrading of KDP road from 2-lane to 4-lane. Based on the ESA, there appears to be no show stopper in the proposed upgradation of KDP Road. The option to upgrade the existing road within the existing 50-m RoW as opposed to constructing a new road or new alignment has taken into serious account key environmental and social risks and impacts and potential show stoppers. If designed and implemented properly following mitigation hierarchy, risks and impacts can be managed.

Moving forward, the ESIA at detailed design phase of KDP road will assess in greater detail the E&S risks and impacts of the road works based on final design and alignment. The ESIA will include a detailed biodiversity assessment that focuses on project risks and impacts on Parsa National Park, its biodiversity and transboundary movement of wildlife. An Environmental and Social Management Plan (ESMP strictly following the mitigation hierarchy will be developed and will include a Biodiversity Management Plan to address risks and impacts on biodiversity and wildlife. If biodiversity offset is required based on the ESIA and biodiversity assessment, this will be included in the Biodiversity Management Plan and will be implemented. Similarly, other E&S risks and impacts and mitigation measures will also be covered in the detailed ESIA/ESMP. The ESA has identified 8 wildlife crossing points along the KDP road segment for which wildlife crosses will be included in the detailed engineering design (the chainage for wildlife crossings are: 250+400, 272+400, 276+100 , 285+700 , 329+300 ,362+200 , 364+400, 357+800) and will be implemented as part of the KDP road design. Other measures such as fencing will also be studied in the ESIA and included in the ESMP. The monitoring done by WWF-Nepal on the wildlife passes built under the Bank-funded Narayangyat-Mugling (NM), the first of its kind in Nepal, demonstrated that these wildlife passes can be effective measures to allow unimpeded migration of small, medium to large mammals as well as reptiles. Properly designing the passes by wildlife experts in consultation with project engineers, WWF-Nepal, Department of Environment and the Department of National Park and Wildlife Reserve

is a key to effective design, construction and operation of these wildlife passes. The Manual developed by DoR with Bank support on designing Wildlife-Friendly Infrastructure will be used in the final design of these passes.

A cumulative impact assessment will be carried out during the detailed design phase of KDP road as part of the ESIA. In addition, a Strategic Environmental and Social Assessment will be conducted for the entire Mahendra Highway/East West Highway during project implementation to assess the long-term risks and impacts of the upgradation of the entire Mahendra Highway and to come up with and implement well-coordinated solutions and management to these long term and cumulative E&S risks related to the upgrading of the entire Mahendra Highway/East West Highway. These future commitments are recorded in the Environmental and Social Commitment Plan of DoR.

The ESMP for KDP Road will apply the mitigation hierarchy and will include mitigation measures, monitoring plan, capacity building, responsibilities and reporting system and environmental and social costs. In addition, the ESMP provides measures to address GBV issue at project level. The key issues regarding the labor will be managed in compliance with National Labour Act, 2017 and Labour Rules 2018 and WB ESF 2018 through comprehensive Labor Management Procedures and Occupational Health and Safety Plan (OHSP). Established GRM will help to lodge grievances and its resolution. Worker Camp Operation Plan and Worker's Code of Conduct will be prepared to discourage or minimize GBV. The ESMP obligates the contractor, upon mobilization, to prepare the Contractor's (C-ESMP), which shall be prepared prior to the commencement of construction activities. The C-ESMP shall include OHS plan, Water and Waste Management Plan, Influx management Plan, Workers camp management plan, Traffic management and road safety management Plan, Quarry/borrow area management plan, and Site restoration Plan among others in accordance with the GoN and IFC&WB workers accommodation guidelines.

A separate RAP will be prepared to address land acquisition and physical and economic displacement as a result of land acquisition. All losses (private and public assets) will be compensated with replacement costs as per RAP in accordance with ESS5 and GoN requirements. A Resettlement Policy Framework was prepared and disclosed by DoR to guide the preparation of a RAP for KDP Road.

Risks and impacts on ethnic minorities/indigenous peoples will be assessed in the ESIA and a Vulnerable Community Development Plan (VCDP) will be prepared, if required, based on the Vulnerable Community Development Framework (VCDF) prepared and disclosed by DoR. If Free and Prior Informed Consent (FPIC) is required, it will also be secured during the preparation of KDP road following the VCDF that has provisions for FPIC.

Institutional Arrangement

DoR under MoPIT is the key implementing agency for development and implementation of strategic road projects (Government/Donor funded). DoR has five deputy directorates/branches that develop and implement projects. To facilitate field implementation, DoR maintains 33 Divisional Road Offices (DROs). Development Cooperation Implementation Division is one of the key directorates undertaking all donor funded projects. Project Coordination Units (PCU) under DCID prepares Initial Environmental Examination (IEEs), ESIAs, RAPs/VCDPs and perform other E&S risk management. A PCU will be created to manage this project.

Geo-Environment and Social Unit (GESU) is the focal point for the E&S risk management and monitoring unit at DoR.GESU undertakes compliance monitoring and review of IEE, ESIA and RAP and VCDP for government/donor-funded projects. MoPIT is the governing agency mandated by the EPA to review and approve IEEs for projects in the transport sector. It also reviews and endorses ESIA reports for review and approval by the Ministry of Forest and Environment (MoFE). EIA Unit under MoFE undertakes review and approves EIAs.

The other institutions such as Department of Forestry and Soil Conservation (DoFSC), Department of National Parks and Wildlife Conservation (DNPWC), Department of Labour and Occupational Safety (DoLOS) and, project affected M/RM also have supportive roles for the project implementation.

Contractors and sub-contractors will be required to comply with the ESMP and related plans, which will be spelled in bidding documents, work contracts and in the Environmental and Social Commitment Plan of DoR.

Training and capacity building of DoR and agencies involved in project implementation to manage environmental and social risks and impacts will be supported by the project under the institutional strengthening component.

.

CHAPTER 1: INTRODUCTION

1.1 Project Background

Nepal entered to a systematic construction of road networks throughout the country after the emergence of democracy in 1950. The longest road network of Nepal is the Mahendra Rajmarga (MRM) with a total length of 1,028 km trunks from eastern to western boarder of Nepal. This road traverses through the southern low-lying Terai Region (southern flat plains) of Nepal. The MRM is the main trade and physical mobility corridor for Nepal. The highway was designed and developed about 50 years ago and the existing condition of the MRM is poor. With increase in country population, associated increase of vehicle number and frequency of travel, the Department of Roads (DoR) is proposing to upgrade it from 2-lane four-lane standard in a phased manner.

About one-third of the MRM is the 366-km Pathlaiya- Kakarbhitta (KP) road corridor. It encompasses 10 districts in the zone of influence. Five districts viz: Bara, Rauthat, Sarlahi, Mahottari and Dhanusa are located in Central Nepal and five districts: Siraha, Saptari, Sunsari, Morang and Jhapa - are located in Eastern Nepal. As of present categorization, Sunsari, Morang and Jhapa in State no 1 and remaining Bara, Rautahat, Mahotari, Sarlahi, Dhanusa, Siraha and Saptari in State no 2. The road is situated in the eastern Terai Region of Nepal, mostly in the flat area with fast growing population, small, medium and large urban centers along the road. The area is mostly developed for agriculture, but industry also has been actively developed in the region in last decades.

A segment of the KP corridor of the MRM highway is the 130-km Kamala-Dhalkebar –Pathlaiya (KDP) Road, which is proposed for World Bank financing under the proposed Strategic Road Connectivity and Trade Improvement Project (SRCTIP). The KDP segment traverses through 5 Districts and is about one-third of the KP corridor of the MRM.

Figure 2: Map of the project territory at the landscape scale with highlighted road network

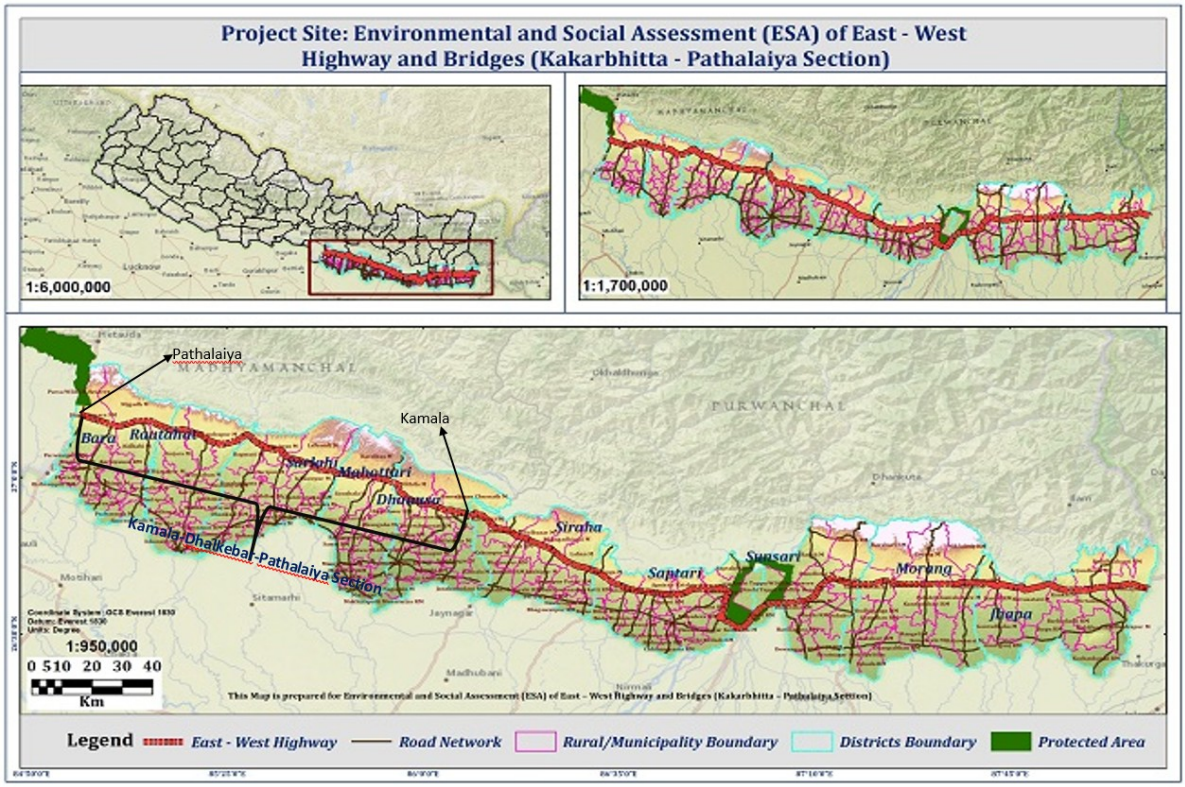
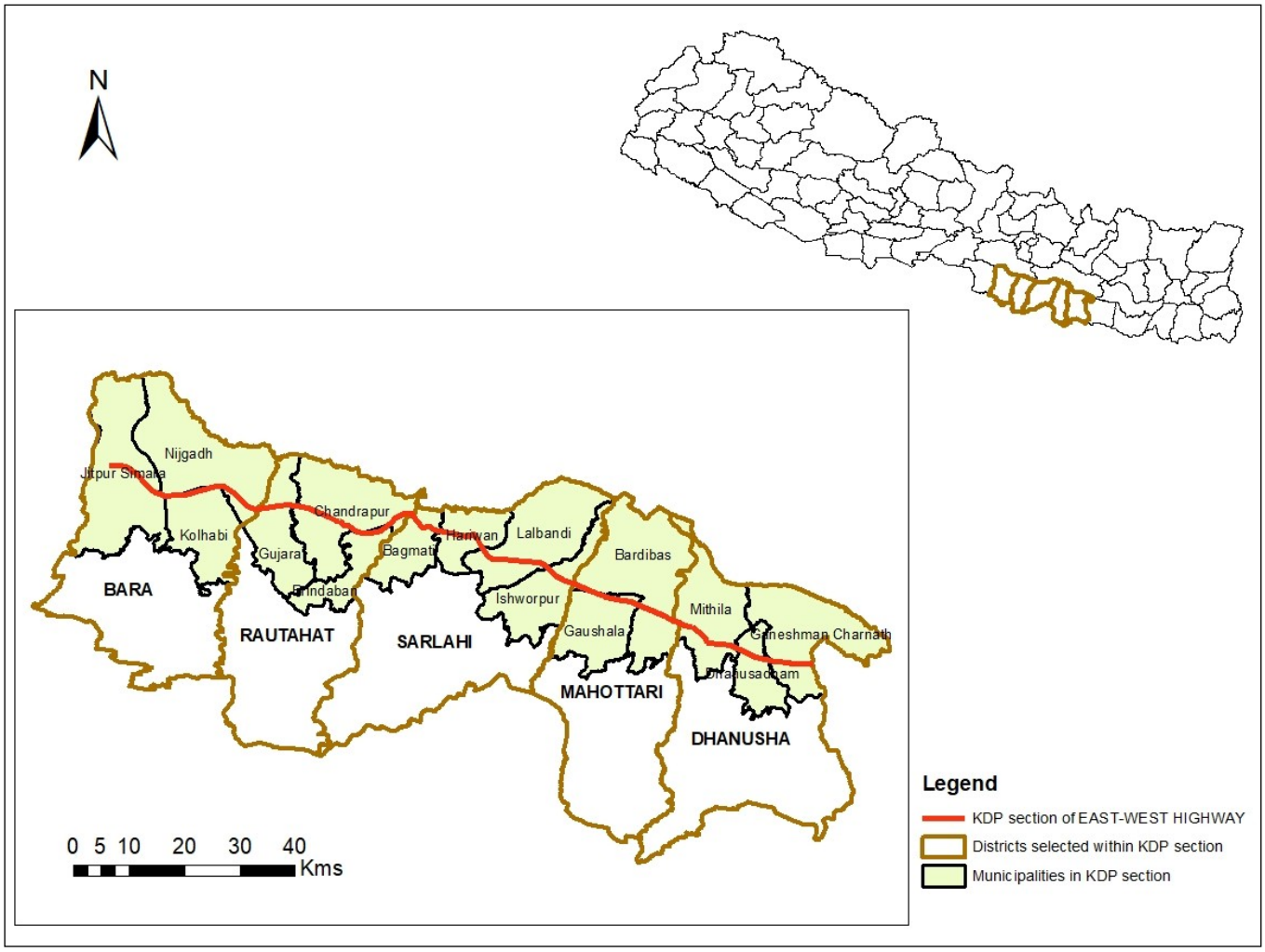


Figure 3: Map of KDP section with boundary of Municipality



1.2 Purpose of this Document

Environmental and Social Assessment is an upstream assessment to screen and assess strategic environmental and social issues, risks and impacts of the upgrading of the Pathalaiya – Kakarbhitta Road corridor that also covers the Kamala – Dhalkebar – Pathalaiya road segment. The ESA was conducted under the ongoing Bank-financed Nepal India Regional Trade and Transport Project (NIRTTP) that focuses on the strategic environmental and social assessment of the KP corridor of the MRM, including the KDP road segment. An ESA is done in lieu of a road-specific ESIA since the feasibility study and detailed engineering design of the KDP road segment are not yet available. The outcomes of the upstream assessment are to inform the road-specific ESIA that will be conducted during detailed design phase.

1.3 Structure of the Report

The report is contained of 11 Chapters as follows:

Executive Summary
Chapter 1: Introduction. This chapter provides baseline information about the project and outlines the purpose of this document.
Chapter 2: Regulatory and Policy Framework for ESA process in Nepal. This chapter provides a brief summary and interpretation of national legislation and international standards relevant to ESA process in Nepal as well as existing gaps in planning and implementation of social and environmental plans.
Chapter 3: Project and Site Description. This chapter describes the project motivation and existing sites along the road as well as project activities.
Chapter 4: Baseline conditions. In this chapter, the main features of physical, biological and socio-economic environment are described and selected valued environmental and social components for further analysis are characterized.
Chapter 5: Analysis of alternatives. This chapter is focused on the scenarios of road development and "no road upgrades" options and their comparison, basing on current level of knowledge.
Chapter 6: Significant environmental impacts. This chapter outlines the summary of impacts on physical and biological environment as well as on historic, archaeological and cultural sites and socio-economic impacts.
Chapter 7: Social impacts. In this chapter, the specific issues relevant to vulnerable groups and impacts of land use change on local communities and their livelihoods are discussed.
Chapter 8: Site-specific assessment of the environmental and social impacts. This chapter is focused on specific assessment of the year-one projects and scenario-based analysis of environmental and social impacts.
Chapter 9: Environmental and Social Management Plan. This chapter clarifies the needs in specific assessment and monitoring and outlines site-specific mitigation plans. In this chapter also there are drafted implementation schedule and cost estimates for mitigation measures as well as integration of EMP with the project.
Chapter 10: Stakeholder engagement. This chapter provides the stakeholder engagement or the communication strategy.
Chapter 11: Conclusions and Recommendations. This chapter provides the key findings and conclusions of the report.

1.4 Methods adopted to prepare the ESA Report

The appropriate methods to prepare this report include:

- Analysis of the Baseline Assessment report data;
- Consultations with DoR, WB and GESU;
- Review of WB and government of Nepal policies and legislative requirements;
- Project area visits and consultations with interested stakeholders;
- Review of the relevant literature sources.

CHAPTER 2: REGULATORY AND POLICY NETWORK FOR ESA PROCESS IN NEPAL

2.1 Legal requirements in Nepal

The detailed description of legislation, international standards and policies has been done in the Baseline ESA report, therefore in the current chapter the project team will not duplicate detailed information, but provide a summary of legal documents focusing more on regulatory and policy network for ESA process in Nepal.

The Environmental Impact Assessment (EIA) is mandatory in all national highway construction projects; however, for smaller roads the screening and Initial Environmental Examination (IEE) are required. The project cycle in road development projects usually includes 6 well-distinguished stages, starting from development of project concept and divided further on 5 consecutive steps (Khadka et al., 2013): pre-feasibility, feasibility, design and cost estimates, implementation and monitoring and evaluation.

The most important initial steps in the entire process are associated with assessment of needs in road construction or upgrades, planning and design. At this stage, the evaluation of transportation needs, technical, economic, environmental and financial feasibility studies, defining priorities and strategy for road sector development, should be conducted, basing on the best practices and regulatory requirements. Coordination between different stakeholders and consideration of entire landscape represents important preconditions for strategic planning and selection of best possible alternatives that to prevent adverse negative (especially cumulative) impacts in the future. The issues relevant to wildlife and social life that can be impacted by road development also can be identified at this stage in the process of site assessment and screening.

The ESA correlates, first of all, with pre-feasibility stage of the EIA process, when the best road alternative can be selected and mitigation needs evaluated through multi-stakeholder involvement, consideration of cumulative and secondary effects. At this stage, the major potential negative social and environmental impacts have been analysed and provided description of measures that should be taken to avoid, minimize, or mitigate negative impacts and enhance positive effects. The economic or cost-benefit analysis is usually provided at this stage. At this stage, the impact of project on wildlife and society is minimal, but decisions for road design and project on road upgrades/construction are crucial for planned implementation.

Screening or pre-feasibility study at the earlier stage of the project saves money and time, establishes the needs for the project, and identifies the environmental issues of major concerns (Khadka et al., 2013). For example, in the road development projects, a screening phase requires to review the long-term road impacts on environment and wildlife and biological functioning of existing ecosystems, taking into account the structure of the landscape, where the road has been planned to be constructed/upgraded. Threshold criteria should also consider how the planned road may affect wildlife habitats and species, including following impacts:

- Habitat fragmentation, loss or transformation (what species may be affected?);
- Barrier effects for seasonal and daily movement (access to food, breeding sites and other valuable resources);
- Threat of wildlife – vehicle collisions, especially with large animals such as elephants or water buffalos (safety issues);

- Disturbance and pollution effects on species and ecosystems;
- Expansion of invasive species, ecosystem services loss;
- Possible indirect and cumulative impacts.

The costs of mitigation measures to reduce or avoid all these impacts should be included in the calculation of financial investment for review of environmental and financial risks of the project. According to Environmental Protection Regulations (EPR, 1997) in Nepal, the Highway construction projects going automatically in Schedule 2: the category requiring application of EIA. But even on this stage the potential risks of the project development should be considered, including monetary values of biodiversity offsets and compensation; opposition to project execution from environmental community; costs of mitigation measures, the impact of the project footprint, potential constraints on investment and financing. The information that should be gathered and analysed during screening includes five major components:

- Scale and location of the project, including maps of sensitive areas;
- Description of main components of physical, biological and social environment (baseline information);
- List of potentially affected physical, biological or social valued components;
- Assessment of nature and magnitude of potential impacts; and,
- Definition the environmental category of the project (adapted from Tsunokava and Hoban, 1997).

During this stage the conducted analysis provides materials for the preparation of preliminary road design and determines whether a full EIA is required.

2.2 Legal and institutional framework for EIA and IEE process in Nepal

The main institutions involved in the road development, planning, administration and control are the Ministry of Physical Infrastructure and Transportation and Department of Roads, responsible for road planning, administration, management and control. However, the road development planning and management should also include consideration of environmental and social issues, therefore it requires involvement of other agencies, ministries and organizations, having the own role in the development process.

The Ministry of Physical Infrastructure and Transportation (MoPIT) is the umbrella agency undertaking the planning and construction of the roads, working at central level as Executing Agency. Department of Road (DoR) is functioning as implementing agency for the sectoral road programs. A project implementing unit, headed by project manager, has been established for all subprojects of road development. All aspect relating to resettlement and land acquisition activities will be addressed in close consultation and collaboration with the GESU of DoR. During the implementation of road construction/improvement plans under sector wide concept, and depending on either upgrading or new road works, a number of other agencies/organizations may become involved such as: MoPIT,

MoFE, MoF, MoFESC, MoFAGA, NPC, DoR including GESU, DOF, DFO, NTNC, DNPWC, Provincial Ministries, DDC,Rural Municipalities,, Municipalities, CBOs, NGOs, INGOs etc. The

overall responsibilities of the MoPIT comprise the coordination with NPC and MoF for the final selection of road network and the finalization of budget allocation. MoPE has responsibility for providing adequate environmental and social safeguard in the design and implementation of road network project. The ministry is responsible for the review of scoping documents and the approval of ToR for EIAs. The ministry reserves the right to supervise all the project related activities that are likely to have impacts on social and environmental sectors. The MoFE has the responsibility for all forestry management aspects for any road, which passes through forest land, conservation areas, national parks, wetlands, buffer zone, or areas of sensitive ecological habitats. In such circumstances MoFE has to be consulted and involved during IEE/EIA studies, and when any trees felled during the construction stage, to give their prior approval or ask corrective and compensatory measures.

In Nepal, the legal framework is consisted of several acts, rules, regulations and policies to protect environment and wildlife. List of required permissions/clearances has been provided below in the Table 2.1.

Table 1: Permissions and Clearance Required

No	Clearance	Act/rule/notification guideline	Concerned Agency	Responsibility
A. Preconstruction Stage				
1	Environmental Clearance	Environmental Protection Act, 1996; Environmental Protection Rule, 1997, Environment Protection Act, 2019 with amendments, Environment Policies, 2019	Ministry of Forest and Environment, Department of Environment, Department of National Parks and Wildlife Reserve, Ministry of Physical Planning and Work	Department of Road (DoR)
2	Land Acquisition and Compensation	Land Acquisition Act, 1977 (with amendments)	Ministry of Physical Planning and Work	Department of Road (DoR)
3	Forestry clearance for felling of trees	Forest Act (2019), Forest Rule (1995) with amendment , Forest Product Collection and Sale Distribution Guidelines, 2001,Guidelines for the use of forest land for another purpose 2071, and local government operation act 2074	Ministry of Forest and Environment	Department of Road (DoR)
B. Implementation stage				
4	Permission for construction material quarrying	local government operation act 2074 ,Soil and Watershed Conservation Act, 1982, Watershed Conservation Rule, 1985, EPA, 2019, and EPR, 1997 (with amendments	Concerned project and concerned Municipalities, Rural Municipalities,	Contractor
5	Consent to operate Hot mix plant, Crashers and Batching	local government operation act 2074	Concerned project and concerned Municipalities, Rural Municipalities,	Contractor

No	Clearance	Act/rule/notification guideline	Concerned Agency	Responsibility
	Plants			
6	Consent for disposal of sewage from labour camps	Water Resource Act, 1992	Concerned project	Contractor
7	Pollution under Control Certificate	Motor Vehicle and Transportation Management Act, 1993	Department of Environment, Department of Transport Management	Contractor

Source: *TPPF Consultants (2012with update).*

The Ministry of Physical Infrastructure and Transportation (MoPIT) is responsible for liaison and cooperation with other line ministries, agencies and bodies for road related activities. Formal coordination is needed between MoPIT and MoFE and such coordination is requiring on environment issues and project effective implementation of road construction activities. National level mechanism for road related construction and maintenance under MoPIT, in coordination with planning, monitoring and evaluation division and MoFE should align to work on environmental, economic and social issues related to road development project.

DoR, responsible for road related infrastructure constructions and road expansion, requires close coordination with Department of Environment for identifying the issues that to be addressed and resolved at the project level EIA, IEEs.

2.3 International agreements and treaties

The description of International agreements and treaties has been done in the Baseline ESA report. So, in the current chapter the project team provides only summary and main recommendations relevant to environmental assessment process in Nepal in accordance with obligations to the signed conventions and treaties (Table 2.2.):

Table 2: International Conventions signed by Nepal and their relevance to ESA process

No	Convention/Treaty	Nepal Joint	Relevance to ESA
1	International Convention on Biological Diversity, 1992	1992	Introduction of appropriate EIA process
2	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973	1975	Annexes 1,2 and 3 – species protection
3	World Heritage Convention, 1975		Natural and cultural World Heritage Sites consideration
4	Convention on the Rights of Child, 1989		Rights of child, prevention of exploitation children
5	Plant Protection Convention, 1952 (Second Amendment 1997)		Prevention of invasive plants and disease introduction and spread
6	UN Framework Convention on Climate	1994	Road sustainability, control

	Change (UNFCCC), 1992		of GHG emissions
7	UN Convention to Combat Desertification (UNCCD), 1994	1997	Halt the process of agriculture land degradation and desertification
8	The Ramsar Convention (Convention on Wetlands of International Importance, especially as waterfowl habitats), 1971	1987	Prevention of wetland degradation
9	The Basel Convention on the control of transboundary movement of hazardous wastes and their disposals, 1989		Prevention of waste disposal and pollution

Source: *Project team, 2019*

2.4 World Bank Environment and Social Framework

World Bank ESF Policy, Directives and Standards – Extent of Relevance

The Section below discusses the relevance of ESF Policy, each of the ten standards (ESS1 to 10) and associated Directive; their requirements are tabulated in Table 2.2. Additionally, it also discusses the relevance and requirements relating to other guidance notes of World Bank.

Table 3: World Bank ESF Policy, 2016 and World Bank Groups' EHSGs 2007

World Bank ESS Policy, Standards, Directive	Objectives	Requirements
World Bank Environment and Social Policy for Investment Project Financing	It sets out the mandatory requirements of the Bank in relation to the projects it supports through Investment Project Financing.	The types of E&S risk and impacts that should be considered in the environmental and social assessment. The use and strengthening of the Borrower's environmental and social framework for the assessment, development and implementation of World Bank financed projects where appropriate.
ESS-1 Assessment and Management of Environmental and Social Risks and Impacts	Identify, assess, evaluate, and manage environment and social risks and impacts in a manner consistent with the ESF. Adopt differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable, and they are not disadvantaged in sharing development benefits and opportunities	The types of E&S risk and impacts that should be considered in the environmental and social assessment. The use and strengthening of the Borrower's environmental and social framework for the assessment, development and implementation of World Bank financed projects where appropriate.

World Bank ESS Policy, Standards, Directive	Objectives	Requirements
ESS-2 Labor-and-Working-Conditions	Promote safety and health at work. Promote the fair treatment, non-discrimination, and equal opportunity of project workers. Protect project workers, with particular emphasis on vulnerable workers. Prevent the use of all forms of forced labor and child labor. Support the principles of freedom of association and collective bargaining of project workers in a manner consistent with national law. Provide project workers with accessible means to raise workplace concerns.	Requirements for the Borrower to prepare and adopt labor management procedures. Provisions on the treatment of direct, contracted, community, and primary supply workers, and government civil servants. Requirements on terms and conditions of work, non-discrimination and equal opportunity and workers organizations. Provisions on child labor and forced labor. Requirements on occupational health and safety, in keeping with the World Bank Group's Environmental, Health, and Safety Guidelines (EHSG).
ESS-3 Resource-Efficiency-and-Pollution-Prevention-and-Management	Promote the sustainable use of resources, including energy, water, and raw materials. Avoid or minimize adverse impacts on human health and the environment caused by pollution from project activities. Avoid or minimize project-related emissions of short and long-lived climate pollutants. Avoid or minimize generation of hazardous and non-hazardous waste. Minimize and manage the risks and impacts associated with pesticide use. Requires technically and financially feasible measures to improve efficient consumption of energy, water, and raw materials, and introduces specific requirements for water efficiency where a project has high water demand.	Requires an estimate of gross greenhouse gas emissions resulting from project (unless minor), where technically and financially feasible. Requirements on management of wastes, chemical and hazardous materials, and contains provisions to address historical pollution. ESS-3 refers to national law and Good International Industry Practice, in the first instance the World Bank Groups' EHSGs.
ESS-4 Community-Health-and-Safety	Anticipate or avoid adverse impacts on the health and safety of project-affected communities during project life-cycle from routine and	Requirements on infrastructure, taking into account safety and climate change, and applying the concept of universal access, where technically and financially feasible. Requirements on traffic and road safety,

World Bank ESS Policy, Standards, Directive	Objectives	Requirements
	non-routine circumstances. Promote quality, safety, and climate change considerations in infrastructure design and construction, including dams. Avoid or minimize community exposure to project-related traffic and road safety risks, diseases and hazardous materials. Have in place effective measures to address emergency events. Ensure that safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities.	including road safety assessments and monitoring. Addresses risks arising from impacts on provisioning and regulating ecosystem service. Measures to avoid or minimize the risk of water-related, communicable, and non-communicable diseases. Requirements to assess risks associated with security personnel, and review and report unlawful and abusive acts to relevant authorities.
ESS-5 Land-Acquisition-Restrictions-on-Land-Use-and-Involuntary-Resettlement	Avoid or minimize involuntary resettlement by exploring project design alternatives. Avoid forced eviction. Mitigate unavoidable adverse impacts from land acquisition or restrictions on land use by providing compensation at replacement cost and assisting displaced persons in their efforts to improve, or at least restore, livelihoods and living standards to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher. Improve living conditions of poor or vulnerable persons who are physically displaced, through provision of adequate housing, access to services and facilities, and security of tenure. Conceive and execute resettlement activities as sustainable development programs.	Applies to permanent or temporary physical and economic displacement resulting from different types of land acquisition and restrictions on access. Does not apply to voluntary market transactions, except where these affect third parties. Provides criteria for "voluntary" land donations, sale of community land, and parties obtaining income from illegal rentals. Prohibits forced eviction (removal against the will of affected people, without legal and other protection including all applicable procedures and principles in ESS5). Requires that acquisition of land and assets happens only after payment of compensation and resettlement has occurred. Requires community engagement and consultation, disclosure of information and a grievance mechanism.

World Bank ESS Policy, Standards, Directive	Objectives	Requirements
ESS-6 Biodiversity-Conservation	Protect and conserve biodiversity and habitats. Apply the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity. To promote the sustainable management of living natural resources.	Requirements for projects affecting areas that are legally protected designated for protection or regionally/internationally recognized to be of high biodiversity value. Requirements on sustainable management of living natural resources, including primary production and harvesting, distinguishing between small-scale and commercial activities. Requirements relating to primary suppliers, where a project is purchasing natural resource commodities, including food, timber and fiber.
ESS-7 Indigenous-Peoples	Ensure that the development process fosters full respect for affected parties' human rights, dignity, aspirations, identity, culture, and natural resource-based livelihoods. Promote sustainable development benefits and opportunities in a manner that is accessible, culturally appropriate and inclusive. Improve project design and promote local support by establishing and maintaining an ongoing relationship based on meaningful consultation with affected parties. Obtain the Free, Prior, and Informed Consent (FPIC) of affected parties in three circumstances. Recognize, respect and preserve the culture, knowledge, and practices of Indigenous Peoples, and to provide them with an opportunity to adapt to changing conditions in a manner and in a timeframe acceptable to them.	Applies when the Indigenous Peoples are present or have a collective attachment to the land, whether they are affected positively or negatively and regardless of economic, political or social vulnerability. The option to use different terminologies for groups that meet the criteria set out in the Standard. The use of national screening processes, providing these meet World Bank criteria and requirements. Coverage of forest dwellers, hunter gatherers, and pastoralists and other nomadic groups. Requirements for meaningful consultation tailored to affected parties and a grievance mechanism. Requirements for a process of free, prior and informed consent in three circumstances.
ESS-8 Cultural-Heritage	Protect cultural heritage from the adverse impacts of project activities and support its preservation. Address cultural heritage as an integral aspect of sustainable development. Promote meaningful consultation with stakeholders	Requires a chance finds procedure to be established. Recognition of the need to ensure peoples' continued access to culturally important sites, as well as the need for confidentiality when revealing information about cultural heritage assets that would compromise or jeopardize their safety or integrity. Requirement for fair and equitable

World Bank ESS Policy, Standards, Directive	Objectives	Requirements
	regarding cultural heritage. Promote the equitable sharing of benefits from the use of cultural heritage.	sharing of benefits from commercial use of cultural resources. Provisions of archaeological sites and material, built heritage, natural features with cultural significance, and moveable cultural heritage.
ESS-9 Financial-Intermediaries	Sets out how Financial Intermediaries (FI) will assess and manage environmental and social risks and impacts associated with the subprojects it finances. Promote good environmental and social management practices in the subprojects the FI finance. Promote good environmental and sound human resources management within the FI.	Financial Intermediaries (FIs) to have an Environmental and Social Management System (ESMS) - a system for identifying, assessing, managing, and monitoring the environmental and social risks and impacts of FI subprojects on an ongoing basis. FI to develop a categorization system for all subprojects; with special provisions for subprojects categorized as high or substantial risk. FI borrowers to conduct stakeholder engagement in a manner proportionate to the risks and impacts of the FI subprojects.
ESS-10 Stakeholder-Engagement-and-Information-Disclosure	Establish a systematic approach to stakeholder engagement that helps Borrowers identify stakeholders and maintain a constructive relationship with them. Assess stakeholder interest and support for the project and enable stakeholders' views to be taken into account in project design. Promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life-cycle. Ensure that appropriate project information is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner.	Requires stakeholder engagement throughout the project life cycle, and preparation and implementation of a Stakeholder Engagement Plan (SEP). Requires early identification of stakeholders, both project-affected parties and other interested parties, and clarification on how effective engagement takes place. Stakeholder engagement to be conducted in a manner proportionate to the nature, scale, risks and impacts of the project, and appropriate to stakeholders' interests. Specifies what is required for information disclosure and to achieve meaningful consultation.
Environmental and Social Directive for Investment Project Financing	This Directive applies to the Bank and sets out the mandatory requirements for the implementation of the Environmental and Social Policy for Investment Project Financing (IPF).	It lays down the following responsibilities of the Bank to manage ES risks and impacts as below: a) undertake its own due diligence of the ES risks and impacts related to the Project; b) support the Borrower to engage in meaningful consultation with stakeholders, in particular affected communities, and in providing Project-based grievance mechanisms; c) assist the Borrower in

World Bank ESS Policy, Standards, Directive	Objectives	Requirements
		identifying appropriate methods and tools to assess and manage the potential ES risks and impacts of the Project; d) agree with the Borrower on the conditions under which the Bank is prepared to provide support to the Project, as set out in the ESCP; and e) monitor the ES performance of a Project in accordance with the ESCP and the ESSs.
Bank Directive Addressing Risks and Impacts on Disadvantaged or Vulnerable Individuals or Groups	This Directive establishes directions for Bank staff regarding due diligence obligations relating to the identification of, and mitigation of risks and impacts on, individuals or groups who, because of their particular circumstances, may be disadvantaged or vulnerable	It requires the Bank task team to support the borrower in establishing arrangements for the undertaking and preparation of the environmental and social assessment of the project as required by ESS1. It reviews the terms of reference for the environmental and social assessment to verify that (a) identifies (or requires the identification of) groups or individuals affected by the project that may be disadvantaged or vulnerable; and (b) requires an assessment of project risks and impacts, and identification of differentiated mitigation measures, as they pertain to the disadvantaged or vulnerable individuals or groups that are identified.
World Bank's Guidance note on managing the risks of adverse impacts on communities from temporary project induced labor influx, 2016	The document provides guidelines to address issues and risks arising from influx of migrant labor leading to gender-based violence, forced labor etc.	Requires preparation of a labor influx management and GBV risk mitigation plan
Good Practice Note on Road Safety	Road Safety - To identify, evaluate and monitor the potential traffic and road safety risks to workers, affected communities and road users throughout the project life-cycle and, where appropriate, will develop measures and plans to address them. The Borrower will incorporate technically and financially feasible road safety measures into the project design to prevent and mitigate potential road safety risks to road users and affected communities".	Requirements on traffic and road safety, including road safety assessments and monitoring.
General EHS Guidelines, April, 2007, IFC	The General EHS Guidelines contain information on cross-cutting environmental, health, and safety issues potentially applicable to all industry sectors	Requirements on environmental, health, and safety issues during construction of project road.
EHS Guidelines for Construction Materials Extraction, April, 2007, IFC	The EHS Guidelines contain the performance levels and measures that are considered	Requirements on the resource management of construction materials extraction activities such as aggregates, limestone, slates, sand,

World Bank ESS Policy, Standards, Directive	Objectives	Requirements
	to construction materials extraction activities such as aggregates, limestone, slates, sand, gravel, clay, gypsum, feldspar, silica sands, and quartzite	gravel, clay, gypsum, feldspar, silica sands, and quartzite

The Bank undertakes environmental screening of each proposed project that to define the extent and type of required environmental assessment. The projects are classified by four risk categories/classification based on their type, location, sensitivities and scale:

- **High**: A Project is classified as **High Risk** if the project is likely to generate a wide range of significant adverse risks and impacts (preservation areas, cultural heritage sites, traditional communal lands etc) and are on human populations or the environment and impact is long term, permanent and/or irreversible, high in magnitude, significant adverse cumulative impacts and a high probability of serious adverse effects to human health and/or the environment.

- **Substantial**: A Project is classified as **Substantial Risk** if the Project may not be as complex as High Risk Projects, its ES scale and impact is large to medium (temporary, predictable and/or reversible and are medium in magnitude), medium to low probability of serious adverse effects to human health and/or the environment and there are known and reliable mechanisms available to prevent or minimize such incidents

- **Moderate**: A project is classified as **Moderate Risk** if risks and impacts on human populations and/or the environment are not likely to be significant, located away from environmentally or socially sensitive areas, impact is predictable and reversible, duration is short term and low in magnitude; low probability of serious adverse effects to human health and/or the environment and can mitigate easily

- **Low**: A project is classified as **Low Risk** if it's potential adverse risks to and impacts on human populations and/or the environment are likely to be minimal or negligible. These Projects, with few or no adverse risks and impacts and issues, do not require further ES assessment following the initial screening

2.5 Analysis of legal and institutional issues and gaps in implementation of social and environmental plans

There is some specific in road development projects, because duration and extent of effects are far beyond the project scope and usually can appear when construction is finished. Therefore, recommended steps for EIA in such cases include:

- Early use of mitigation hierarchy;
- High –level of understanding of species affected;
- All forms of impact are taken into account;

- Same alignment for more than one linear infrastructure plan;
- Engagement of all relevant stakeholders;
- Using geospatial information to determine location of wildlife crossing structures.

International practices and lesson learned suggest prohibiting construction when:

- Alternative locations have not been considered or explored in the design and planning process;
- Wildlife-friendly design has not been incorporated;
- Mitigation and compensation plans are not well considered.

In the case of Patlaiya-Kakarbhitta road upgrades, the valued environmental and social component approach has been taken into account that explores possible predicted impacts and applies the mitigation hierarchy for selected components, which will serve as umbrella for other physical, biological and social issues, relevant to the project area.

The environmental and social legislation of Nepal provides a good basis for the conducting of ESA, EIA, ESIA and development of mitigation measures with general or site-specific recommendations, designed as EMPs, ESMP, RAP and other relevant documents, helping to companies and managers to settle the necessary preconditions for protecting of environment and mitigating impacts on social life during road constructions and operations. At the same time, according to informal reports about existing practices, there are some gaps in implementation of social and environmental plans after completion of the reports, especially in the area of environmental management and monitoring. That to assess the existing gaps and find the ways to improve the existing practices; the project team conducted a SWOT analysis, relevant to existing law and practices of its implementation (Table 2.3).

Table 4: SWOT analysis of gaps in implementation of social and environmental plans

Strength	Weakness
-National laws and policies correspond to international standards and WB operation policies, allowing efficient EA process; -Existing institutional structure (DoR, GESU) is responsible for implementation of SEP -Developed guidelines and instructions help the implementation of SEP -RAP are obligatory for development projects -Participatory approach applied in many projects, ensuring engagement interested stakeholders - ESMF provides guidance for new road construction and upgrades - Policy to compensate and rehabilitate forest area (planting 25 trees instead of 1 cut) -Participatory approach for engagement stakeholders - Enhancement of local capacity - Good protected area management	- Insufficient control and enforcement of implementation; -Lack of 'clearing house mechanism' for SEP implementation; -Lack of control and post-project monitoring - Insufficient capacity and lack of human resources - Lack of budget -Lack of initiatives and adequate payment - Lack of coordination, agreements and resources for post-project activities - Lack of best practices

Opportunities	**Threats**
-Handling the responsibilities for SEP implementation to interested stakeholders; -Development of regulations to ensure efficient cooperation process in road development projects; -Financial mechanisms and designated roles for the control and monitoring - Capacity building between DoR, Ministry of transportation, other national interested stakeholders (ministries) and provincial and local authorities for management and monitoring - Delivering some monitoring and management functions to provincial stakeholders and other authorities - Increasing training component for stakeholders -25% of forest in the country is managed by people, opportunities for engagement	- Loss of valuable assets, infrastructure and natural resources; - Habitat degradation; - Social instability; - Potential threats of development projects for local life styles and loss of valuable natural assets; - Impacts on fragile and limited land resources

As follows from the SWOT analysis, the strength in implementation of social and environmental plans (SEP) is based on the good national laws and practices, corresponding to international standards; existing institutional structure, responsible for implementation of plans; used practical instruments and guidance, supporting selectin of appropriate tools and practices and enhanced through participatory approach. At the same time, insufficient control, lack of post-project monitoring, insufficient capacity, lack of resources and lack of coordination mechanisms ensuring effective post-project cooperation often result in the delay or absence of plan implementation. Capacity building, training, sharing of best practices, engagement of interested stakeholders in the implementation of ESMPs presents opportunities for the improvement of plan execution. Lack of such activities may lead to loss of valuable natural assets, infrastructure and natural resources, increased adverse cumulative impacts affecting life styles and livelihoods and as a consequence to social instability in the affected regions.

CHAPTER 3: PROJECT DESCRIPTION

3.1 Motivation of the Project

More than 7.5 million people inhabit Terai-Arc Landscape, located in the southern part of Nepal close to the border with India. This region is developing fast with average population growth of 2.1% annually (TAL, 2015). Population growth pressure dictates the needs for the development of human communities and speeding-up urbanization of traditionally rural areas with fast development of industry, modern market-oriented agriculture, facilitating trade and growing specific services in the human-encroached areas.

Relationship of the Mahendra Highway and KDP Section

Figure 4: Current state of EWH in Terai Region

Nepal entered to a systematic construction of road networks throughout the country after the emergence of democracy in 1950. The longest road network of Nepal is the East-west Highway (also named Mahendra Highway) which lengths of 1,035 km trunks from eastern to western boarder of Nepal. This road traverses through the southern low-lying Terai Region (southern flat plains) of Nepal. The East-West Highway (MRM) is the main trade and physical mobility corridor for Nepal. As it is mentioned above, it was designed and developed about 50 years ago and the existing condition of the MRM is poor. With increase in country population, associated increase of vehicle number and frequency of travel, the Department of Roads (DoR) is planning to upgrade EHW widening to four-lane standard in phase wise basis. Roads not only provide safe and efficient movement of goods and people across the country, they are also permanent parts of physical, cultural and social environment (Robinson 1971; Lay 1992).

Due to the increase in population and subsequent ribbon development along the existing Highway, the current double-lane road is inadequate and unsafe as well. To enhance efficiency in the transportation and improve road safety, the Nepal Government intends to improve the road corridor from Pathlaiya to Kakarbhitta (KP), including the Kamala-Dhalkebar-Pathlaiya (KDP), which is part of the KP corridor. The project development objectives are to increase connectivity along selected sections of Nepal's Strategic Roads Network and to strengthen the GON's capacity through institutional development for preparing major projects in the transport sector. The outcome will be achieved through road rehabilitation and improvement with associated bridge construction and expansion.

3.2 Site Description

The Kakarbhitta-Pathlaiya (K-P) corridor of the Mahendra Highway, with approximately 366 km length, passes through largely farmlands, then forests, settlements and commercial areas. The road alignment crosses through the area of the fluvial sediments of the Indo-Gangetic Plain, just south of the Siwalik Ridge. The elevation of the Gangetic Plain ranges from 100 to 300 m above mean sea level (amsl). Overall topography of road alignment from Kakarbhitta to Pathlaiya is nearly flat to very gentle slope. The road alignment starts in the area with flat topography from Kakarbhitta (elevation 100 m amsl) ascends very gradually upto the Surunga. From the Surunga, road alignment descends very gently upto Dudhe Bazaar. From Dudhe, the road again ascends very gently upto Mahuli Bazaar. After Mahuli Bazaar the road alignment descends upto Mirchaiya. After Mirchaiya road alignment again ascends very gentle upto the Lalbandi. After Lalbandi the road alignment descends very gently to Pathalaiya.The alignment crosses major rivers like the Kankai River, Ratuwa Khola, Saptakoshi River, Kamala River, Bagmati River, Bakiya, Pashaha Khola, Dudhaura Khola. These rivers originate from the Lesser Himalaya as well as Higher Himalaya. But small rivers along the road alignment are originated from the Siwalik Range which is ephemeral or intermittent. Due to topography and geomorphology the road section is subdivided into eight sections. The road ends at the intersection with East West Highway in Patlaiya Village of the Bara District.

The proposed 130-km Kamala-Dhalkebar-Pathlaiya (KDP) road segment is part of the KP corridor of the MRM highway. The KDP road segment traverses 5 districts viz: Bara, Rautahat, Sarlahi, Dhanusha, Mahottari districts. The existing width of the road is around 8-10 m and it is expected to upgrade up to 22 m wide. This ESA covers the whole stretch from the Kakarbhitta to Pathalaiya with the length 366 km. The KDP section traverse through the plain area with the elevation of the project surrounding area is 62m to 807 m of the Terai region of Province no. 2. The Hydrology of this alignment is dominated by the Bagmati and Kamala River. The main settlements area for this sections are;Godar, Dhalkebar, Bardibas, Lalbandi, Hariwan, Karmaiya, Chapur, Nijgadh and Pathalaiya. The project area is dominated by Madhesi, Dalit, Janajati, Muslim and Bahun/Chhetri. The population of Madhesi other groups is 49.9 percent followed by Dalit (14.6%), Janajati (13.3%), Muslim (12.3%), and Bahun/Chhetri (8.8%). The population of Newar is less than one percent.

3.3 Project Area of Influence

The right of way (RoW) for the 25 meter either side from centerline (50 M) on either side and direct impact area was taken as 300 m corridor along the RoW (that is 150 m on each side from the centerline of road). Indirect impact area was considered as 10 Km on each side from centerline of the road in terms of indirect and cumulative impacts of highway especially in the view of scenario-based analysis of potential environmental and social impacts. Indirect impact area extends to the territory of India in the south, so, in the case of project implementation it is expected that cumulative and indirect impacts of road construction may be transboundary. From the total area of 743,867.78 hectares in the indirect impact zone, 36370.51 ha lie within the territory of India.

3.5 Description of the Project Area

The project road improvement along KP corridor, including KDP road segment, is part of currently existing 1027 kilometers long East-West Highway – the most strategic highway linking the country from east to west in flat terrains (mostly), links Kakarvitta in east and Gaddchauki in west – border

towns with India. This Highway is also the main trade corridor in Nepal, and runs mostly in the Terai plains with some stretches passing through the Chure – a highly unstable and fragile hill range.

The KP section crosses 10 districts in central and eastern Terai Region, along Kakarbhitta-Pathlaiya Road. All districts and VDCs are incorporated in the assessment study report, including the major settlement area; Pathlaiya, Nijgad, Pashakhola, Chandranigahapur, Bagmati, Karmiya, Hariwon, Nawalpur, Lalbandhi, Bardibas, Bandipur, Bhardaha, Lahan, Rupani, Bhantabari, Inaruwa, Itahari, Damak, Birtamod, Kakarbhitta and other settlements. The road alignment between Kakarbhitta and Pathlaiya has covered the Bhabhar as well as Middle Terai zones of the Indo-Gangetic Plain.

Road alignment between Kakarbhitta and Pathlaiya consists of mainly two types of soil namely, residual and alluvium. The alluvial and moist soil support a number of crops among which paddy, wheat, pulses, moong, sugarcane, jute, tobacco and maize. This region includes drier, mostly cleared agricultural land.

Overall topography of road alignment from Kakarbhitta to Pathlaiya is nearly flat to very gentle slope. The elevation of the Gangetic Plain ranges from 100 to 300 m above mean sea level (amsl). The alignment crosses major rivers like the Kankai River, Ratuwa Khola, Saptakoshi River, Kamala River, Bagmati River, Bakiya, Pashaha Khola, Dudhaura Khola. These rivers are originated from the Lesser Himalaya as well as Higher Himalaya. But small rivers along the road alignment are originated from the Siwalik Range. These rivers are mostly dry during the dry season. The Proposed Road runs through three physiographic units of the southern part of Nepal the Terai or Indo-gangetic Plain, Siwalik and the Dun Valley, and areas are subjected to moderate to High Seismic hazard.

The K-P Road corridor comprises of sections which harbor globally and nationally significant wildlife species, a number of environmentally sensitive areas such as wildlife reserves and national park. There is a good Sal (*Shorea robusta*) forest between Pathalaiya-Nijgadh, and further to east, various wild animals have been documented. Halkhoria Lake, which lies within the extended area, is an important site for wildlife to wallow and drink water during the dry season. Parsa National Park, Betana wetland Community Forest (Area between Koshi barrage and Urlabari), Koshi tappu wildlife reserve (a very important Ramsar site), Belbari – Pathari forests and Belbari – Pathari forests are some environmentally sensitive areas.

This Kamala-Dhalkebar-Pathalaiya road alignment has a total length of 130 km of which 14 km pass through the southern border of Parsa National Park that separates the park from private lands on the other side of the road. KDP Road only affects Parsa National Park but will not affect the Koshi-Tappu Wildlife Reserve and Betana wetlands since these environmentally-sensitive areas more than 100km away.

CHAPTER 4: BASELINE CONDITIONS

As it was stated in the previous Chapter, the project area in Pathalaiya – Kakarbhitta corridor, including the KDP road segment stretches on distance of 366 km and covers 10 districts with changing physical, biological, socio-economic and cultural environment from more natural western areas to more populated central and eastern districts. The effect of road development within such large area also will be very diverse and site-specific. It is impossible to survey such large area during relatively short period of time, committed to ESA. Thus, the analysis of baseline data was based on site-specific approach, consideration of environmentally and socially sensitive areas and valued environmental and social components (VEC and VSC) within the existing highway. The selection of appropriate valued components allows focusing assessment on aspects of natural and social environment that are most important to society. The use of valued components also improves the selection of appropriate study methods and focuses analysis on key project-environmental interactions. Effect pathway may be different, in some cases the project may impact valued components directly; in others, the project may affect valued components indirectly, causing changes in natural and social environment, on which the valued components depend.

Indicators are metrics, which used that to measure and report on the conditions of valued components; they must be clearly identified that ensure analysis of interactions between the projects and selected valued components. During the preparation of Baseline Report there were selected the

Attributes of indicators:

- ***Relevant**: they relate directly or indirectly to selected VC;*
- ***Practical**: there is a practical way to evaluate the indicator basing on existing data or predictive models;*
- ***Measurable**: the measurement of the indicator informs about potential effects on VCs;*
- ***Responsive**: to the potential effects of the project;*
- ***Accurate**: in the reflecting changes of the indicator;*
- ***Predictable**: in term of their response to the project.*

Source: Guideline for the selection of VCs and assessment of potential effects, 2013.

valued environmental and social components, which are used in the current study that to review and analyse the nature and extent of expected impacts, to improve the consistency and overall quality of Environmental and Social Assessment in accordance with national legislation and international environmental and social safeguard standards and practices.

Selection of valued components was based on the issue scoping, detailed review of existing available information and consultation with key stakeholders. Selected valued components reflect the value and priorities of Government, public, local indigenous and other communities. The candidate Valued Components were defined on basis of issues scoping. Then, they were revealed through scoping and consultations with interested stakeholders and refined on their value and importance to people, in accordance with regulatory requirements and as potential for evaluation of substantial project effects. Selected Valued Components are used in the current ESA report to ensure effective, efficient and focused analysis of possible impacts of road upgrades in the Patlaiya – Kakarbhitta section of the highway. That to characterise valued components, assess their interactions with the project and determine possible impacts and mitigation measures, the project team followed to the defined methodological steps, presented in Figure 5.1 (Guidelines for the selection of VCs and assessment of potential effects, 2013).

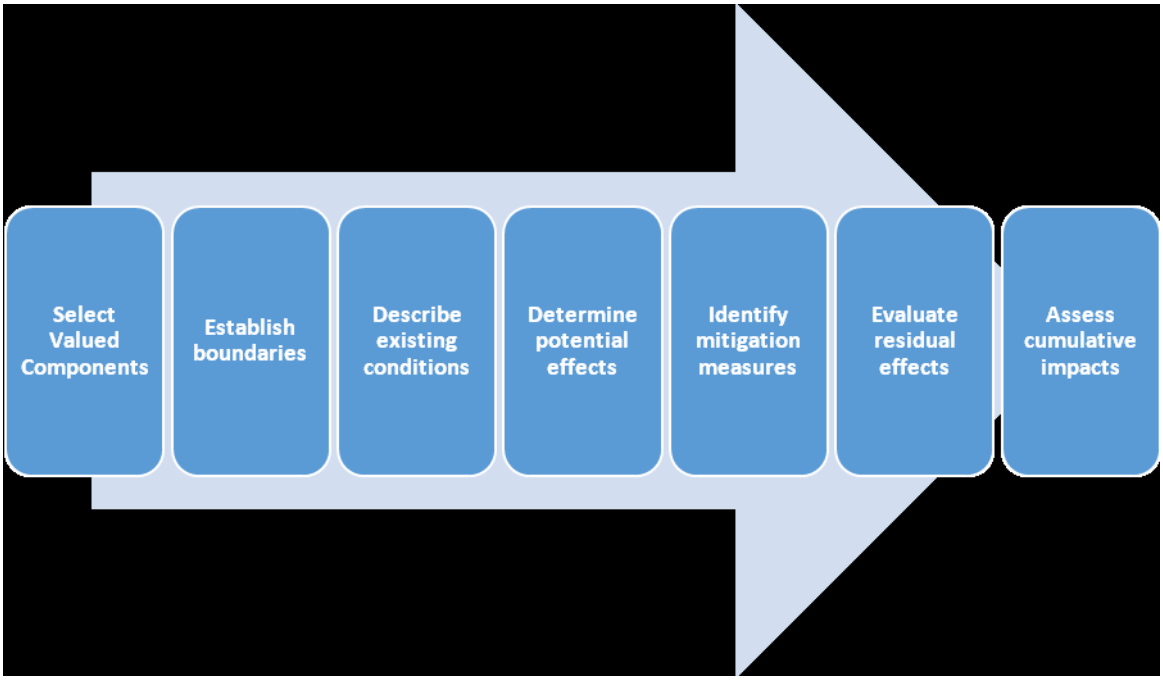


Figure 5: Methodological steps in application of Valued Components

Detailed baseline report highlighted the baseline conditions for physical, biological and socio-economic and cultural environment along the Patlaiya-Kakarbhitta section. Thus, only brief summary has been provided in the current report with focus on selected Valued Environmental and Social Components in the project area.

4.1 Physical Environment and Selected Valued Environmental Components (VECs)

Physical components in the project area include features such as topography and geomorphology, land use, regional geology (soil type and distribution, slope stability, seismicity), hydrology and natural drainage, climate, ground water, air quality, etc. Reviewing the baseline information and consideration of potential interactions between project (highway upgrades and operations), other linear infrastructure development and physical environment the following valued environmental components were identified:

- Topography (bank slope stability and soil erosion);
- Natural drainage and watershed management (flooding);
- Soil, and
- Atmosphere (Air and noise pollution).

Valued Environmental Components of Physical Environment in the Terai Region were selected after assessment of possible adverse impacts of road upgrades on physical components as follows:

4.1.1. Topography and Geomorphology

The East-West Highway is situated within two geographic regions: Gangetic Plains (Terai Region) and Churia Range. It crosses three physiographic units: Terai (northern edge of Gangetic Plain), Churia Range (Siwalik) and Dun Valleys with variations in elevations from less than 200 m over sea level up to 700 m with rock and soil types mostly of alluvial nature. The proposed road alignment passes on the loose soils of the fluvial sediments of the Indo-Gangetic Plans. The road alignment is located south of the Main Frontal Thrust in Nepal. Drift geology showed that road alignment lies on residual and old alluvial soil deposits. The slope stability in rocks of the project area should be stable and stability of soil conditions are good.

Figure 6: Fragile bank slopes and soil erosion

However, there is possibility of bank erosion along the rivers. Thus, it is not expected that it will be problems in the project area, relevant to slope instability or landslides. Riverbeds provide various construction materials, which will be sufficient for road construction. In general, the road alignment lies in low soil hazard zone. The main influencing components for occurring of the medium soil hazard are soil depth, land use pattern and the soil slope. The slope stability is good, so, necessity for realigning any of the subsection is not envisaged on account of geological consideration.

So, **bank slope conditions** may be recommended as Valued Environmental Components that can be affected during road upgrades, specifically, during bridge construction and in the result of collection the materials for road construction in river beds. Not only direct, but indirect and cumulative effects may impact the bank slope stability, including high siltation and possible flooding in the monsoon season. This issue is addressed by Environmental Protection Act (1997), Soil and watershed conservation act (1982) and Water resources act (1992), which ensure control of erosion, landslides and sedimentation in road development projects. Bank slope instability and soil erosion will serve as indicators of adverse impacts, associated with road development, which can be monitored during and after road upgrades and bridge construction (impact monitoring). It is recommended to extract materials for road construction, at least, one km upstream from each bridge along the highway that to prevent the adverse impact of bank erosion.

4.1.2. Natural Drainage and Watershed Management

The drainage network in the project area is represented by 23 major rivers, which can be grouped as old pre-Himalayas (Koshi River), young Mahabharat (Kankai, Kamala and Bagmati) and very young Post-Churia (other rivers). Only Koshi River is snow-fed, all other rivers depend on rainfall for their runoff. Major rivers are Koshi River, Bagmati River, Lal Bakaiya River. Other water-bodies are represented by wetlands, springs, canals, artificial ponds, ditches.

Figure 7: Siwalik range border Terai Plain

The project road lies in the Siwaliks and Terai regions. The Siwaliks region is known to have limited groundwater availability. However, the Terai region has abundant ground water resources to supply drinking and other domestic purposes. The seasonal range of depth to water table in the Terai varies from 0 to 10 meter below ground surface. The quality of ground water in this area should be monitored closely, as presence of arsenic and other minerals have been detected in several areas.

The climate of the region is tropical with hot and wet summer, when maximal temperatures can reach up to +42^{0}C and winter minimal temperatures are +16^{0}C. Annual rainfall is very high, in many areas along the highway it is more than 1,500 – 1,800 mm per year. Rainfall is more intensive during monsoon season (in June – September) with large local variations relevant to orography and specifics of local conditions. Heavy rainfall occurs on some sections of the southern Himalayan slopes. Rainfall is also high along the Chure range. Regions close to the Indian border receive about 1,500 mm rain in a year, while at the foothills of Chure the annual rain fall reaches 2,000 mm. On the northern side of the Chure the rainfall diminishes again. In the lee-ward side of the ranges, rainfall is reduced due to rain shadow effects. There is no effect of flood in most of the areas that it touches, but it has caused widespread sufferings to the people in Terai and northern districts of Bihar. In 1993, people have seen the worst destruction by the Bagmati River. Poor water management, lack of proper weather forecasting and awareness were the main cause of mass destruction.

In the Lal Bakaiya River basin, the mean annual precipitation is 1,434 mm at Gaur (in the south), 2,040 mm at Nijgad (Bhabar area), and 2,306 mm at Makawanpurgarhi (Mahabharat range), increasing with altitude. This area experiences frequently high intensity rainfalls and flash floods, which are highly localized. Between 1954 and 2010, damages from floods in this basin were reported 21 times or every 2-3 years. Mostly flood events were highly localized covering only one or two VDCs. The river floods areas within Nepal include Gaur Municipality and Brahmapuri VDC. Only 3 floods in 1971, 1993 and 2010 were regional in term of area coverage.

Taking into account the high level of rainfall in the Terai Region, the water network is abundant in the project area and water may cause drainage problems along the highway, especially during wet monsoon seasons, associated with water-logging. The areas of possible water-logging should be identified and mitigation measures proposed at the planning and design stages. The capacity of rivers

for transport of water, especially in the places of bridges must be considered taking into account climate change scenarios, transportation by rivers of high amount of silt and other associated issues.

Climate change also can contribute to severity of the floods, because it is predicted in climatic scenarios that rainfall amount might be increased in Terai region, especially in the monsoon season. Meteorological stations in Terai region show increasing level of precipitation in July from 1970 to 2009. The frequency and intensity of rainfalls is also increased, as well as rainfalls causing rise in flash floods and debris flows. Escalation in total rainfalls intensity facilitated an increase in number of landslides. In such scenarios, more floods can be expected along the highway and design of the drainage structures should be made accordingly to prevent seasonal disasters in specific areas of the Lal Bakaiya and Bagmati River basins. The impact of climate change reveals that there will substantial increase in the number of extreme rainfall events and in the frequency and magnitude of extreme river flows.

So, the **natural drainage systems** should be considered as Valued Environmental Components in the project area. During road upgrades, bridge construction and highway operations the natural drainage system can be affected directly and indirectly through the quarrying and stockpiling activities as well as in a result of barrier construction for natural flow (especially small streams and brooks in the project area), which need adequate drainage systems to prevent water-logging along the road in wet seasons.

Figure 8: Abundant water resources provide opportunities for livelihood of local communities

The management and protection of natural drainage systems are regulated by several national laws such as Soil and watershed conservation act (1982), Water resources act (1992), Water resources rules, Environmental Protection Act (1997) and other documents. Indicators of impact from road construction are water-logging and probability of floods along the highway in specific places. The climate scenarios and flood probability should be considered at the stage of planning and design of road upgrades to prevent the destruction of adjacent villages, agricultural areas and natural habitats. Well planned and proper drainage system can prevent flooding along the road. The road height is also important parameter that should be considered to prevent flooding. In some places, the existing highway lies very close to other linear structures, such as new planned Railway and Post road. The Railway is planned to have height in several meters (up to 5-7 m), in such case, the interaction of impacts at the landscape scale will have place and can cause the cumulative impact strengthening the water-logging and proper drainage problem. Coordination of drainage structure location and capacities should be done between several projects.

Most of the bridges and culverts along the KP section are being old, many of them damaged and need urgent replacement or restoration to ensure movement of vehicles. Only last summer (2017) one of the bridges in the Bara District was completely broken causing delays of vehicle movement, turned to the earth road through the river bed, which is possible in the dry season, but can paralyse traffic in the next wet season (summer 2018). Proper management of natural water drainage, affecting the road

structures and surrounding environment, is vital in the Terai region, because any interruption of natural drainage flow may cause not only technical traffic congestion and delay problems, but also may lead to ecological disaster (for example, degradation and loss of Sal forests due to waterlogging) and social catastrophes (destructive flooding of settlements and agriculture with loss of income and assets and lives of local inhabitants, in some cases). Appropriate planning and maintenance of such structures have extreme importance during design and development of the highways.

Figure 9: Siltation may cause improper work of drainage structures

Siltation is another serious problem, which is very significant in Terai Region, the bridge construction and culvert parameters should consider impact of siltation and develop design, preventing the accumulation of silt near bridges and in culverts, because siltation can cause improper functioning of culverts and can result in strengthening of flooding effects.

Taking into account, the seriousness of both designated above problems and interactions between selected VECs (bank slope conditions and natural drainage systems), these aspects should contribute to review and revising of current practices for:

- Calculating return period, design discharge, high flood level, clearance above high flood level, length of waterway, water current force, etc.
- Design methodology of bank slope protection works (retaining and breast walls), subsurface drains and catch drains, etc.
- Design of pavement including selection of appropriate type of base and sub-base, materials,
- Increase road surface camber for quick removal of surface water,
- Increase frequency of periodic maintenance,
- Revise the road and bridge design parameters conducting consultation with the departmental staffs, designers, hydrologists, meteorologists and Climate Change specialists.

4.1.3. Soils

Soils along the Pathlaiya-Kakarbhitta section are mostly of residual or old alluvial deposits, represented by boulder and cobble, sands and silts. Soils are mostly stable, but it is possible their erosion mostly along river banks. So, river bank protection is required during construction of bridges and other road infrastructure. Extensive soil erosion and landslides in upper catchments of the large rivers (Koshi, Bagmati and Lal Bakaiya) have produced a high silt yield. In the basin of Koshi River it is one of the highest in the World with about 19 m3/ha/year (10 cu yd/acre/yr), which is relevant to the age of the river, flowing through young Himalaya Mountains with increased gradient, causing side and bed erosion along the course, frequent landslides and seismic disturbances and lack of the flat valleys in the mountains. The river transports sediment down the steep gradients and narrow gorges in the mountains and foothills, where the gradient is, at least, ten metres per km. On the plains

beyond Chatra, the gradient falls below one metre per km to as little as 6 cm per km as the river approaches the Ganges.

Such "exposure" of fine soil particles from the upper catchment area to the flat plains provided conditions for the formation of fertile plains, beneficial for agriculture development. Thus, Terai region is known by its abundant agricultural production and fertile soils. Soil is an extremely important element of local economy and livelihoods of local agricultural communities. Agriculture along KP section occupies more than 50% of land-cover area: in the proximity of the road (ROW and DIA), 61.2% and 59.8%, respectively, and in the indirect impact area it represents 52.9% of the land. Soils are valued by people; protection of soils is addressed in the Soil and watershed conservation act (1982), Environmental Protection Act (1997) and Water resources act (1992).

Thus, **soils** in the project area may be recommended as a VEC that can be affected directly during road construction and upgrades by disposal of excavated excess materials with further effects of soil erosion and indirectly by contamination of soils along the roads with adverse effects on productive top-soil. The Road upgrading will produce large volume of excess fill materials and require places for stockpiling, labour camps, which can be considered as an indicator of road development impact on soil. Disposal of excess fill at low impact sites should be undertaken to minimize the damage to environmental and social features. Excess fill should not be side casted over the edge or near drainage lines, above houses or in any other places where it is likely to cause damage to natural or social features. There is also threat of loss the significant amount of fertile top-soil in the project area.

As per the norms provided by Environmental and Social Management Frameworks: A guide to the environmental and Social Issues (Geo-Environment Section of Department of Road, 2007) the designated disposal sites should be carefully selected and recommended to prevent adverse impacts on soils. Such sites should be away from cultivated land, settlements, water sources, public places, schools and health centers, forest, fragile ecosystem and landslide prone areas, etc. Soil protection also should be recommended in the Initial and Site- specific Environmental Management Plans through identification appropriate designated sites for disposal, meeting the standards given in ESMF (2007). Barren land occupies quite significant area, covering around 4% in all data sets. This is, more likely, attributed to presence of open land with sand, gravel and boulders in river valleys. The presence of barren land in the road corridor indicates also that there are opportunities to find places for quarries, stockpiling, camps and other technical sites during road construction.

Figure 10: Fertile soils in Terai region provide favorable conditions for agriculture

Recommendations for protection of productive top-soil also should be done that to prevent the loss of this fertile layer and keep it for land reclamation after construction.

4.1.4 Land Use

The proposed alignment for the section KDP have identified the following land and use requirement along the corridor and along the Right of Way.

Table 5: Land Use and requirement in alignment

Towards Left side of the Road corridor			Towards Right Side of the Road Corridor			
SN	Type of Land	Land Required	Type of Land	Land Required		
1	Forest	65.698	Forest	70.92		
2	Cultivated	21.365	Cultivated	20.45		
3	Settlement	34.86	Settlement	28.83		
4	Barren	8.21	Barren	9.96		
Total		130.143		130.173		
Total Land Required						260.316 ha

For the whole ROW the following land requirement and land use is required:

SN	Land Type	Required Land
1	Forest	273.236
2	Cultivated Land	83.64
3	Settlement	127.4
4	Barren	36.35
	Total	520.6334 ha

4.1.5. Atmosphere (Air and Noise, Solid Waste Management etc.)

Water quality in the project area was tested from two different locations. Sirsiya River from Parwanipur and tube well water from Simara bazzar. The drinking water quality from tube well showed that all the physical parameters are within National Drinking Water Quality Standards, (NDWQS) the limit as prescribed by GoN. However, the biological parameters of fecal coliform were found exceeding the acceptable standards in the water sample collected from the tube-well at Simara Bazar.

At Sirsiya River in Parwanipur, the concentration of BOD5, oil and grease were found to be 108 mg/l, and 19 mg/l respectively which is almost two times higher than the limit of the generic standards for both. This can be due to direct disposal of domestic and industrial liquid and solid waste into the river (Annex 1).

At present, air quality on the roads is very low due to high traffic flow, poor road conditions, destructed soil, car combustion and lack of mitigation measures. Pollution in road development

projects is one of the evident direct impacts affecting water and soil. The dust pollution along KP section is visible in the dry seasons. Other pollutants also can be considered as indicators taking into account their importance for public health and coverage by regulatory framework. Arsenic contamination in drinking water is reportedly high; it was estimated that 3.5 million people in the region are directly exposed to 10 and 50 µg/L. The information on air pollution from the project site is very scanty.

Noise pollution is the major annoyance particularly for the people living in roadside settlements, close to the highway. The research findings indicated that the noise produced by the vehicle plying in the Highway is mostly exceeding 70DB (A), disturbing people as well as wildlife in many cases.

There are many adverse effects from road construction/upgrades and operations on air quality. Some of them are dust and gas emission, air pollution from vehicles, etc. Dust emission is most prominent in the dry season, when effect of pollution is visible on the distance in 1 km and more in open places.
Information on air quality in some sections of the Raxual-Amlekhgunj Petroleum Pipeline Area is shown in Table 4.1. The air quality monitoring data shows that the Total Suspended particulate (TSP) in the ambient air at Simara, particularly at the site – by the side e of Hotel Samyak, along the Tribhuvan Highway, exceeds the National Ambient Air Quality Standard (NAAQS) while TSP concentration at Amlekhgunj (inside NOC staff quarter) was found within the national standards. Birgunj has higher carbon monoxide and lead concentration in the air as compared to other part of the country located in middle hills. However, the air quality data for carbon monoxide and lead concentration in Birgunj was within the tolerance limit. The observed levels of PM10, PM2.5, SO2, NOx, benzene, and ozone in both the locations were found lower than the recommended safe level.

In ananother study done by National Health Research Council in 2004, the report shows that Total Suspended particulate (TSP) and Particulate matter of size less than 10micron (PM10) levels in the ambient air at Birgunj exceeded several times of the national standard. Average PM10 level in Bhanuchowk, Ranighat and Adarshanagar were found 380µg/m3, 358µg/m3 and 220µg/m3 respectively. However, Birgunj was found to be least polluted among three studied cities Kathmandu, Pokhara and Birgunj, with all kinds of gaseous pollutants. Observed levels of NO2, SO2 and CO in all locations of this city were found very low than the recommended safe level (Table 2 in Annex 1).

Noise associated with pipeline construction will be short term in the project area but cannot be fully mitigated. Therefore, residual noise impacts during construction are recognized.

For baseline information, noise level monitoring was conducted at two different locations within the project area. One at Simara (infront of Samyak hotel) and other one at Amlekhjung (inside NOC staff quarter area) using sound level meter (CENTER 320) and calibrator (CENTER 326) takes 6 hours data. The result of the monitoring is illustrated in **Table 6.** The measured minimum and maximum range of noise at two stations ranged from 98.3-52.0 dBA.

Table 6: Noise Quality Data (Average 6 hours)

Location	Time	Observed Value (dBA)					
Simara- infront of Hotel Samyak		L_{min}	L_{max}	L_{eq}	L_{90}	L_{50}	L_{10}
	08:30-09:30	64.7	95.2	78.0	69.2	74.4	80.0
	10:40-11:40	68.6	98.3	81.2	72.2	75.0	83.4
	13:00-14:00	60.5	88.7	76.9	74.5	77.6	81.4
	18:00-19:00	54.1	97.9	66.1	59.6	65.2	73.5
	20:00-21:00	52.0	86.4	58.4	60.1	63.5	68.5
	21:00-22:00	48.9	83.6	56.2	62.4	66.3	69.7
Amlekhjung-inside NOC staff quarter area	11:10-12:10	58.4	88.4	67.9	62.7	66.2	72.0
	13:00-14:05	55.4	91.2	68.7	60.0	67.8	71.5
	15:10-16:10	61.2	88.4	70.9	64.7	66.7	73.5
	18:30-19:30	52.4	81.4	65.4	60.1	65.8	70.9
	21:15-22:10	47.3	68.8	50.9	52.3	55.8	60.1
	23:00-00:00	48.8	76.5	52.5	51.8	54.6	61.1

Source: *EIA Report of Raxaul-Amlekhgunj Petroleum Pipeline Project, 2017*

Ambient environmental conditions in the project area are candidate valued environmental components that can be highly affected by road development. Potential effects of the road development on atmosphere quality and climate can be measured through indicators such as air quality and greenhouse gas (GHG) emission. If GHG emission is not easy to measure and monitor, air pollution is a good indicator that reflected by legislation and regulatory requirements and represent one of the priorities for consideration in road development policies in Nepal. Pollution is causing a deterioration of the environment. Air and noise pollution also can cause many health problems for local communities.

Environmental Protection Act (1997), Motor vehicle and transport management act (1993), Soil and watershed conservation act (1982) and Water resources act (1992) as well as Motor vehicle and transport management act (1993) promote necessary mechanisms to prevent air, liquid and solid pollution. Nepal vehicle pollution standard and National standard on air quality ensure implementation of mitigation measures in road development projects. The Environmental Protection Act (1997) only is relevant to noise control.

Figure 11: Dust and solid wastes are typical features along operating EWH

It is impossible to avoid impact of roads on air quality. However, mitigation technics to minimize adverse effects on environment and human health are well known. Mitigation measures include minimizing effects through different actions: air quality control, water springing during construction in the excavation sites, replanting of trees, management road sides, emission and dust control. In Terai Region, in places with dense forest cover the effect of air pollution is invisible already on distance 150-200 m from the road, because broad-leaved trees serve as natural shield, filtrating air and preventing dust exposure. Therefore, as one of preventive measures, it can be recommendation for plantation of trees with high capacity to

stop spread of dust and consume carbon dioxide. Local native trees are the best solution to mitigate adverse dust emission effects. Solid and liquid pollution is another issue, especially during construction stage as well as chemical pollution. Quarries and borrow areas can be recommended for proper management of waste, chemical and other hazardous materials during construction. Tsunokawa and Hoban (1997) recommend restoration and landscaping quarries and borrow areas after road construction for different natural, economic or recreational uses. The impact of noise can be especially significant during construction or road improvement stages, when operations of heavy machinery create disturbance for people and wildlife. During operation stage it can be noise from traffic and horns. It is impossible to avoid noise during road construction and operations, but it is possible to minimize effect of noise through special barriers, which are usually expensive. In the forest areas the noise can be significantly minimized using natural barriers like green walls of trees along the road.

Selected valued environmental components will be used for assessment of environmental impacts and development of appropriate mitigation measures.

4.2 Biological Environment and Selected Valued Environmental Components

The key issues that should be considered during selection of Valued Components for biological environment include importance them for people and regulatory requirements. The Valued Environmental Components for Biological Environment in the project area are consisted of environmentally sensitive areas, terrestrial and aquatic habitats, threatened and endangered species.

4.2.1. Environmentally Sensitive Areas

Environmentally sensitive areas along the Pathlaiya-Kakarbhitta section include protected areas (Parsa National Park and Koshi-Tappu Wildlife Reserve) and Betana wetlands. Other environmentally sensitive areas in the section are represented by valuable ecosystems for some species, and by the important movement corridors. So, environmentally sensitive areas comprise of three VECs: Wildlife reserves and parsk, Valuable Ecosystems and Important Movement Corridors. These VECs are selected basing on the overall importance and value for people, regulatory requirements, potential for substantial project effects and for their potential for the analysis of existing and post-construction conditions.

Importance to people: Environmentally sensitive area is a part of Terai Arc Landscape. Terai Arc Conservation Strategy (2015) highlights significance of habitats, ecosystem processes and important movement corridors for biodiversity conservation and sustainable development of local communities. The importance of biodiversity for national and local economies is highlighted in many strategic documents. Many indigenous people in the Terai region, especially living closely to Parsa National Park and Koshi-Tappu Wildlife Reserve still depend on biodiversity resources and ecosystem services, provided by natural habitats habitats and valuable ecosystems.

Regulatory requirements for the environmentally sensitive VECs: The Environmental Protection Act (1997) and National Parks and Wildlife Conservation Act (1973) are basic laws, ensuring conservation of wildlife. The Nature conservation sustainable framework for development (2015) provides detailed aims and objectives for biodiversity conservation in country for next decade.

Potential for substantial project effects: The Nepal National Biodiversity Strategy and Action Plan (2014) underline that loss of habitats, encroachment, expansion of cultivation and development of infrastructure are among the major threats to biodiversity. Linear structures have been considered as one of the threats for biodiversity conservation, especially in the plain regions with relatively high ratio of protected areas and rich species diversity occurring within protected areas.

Key for ecosystem function: Protected areas and important wildlife habitats provide many ecological services for local communities, regions and the country, including their high potential for recovery of threatened species, development of ecotourism, ensuring education and cultural services and many others. Movement corridors secure gene flow and normal population processes at the landscape scale, dispersal and colonization, species conservation and rehabilitation.

Potential for the analysis of existing and post-construction conditions: Wildlife habitat fragmentation and effect on traditional migratory routes, in general, are not very visible. They can be detected with increased rate of wildlife road mortality, with declining of migratory species populations and other biological patterns only by special monitoring studies and assessments. Scientific research and monitoring within protected areas provide the good base for the analysis of current and post-construction conditions. Staff of protected areas can be engaged in the monitoring of roadkill animals and evaluation of cross-road structures efficiency through establishment of impact monitoring. However the proposed Kamala-Dhalkebar-Pathlaiya road section is existing road section and the proposed road upgrading is only with the existing ROW. The KDP road segment only traverses 14 km within the National Park along its southern border that separates the park from private lands. This road is the backbone of the nepali transport sector and already exist since last 50 years. The proposal is for the upgrading of the existing road section. The upgrading activities is only with the existing CoI area.

4.2.1.1.1. Protected areas, Wildlife Reserves, Wetlands and Other Environmentally-Sensitive Areas

Parsa National Park has important value for the conservation of terrestrial animals and ecosystems, ensuring also movement of critically endangered, endangered, charismatic and common species from Terai flat areas to Siwalik (Churia) Range. Koshi-Tappu Wildlife Reserve provides habitats for terrestrial and aquatic species, ensuring conservation of biodiversity in highly populated area and movement corridors for animals from India to Nepal and back. Parsa National Park will be affected directly and indirectlythrough disturbances during construction work and road operation of KDP Road and by cumulative impacts associated with habitat isolation and fragmentation.

The following table shows the environmentally-sensitive habitats for the whole alignment of the MRM Road.

Section	Length	Status	Natural Habitats
Kakarbitta-Birtamod	17.52 km	Planning for the upgrade	Betana wetlands
Birtamod- Kanchanpur	131km	Planning stage	Koshi Tappu Wildlife Reserve

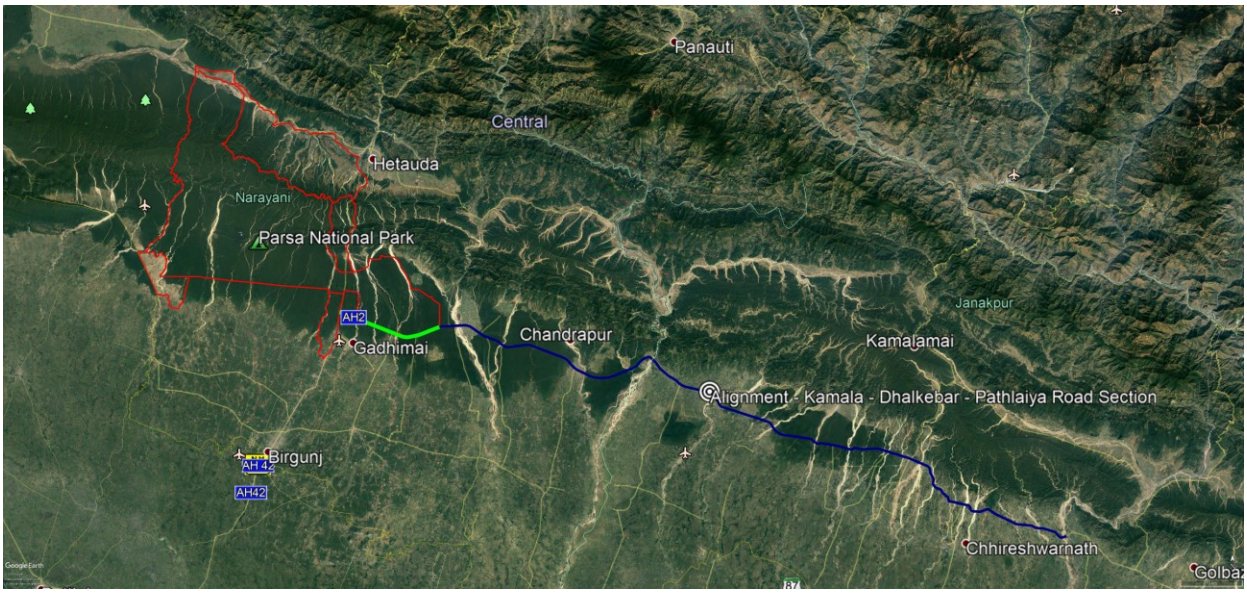
Kanchanpur-Kamala	87.29km	Tendering stage	-
Kamala-Dhalkebar-Pathalaiya	130 km	Feasibility study	Parsa National Park
Pathalaiya- Narayanghadh	105 km	Pre feasibility study	Parsa National Park
Narayanghadh-Butwal	115 km	Under upgradation	Chitwan National Park
Butwal- Mahendranagar		Planning	Banke National Park, Bardiya National Park, ShuklaPhata National Park

Parsa National Park with area of 637 sq. km, bordering the road in Pathlaiya – Nijgad section on distance in 18 km. It gained the park status just in July of last year (2017). In 1976, the Parsa Wildlife Reserve was established on the area of 175 sq.km in the Chure Bhavar Region, mostly to preserve patches of sal forest and wildlife connection with Churia Range, bordering Chitwan National Park on the west. In 1984, the area of Wildlife Reserve was increased up to 499 sq. km. The tropical and subtropical forests [Terai Mixed Hardwood Forest] of the reserve mainly consist of Sal trees - *Shorea robusta* -(about 90% of the Park's forests). The major trees in the riverine forests are Khair – *Acacia catechu* - and Simal (Silk-cotton tree) – *Bombax ceiba*. More than 300 plant species have been found in the Park. There is 14 km road section of the KDP road that is located along the southern border of the the Parsa National Park that separates the park from private lands on other side of the road.

Parsa National Park is located in the south-central lowland Terai of Nepal. With the area of 637.37 sq.km. it has pristine sub-tropical forest type. In history, this area served as a vacation site for the Rana Rulers of the country. In 1984, it has been gazetted as a wildlife reserve to preserve the habitat for wild Asian elephant and a variety of other fauna. It is contiguous with Chitwan National Park in the west. In 2017 it was gazetted as National Park.

The forests are mainly composed of tropical and subtropical species. Sal forests compose about 90 percent of the reserve's vegetation. Along the banks of the rivers, riverine forests are found containing species like Khair and Silk cotton tree. In the north-eastern part of the reserve, at higher altitudes, Sal and Pine forests are occurring. On the southern slope of the Siwalik hills, the forests are dominated by pine. Sabai grass is commercially important species, grows well on the southern face of the Churia hills. The reserve supports good populations of various endangered species include wild Asian elephant, Royal Bengal tiger, Sloth bear, and Leopard. Blue bull, Sambar, Chital, Hog deer, Barding deer, Langur, Rhesus macaques, striped hyena, Jungle cat, and Palm civet are also found in the reserve. The reserve also provides habitat for more than 500 species of birds. For example White breasted kingfisher, Paradise flycatcher, Large racquet-tailed drongo, Golden backed woodpecker, etc are some of the common sights. Giant hornbill, one of the endangered bird species is found in some forest patches. The reserve is also famous for reptiles and different kinds of snakes include common Cobra, Common and banded Karit, Python and King cobra.

Figure 12: Map Showing the Parsa National Park in Green Colour .



Parsa National Park supports populations of critically endangered animal (Chinese pangolin) and endangered animals such as the Royal Bengal Tiger and Asian Elephant. It also has many charismatic animals such as Gaur, Nilgai, Sloth Bear, Common Leopard, Sambar, Chital or Spotted Deer, Hog Deer, Barking Deer, Terai Gray Langur, Striped Hyena, Jungle Cat, Palm Civet and many others. More than 80 mammal species was recorded in the Parsa National Park. The population of resident elephants in the Park is about 40-50 animals. Elephants often cross highway, especially during monsoon season and then in August – November. There are around 500 bird species in the reserve; among them the globally threatened Giant Hornbill (vulnerable) also occurs there. Many reptile and amphibian species inhabit the area of Parsa Wildlife reserve, including two crocodile species, several turtle species and many snake species. The existing KDP road segment has no wildlife crossings that allow wildlife movement from one side of the road to the other. The improvement of the KDP road segment under SRCTIP will have provision for wildlife crossings in areas identified by the park authorities that are known to have high number of wildlife movement. Initial discussion with park authorities identified potentially at least 3 wildlife crossings along the 14km stretch of the KDP road within the borders of the Parsa National Park and 5 crossings outside the national park with the dense forest having frequent wildlife movement area. This will be further assessed and verified in the ESIA for the KDP road segment during the detaied engineering phase of the said road.

Figure 13: Calf of Nilgai in Parsa National Par.k

In 2013, the tiger recovery program started in the reserve, because the tiger density in Parsa was assessed as just 0.78 tigers per 100 square km, compared to Chitwan National Park with 3.84 tigers per 100 sq. km (Lamicchane et al., 2017). Prey density also was much lower in Parsa WR compared

to Chitwan NP as a result of widespread hunting and habitat degradation due to livestock grazing. After

Nepal's commitment to double the size of tiger population by 2022, the Parsa Wildlife Reserve was engaged in this conservation initiative. And just from 2013 to 2016, the tiger population increased in the reserve from 0.78 to 1.38 individual per 100 sq.km (Lamicchane et al., 2017). On the opinion of researchers and Park's staff the tiger population can recover rapidly in the Parsa after relocation of local village, controlled poaching and connectivity to a source population in the Chitwan National Park.

Several wetlands, providing habitats for aquatic and semi-aquatic wildlife and water-birds are located inside of the Park, including important Halkhoria Daha Marshy Lakes (46 ha), which is currently affected by invasive aquatic species, but the special program with engagement of local communities provides the lakes clearing from invasive plant species.

With obtaining of new status of the national park in July 2017 and expanding of the park territory to the north, the conservation value of the park for biodiversity conservation in Terai Region has increased. So, this Critical Habitat needs special consideration of mitigation measures, especially during planning and design stages.

Koshi-Tappu Wildlife Reserve with area of 175 sq. km does not border the East-West Highway directly, but its buffer zone with approximately the same area is located in the proximity of Highway. The reserve was established in 1976 mainly that to protect the Asian Water Buffalo (Arna) – *Bubalus arnee* (Globally Endanegered) - and in 1987 it was designated as a Ramsar Site or Wetland of International Importance, especially for migratory waterfowls. The number of migratory waterfowls is very significant in the reserve, which is famous for bird watching. The reserve together with Koshi-Barrage was also recognized as one of 27 Important Bird Areas of Nepal.

Koshi-Tappu Wildlife Reserve is located in three districts: Sunsari, Saptari and Udayapur, two of which are the part of the project territory. It is rectangle-shaped reserve, which is stretched 10 km northward from Nepal-Indian border along the Sapta Koshi River by 10km-wide stripe with elevation from 75 to 81 m over sea level. Main habitat types in the reserve are wetlands, grassland and deciduous riverine forest area. Mudflats, reed-beds and freshwater wetlands are common landscape features along Sapta Koshi River. Sapta Koshi River is one of the tributaries of the Ganges. It is causing intense flooding in the monsoon season and supporting aquatic and semi-aquatic habitats along the river. Flooding regime also maintain the tall-grass vegetation of grasslands, ensuring abundant grazing area for the wildlife.

Figure 14: Grasslands and flooded plains provide habitats for many animals

Grasslands occupy around 68% of the total territory with tall grassland vegetation (khar-pater). Forest covers only around 6% of the reserve's territory with trees of Indian Rosewood (*Dalbegia sissu*), Simal (*Bombax ceiba*) and Kair (*Acacia catechu*). Grassland and wetland vegetation

is very rich and represented by more than 500 plant species, including reeds, sugarcane, cattail, eel grass (*Vallisneria ssp*.), lotus (*Nelumba nucifera* and *Nymphaea stellata*) and many others. Cogon grass (*Imperata cylindrica*) dominates in grassland vegetation.

Tall grass vegetation, wetlands and riverine forest provide good habitats for many wildlife species. Among mammals, 31 species were recorded in the reserve, including many globally threatened. A Gangetic or South-Asian Dolphin (*Platanista gangetica*) (Endangered globally) is a regular visitor of the area, often staying in groups near Koshi-Barrage, where dolphins fishing closely to local fishermen. Asian Elephant, Chital or Spotted Deer, Barking Deer, Nilgai, Hog Deer, Sloth Bear, Terai Gray Langur, Smooth-coated Otter are other globally and nationally threatened species occur in the wildlife reserve.

The bird diversity in the reserve is very high. Among 485 recorded bird species, Bengal Florican, White-rumped Vulture, Swamp Francolin, Lesser Adjutant, Pallas's Fish-Eagle and several other globally threatened species found breeding, migratory or wintering in the reserve.

The diversity of reptile and amphibian species is also very high. Two crocodile species – Gharial and Mugger Crocodile – occur in Sapta Koshi and wetlands along the river. Golden Monitor Lizard and Indian Python are also common inhabitants of the reserve grounds. Many snake species, including large King Cobra, are common within the reserve territory.

More than 200 fish species, found in Sapta Koshi River, making its attractive for people and many animals.

According to information from the staff of the reserve, the local fauna is impacted by road, especially during winter season, when several mammal species migrate to adjacent areas and to India. The visibility on the road is very low due to fogs, therefore, some species crossing the road can be killed, more often in the morning or night hours.

More likely, that rich biodiversity of the wildlife reserve may be impacted during road upgrades directly and indirectly through habitat fragmentation, isolation of wildlife populations and loss of connectivity due to construction of several linear infrastructures in the proximity of this protected area.

4.2.1.2. Valuable Ecosystems & Wildlife Habitats

Valuable Ecosystems & Wildlife Habitats are presented by Betana Wetland in the Community Forest and Flying Fox Habitat in Ratuwamai Forest, which situated closely to the highway. These habitats have high value for the conservation of some unique or several species and their communities, they also provide multiple benefits to local communities, serving as source of income for people.

Each designated critical wildlife habitats should be considered at the design stage and special site-specific mitigation measures proposed to avoid, minimize or rehabilitate adverse environmental impacts on habitats in the result of road upgrades and bridge construction.

Betana Wetland (BWL)

Betana Lake is a wetland area improved and maintained by local stakeholders that is adjacent to East-West Highway and situated in direct proximity from the road alignment. This site was previously managed by government for sustainable management and optimum utilization of the available resources. Later, the wetland was handed over to the Betana community as community forest. Upgrading both sides of the existing highway might significantly affect this important habitat. Betana Lake is managed by a Community Forest User Group (CFUG), i.e. Betana CFUG. It is located in Urlabari, in Betana Community Forest (Urlabari VDC-7 Morang, GPS coordinates N26.65917, E085.43173. This is a natural wetland of significant importance. It has permanent inflow, including surface runoff from forest and direct precipitation. Outflows are in the form of irrigation channels and Soltee Khola. Based on the type of wetland, this wetland falls under Lacustrine (lake/pond) and Palustrine (marsh/swamp) mixed origin.

Figure 15: Betana wetland serve for recreation and conservation purposes

This wetland is currently managed by communities under community forest management system. The area of the wetland is 63 hectares. At the same time, the wetland ensuring of irrigation for 1500 ha of the adjacent agricultural areas with 6 irrigation systems built by local community. Several recreational activities including boating, picnic, wildlife observations and education programs are source of income for local communities, utilizing part of income resources to maintain and improve the wetland. The Chief of the Community Board told that approximately 600 people visit area every day for recreation and education purposes. Small zoo inside of the recreation area supports hurt and damaged animals, brought to the center for recovery and rehabilitation. Healthy animals have been released back to nature after recovery, if they are able to sustain in the wild conditions. The education center provides information about Betana Wetland and its conservation value to the visitors and organizes regular lectures and workshops for interested stakeholders about value of natural resources in Nepal.

Figure 16: Threatened Indian Softshell Turtle in Betana Wetland

Betana Wetland and its surrounding forest support ten mammal species. The most common species of this area are Golden Jackal, Wild Boar and Rhesus Macaque. An Asiatic Elephant, one of the 'Endangered' species in IUCN Red list, also visit this area occasionally. Other commonly observed fauna includes fishes, crocodiles and diverse species of birds. According to the staff of the recreation area, the wetland provide habitat for 18 fish species, 4 turtle species, more than 300 bird species and for about 20 mammal species. Four fish species

were introduced to the lake for commercial purposes, they are caught and sold by the local community, all other fish species are native. During our visit of area in February we saw the group of Teray Grey Langurs, axis deer, many bird and fish species and one turtle species – immature globally vulnerable Indian Softshell Turtle (*Nissonia gangetica*).

More likely, that upgrading of existing two-lane highway to four-lane certainly need space in both sides. The extension will minimize the wetland area affecting its biodiversity. Since the water area of the wetland is very close to the Highway, the proposed expansion work will have devastating impact on this important wetland. In addition, the water of wetland is supporting irrigation for households downstream. In the result of direct observations and through the consultations with local management team and stakeholders, the project team suggests to move the road alignment at least 500 m down south from the edge of the wetland to avoid the adverse impact on biodiversity and local economy.

Flying Fox Habitat in Ratuwamai Forest Development Project:

The government of Nepal (GON) designated an area of 2853.73 ha for Ratuwamai Plantation, located on the north of Ilam District, for the plantation of the fast growing commercial trees. The area has natural boundaries: Ratuwamai River borders in the west and the Kankai River in the east. This plantation runs parallel to East West Highway for 16 km. The forest plantation project is a government initiative for the producing of timber for electric poles (from fast growing eucalypts *Eucalyptus camaldulensis)* and other timber from teak (*Tectona grandis*) plantations. This forest is managed by Ratuwamai Forest Development Project, under the Forest Product Development Board within the Department of Forests.

A patch of about 700 ha of natural Sal forest (*Shorea robusta)* also exists within the plantation area. This is one of the frequently used major migratory route for wild elephants. The elephants travel through northern part of the forest; and the chance that they will cross the alignment is very small. During the visit of project area in February, the staff of the forestry informed that 11 elephants just used the forestry area, including plantation patches for roaming into western direction. Other wild animals, such a wild boar, frequently cross the highway to raid crops in the cultivated areas south of highway.

Figure 17: One of the roosting trees in Flying Fox colony

Small patch of the natural forest with old trees, located inside of the forestry headquarters provides an excellent habitat for bats. A huge colony of Indian Flying Fox (*Pteropus giganteus*), living on eucalyptus tree, was found in this forest. The total number of bats in this colony is more than 5,000 pairs. Other bat species recorded in the area include *Pipistrellus sps. Megaderma lyra* and *Scotophillus heathi*. Because the habitats of these bats are located within the ROW, they can be directly impacted by the highway expansion. Removal of roosting trees will have impact on the bats as they strategically select trees for colonies. Special consideration should be given to this Habitat for bats, while expanding the highway.

Fact about Nunthar - a critical location

Nune is Nepali word for salt and Thar meaning place. It is believed that the place is named NUNTHAR, because of "Salty rock" and "Salty water" emerging from the ground.

It is located 1.5 km North of MRM in the bank of Bagmati river. One can reach this place travelling by a road that runs from east of the Bagmati Bridge in MRM. Added location detail of Nunthar is Latitude - 27° 9' 3.7" (27.151°) N and Longitude - 85° 29' 11.1" (85.4864°) E. and it is located at an elevation of 219m (719ft). Nunthar lies in Rautahat District, Chandrapur Municipality – 1.

Nunthar lies in the Chure hills and has biological importance and is situated in the bank of Bagmati River. A small area of wet land exists. It has been claimed that Elephant and Rhino from Parsa National Park visit this area once a year. This is because of presence of salty water and salty rock, as assumed. Wild animal visit the location for a leak, however, much is yet to be known as there is no research been done. Nunthar and its surrounding forest area can be a good habitat for wild animal, however, need more study for its ecological. Bagmati River is a good habitat for aquatic wild life. Vegetation of the location was found to be upper "Terai Mixed Hardwood". Two Cashew trees (Anacardium occidentale) were found growing in the area, which is not native to Terai-Chure of Nepal.

As of now the spot is most famous for Shiva Temple and visited by many people for picnic.

This area is also used for cattle grazing thus, frequent movement of domestic animals may invite accidents and cattle-vehicle collisions in this area, affecting the safety of the road.

4.2.1.3. Wildlife Crossing Areas or Movement Corridors

Wildlife Crossing Areas or Movement Corridors may be impacted directly by road construction and indirectly through cumulative and induced impacts, associated with road development and operations through increased rates of wildlife road mortality and traffic wildlife collisions, creating safety problems for people also. Usually, traditional migratory corridors are associated with areas rich by biodiversity, such as protected areas and wildlife habitats. Several wildlife crossing area presented along Patlaiya – Kakarbhitta section, including elephant passing point in Parsa National Park, Belbari – Pathari Forest and Charali Forest, they serve as migratory and movement corridors and not only for Asian Elephants, but also for other charismatic and common species.

Figure 18: Wildlife road mortality is a common feature in the environmentally sensitive areas

The most evident effects of the road development and operations in such areas is wildlife – vehicle collisions (threatening safety issues for motorists and fatalities for wildlife). Only during few days' travel along the Patlaiya – Kakarbhitta section in February without special survey methodology, there were counted around 10 wild roadkill animals, spotted from the car, including 1 langur, 4 rhesus macaques, 1 golden jackal, 2 mustelids (mongoose or similar species), 1 wild cat. Mostly these animals were spotted along the forested areas, closely to their main source habitats. Indirect effects may be described as wildlife habitat fragmentation and interruption of permeability through traditional migratory corridors, causing decrease in biodiversity richness and abundances, reduced habitat area and quality, isolated wildlife populations and even human-wildlife conflicts in some areas (for example, in Koshi-Tappu). Ongoing land-use change process and deforestation trend significantly alter the remained forests and other natural habitat patches in the project area.

Figure 19: Sal forest cutting in the project area

There are some important connections for wildlife movement within the KP sections. "Hotspots" or important points for wildlife movement were identified along the stripe from Patlaiya to Fast Track area by WWF and IUCN. These points are mostly associated with natural drainage structures and marked with well-distinctive colored boards, speed limitation and noise control signs, following to regulations that to prevent negative impacts on wildlife.

Elephant passing point at Parsa National Park:

As per the Conservation Officers of Parsa National Parks (PNP), in 2016 a herd of elephants passed the highway 3 Km east of Pathlaiya. The heard consisted of 16 elephants of various age. Because the size of these mega-animals, they could create a problem for traffic movement. The herd moved from PNP to southern forests. According to the officer, the herd would further move to the agricultural field for feeding. The Government extended the territory of the Parsa Wildlife Reserve to include the forest area upto proposed Kathmandu-Nijgadh Fast-track, including points, where elephants pass the road. According to staff of the reserve, this corridor is used by elephants regularly and special mitigation measures are needed to ensure their movement through the road and safety of motorists.

The road design will include altogether 8 crossings within the KDP sections: 3 crossings inside the national park and 5 crossings outside the national park. The Animal crossings will be designed by experienced Wildlife expert in consultation with authorities and World Wildlife Fund in Nepal.

Belbari – Pathari forests:

Wild animals, such as rhesus macaques, spotted and barking deer are frequently seen crossing the highway in this section. Wild elephants also visit this area seasonally and frequently cross the area to the north of highway. Jaya Chowk (in Urlabari) is meeting point of four different community forests - Manakamana, Hariyali, Pasupati and Santi. Those community forests serve as migratory corridors along highway, to north and south of the highway and provides suitable habitat for wild herbivores, particularly during the dry season.

Charali Forest Area:

Charali forest patch is a natural Sal forests lying in Jhapa district that will be directly affected by the expansion of highway. This block of forest in Jhapa district is managed under community forestry and is a part of 9029.53 ha of national forest handed over to the local communities, which managed and utilized by local people. Thirteen (13) community forests are presented in the area. The Charali forest patch is one of the major forests in the eastern region; it lies on the only forest corridor used by elephants as migratory corridor to travel between Jalthal forest (about 12 km) in the south and Bahundangi in the north. The forests of Jhapa and Morang districts act as trans-border migratory routes with regular movement of wild elephants (Yadav 2002; Shrestha 2007). Jalthal forest is surrounded by human settlements and is under huge pressure. Except elephants, the forest provides habitat for other wild animals. Major wildlife species found in Charali forest and nearby forest patches include elephant, sloth bear, spotted deer, barking deer, common leopard and several others.

Figure 20: Some animals like Rhesus Macaque and Gray Terai Langur are attracted to road by opportunity to find a food in remained wastes

Charali forest, especially Hatemalo and Sundar Nichajhoda CFs, lie along the migratory route of wild elephants and they also serve as habitats for resident elephant population. However, due to elephant-human conflict in the area, the solar electric fence was built in the Indian part of the border, preventing movement of elephants from India to Nepal. Some number of elephants (at least 11) remained on the Nepali territory. These elephants roaming mostly within community forests in the project area, using remained patches of the forest as the permanent habitats and visiting local agricultural areas for feeding.

Buffer zone of the Koshi-Tappu Wildlife Reserve:

The buffer zone area adjacent to Koshi-Tappu Wildlife Reserve also can be considered as wildlife movement corridor, ensuring animal migrations from the reserve to India and back. Although many animals use the Sapta Koshi River valley for movement, some of them, including nilgai, deer species and water buffalo. These three species are most often killed on the road, especially during winter and monsoon season. Most roadkill animals are found during winter, because visibility problems due to fogs – at night or early morning. The places where animals cross the road are well known and should be considered as opportunity for cross-road structure, during road upgrades. Road blocks the free

movement of the animals from the reserve to surrounding areas; there is a need in ensuring of elephant corridor in the area, otherwise elephants just damage fields, kill the people and roaming around looking for food. Human-wildlife conflict is very serious issues near Koshi-Tappu Wildlife Reserve. Only during last 11 months (until February 2018), 385 local peasants asked for the compensation of damages of their fields mostly by elephants and buffalos. Only in last winter 2017-2018, 6 people were killed by wild animals, including 4 by elephants and 2 by wild water buffalo. If the migratory corridors in the area will not be ensured, the human – wildlife conflict can be increased with fatal consequences for people and wildlife.

Another issue is relevant to population isolation of Wild Water Buffalo in the Koshi-Tappu Wildlife Reserve. Due to lack of corridors and permeability, the wild buffalo hybridize with the domestic cattle, which can lead to the problems for local community again (to manage more aggressive hybrids) and for wild buffalo population, which can lose its uniqueness due to inbreeding with domestic cattle.

Figure 21: Human-wildlife conflict and hybridization of wild buffalo with domestic cattle are indirect impacts of habitat fragmentation and isolation in Koshi-Tappu Wildlife Reserve and its buffer zone

More likely that upgrading of MRM in these areas will have a great impact on migratory elephants and other animals. To maintain wildlife populations, affected by highway expansion, the special cross-road infrastructure should be considered. However, in each specific case the accurate consideration of all existing and predicted conditions should be done in consultation with all interested stakeholders and local communities during ESIA process.

Wildlife corridors play important role ensuring wildlife movements across landscape. The appropriate mitigation measures should be designated that to reduce impact of habitat fragmentation and population isolation on wildlife and ensure functioning of the traditional migratory routes. Habitat fragmentation and impact on traditional wildlife movement are evident and need wise solutions that to ensure conservation of important environmental assets in the project area.

4.2.2. Terrestrial Habitat

Main natural terrestrial habitats along KP section are presented by forests. The vegetation along the highway within preserved forest patches is predominantly represented by Sal Forest Type. There are some changes in forest composition, due to demand of the Terai Hardwood Forests. The Terai mixed hardwood forests are found in higher portions within terrestrial areas, while large amount of khair-

sisoo forests are found along the riverine sections. Several forest recovery and forest plantation projects have been designated during survey such as forests of Sagarnath Forest Development Project spread over Sarlahi and Mahotari districts and Ratuwamai Forest Development Project of Jhapa districts. Of the 366 km of the section, about 88 km passes through six different patches of the forests, including a) Pathlaiya-Nijgadh (Southern part is within Parsa National Park), b) Nijgadh-Chandrapur, c) Chandrapur- Bagmati, d) Bagmati-Bardibas, e) Belbari-Pathri and f) Charali forests.

Figure 22: Forests provide multiple services to local communities in Terai region

Importance to people: Local forests in the Terai Region provide multiple valuable services to the local, regional and national communities, serving as a source of valuable timber products (Sal forest), forming local climate, providing source of income for many communities, ensuring wildlife habitats, cattle grazing area, fodder production and many other benefits. According to available data, until June October, 2016, 2360 ha of forest has been registered by 2458 private farmers in 54 districts (CFD 2016). More than 1,813,361 ha of forests have been transferred to about 19359 CFUGs. As of October 2017 some 2461394 ha is managed by community forest groups; most of these community forests are in the Hill Region. The Terai Region has comparatively very few community forests. Forest is a very important asset of the human wellbeing and economic development of Nepal, therefore the forest preservation strategies integrated in many sectoral plans and programs, including TAL and CHAL (2015).

Regulatory requirements: Forests of Nepal has been classified as "private" or "national" based on ownership of the land. Environmental Protection Act (1997, Forest Act (1993) and corresponding rules ensure consideration of forest conservation in development projects. Plant Protection Act (2007), Plant protection rules (2010) and other corresponding rules ensure consideration of illegal use of forest resources and measures for their preservation and control. The Forest Fire Management Strategy (2010) and Forest Encroachment Control Strategy (2012) cover policy issues for management of negative impacts on forest products. The Environmental Friendly Governance Framework (2013) highlight mechanisms, which can be used that to mitigate negative impacts on forest and its biological products.

Potential for substantial project effects: The National Biodiversity Strategy (2014) indicates that major cause of forest loss in Terai and Churia regions is relevant to population encroachment, especially along the East-West Highway. However, the Forest Policy of Nepal (1993) does not consider actions, which could be required in the case of such project implementation. The project effect on the forest is calculated for 6 affected districts in the project area (Table 4.1).

The forest area will be affected in 6 districts during project implementation with projected number of 72088 tree and pole cut and 6790.71 tons of carbon stock loss (Table 4.1).

Besides direct impact on terrestrial habitat, indirect impacts can affect rich wildlife, many bird, amphibian and reptile species, inhabiting terrestrial forest habitat.

Table 7: Projected losses of trees and carbon stock in the Patlaiya – Kakarbhitta Section

District	Tree and Pole stands (number)	Volume (cubic m)	Biomass (cubic m)	Carbon stock (tons)
Bara	7078	3600.69	5478.53	2355.8
Rautahat	10666	3036.31	3990.93	1716.1
Sarlahi	5212	1715.96	2412.26	1037.28
Mahottari	5535	1246.6	1709.79	735.22
Morang	28371	1283.41	1608.5	691.66
Jhapa	15226	529.84	592.2	254.65
Total:	72088	11412.81	15792.21	6790.71

Source: *Project Team, 2018*.

Key for ecosystem function: Forest is one of the most important ecosystems in the Terai Region of Nepal, creating the local climate and providing many valuable ecosystems services, including improved air quality, prevention of dust spread on the distance, water purification, providing habitats for many wildlife species, valuable for local economy, providing different benefits as timber and other forest products and indirect benefits as non-wood forest products. Forests also prevent land and soil degradation, ensuring safety of transportation, especially in monsoon seasons.

Indicator species: Tree species, which will be affected in the result of road extension and widening, will serve as indicators of the impact.

Umbrella indicator: Valuable timber and other forest species such as Sal, Satisal, Khair, Simal, etc.

Potential for the analysis of existing and post-construction conditions: Assessment of forest land-cover before and after road widening with analysis of land use change and deforestation trends in the project area. Evaluation of effect on terrestrial habitats during construction and road operations. Consideration of deforestation issues and mitigation measures to prevent forest loss and fragmentation that to assess cumulative impacts of road development.

Main type of natural terrestrial habitats along the highway is represented by forests. Sal is a dominant species in the sub-tropical forests [Terai-mixed Hardwood Forest] of the Terai Region. The road passes through 6 different patches of forest habitats with total length in 88 km. Forest habitats are represented in 8 of 10 districts along the road, but most significant patches are found in 6 districts. Significant number of trees will be affected directly during road upgrades and widening in the result of habitat clearance and road construction. Approximate assessment of affected trees has been conducted for each district with forest patches calculating the numbers of poles and trees, including sapling and

regeneration of the woody species affected and total area cleared. It was done also biomass (carbon) estimation, which will be lost in the result of the road upgrades, excluding shrubs, bushes, saplings and regeneration of woody species. The numbers of affected trees, poles, saplings and seedlings details are provided in the Baseline Report (2018).

GIS land cover analysis shows that forest and agriculture are two main land use types in the project area, covering together more than 80% of total project area in the Right of Way zone, in direct and indirect impact area. Analysis also shows that in the proximity of highway, forest area decreasing, accounting around 20-22%. At the landscape scale (20 km stripe along the road), the forest in the project area covers more than 30% of the land.

Table 8: Tree species, indicating impacts of the road upgrades on forest

Local Name	Scientific Name	Types	Family	IUCN Category
Amala	*Phyllanthus emblica*	NTFP	Anacardiaceae	
Aanp	*Manginifera indica L.*	Fruits	Moraceae	
Asarey (Currey tree)	*Murraya koenigii*	NTFP	Rutaceae	
Aule / Khatpat	*Garuga pinnata*	Timber	Buseraceae	
Badkaule/ Badkaula	*Casesria graveolens*			
Bahr	*Ficus banghalensis*	Ornamental	Moraceae	
Bakaino	*Melia azedarach*	Fodder	Meliaceae	
Banjhi	*Anogeissus latifolia*	Timber	Combrataceae	
Barro	*Terminalia bellirica*	NTFP	Combrataceae	
Bayar	*Zizyphus mauritiana*	Fruit	Rhamnaceae	
Bel	*Aegle marmelos*	Fruit	Rutaceae	
Bhalayo	*Semecarpus anacordium*		Anacardiaceae	
Bhorla	*Bauhinia vahlli*	Climber	Fabaceae	
Bot Dhayaro	*Lagerstroemia parviflora*	Timber	Lythraceae	
Casia Semia	*Casia siamea*	Herb/ NTFP	Legume	
Chatiwan	*Alstonia scholaris*		Apocynaceae	
Dabdabe	*Gaurga pinanata Roxb.*	Timber	Burseraceae	
Gutel / Velor	*Trewia nudiflora*	Timber	Euphorbiceae	
Harro	*Teminalia chebula*	NTFP	Combretaceae	
Hullure/ Hallude	*Lennea coromandelica*	Timber	Anacardiaceae	
Indrajau	*Holarrhena antidysenterica*	NTFP	Apocynaceae	
Jamun	*Syzigim cumini*	NTFP/timber	Mythaceae	
Karma/haldu	*Adina cardifolia*	Timber	Rubiceae	
Kadam	*Anthocephalus chinensis*	Timber	Rubiceae	
Khair	*Acacia Catechu*	NTFP/timber		TH
Kharane	*Symplocos paniculata*	NTFP	Symploceceae	
Khirro	*Sapium insigne*	-	Euphorbiceae	

Local Name	Scientific Name	Types	Family	IUCN Category
Kushum	*Cartharmus tincrotrius*	Timber	Compositae	
Kumbi/ Kumbhi	*Careya arborea*	Timber	Lecythidaceae	
Kyamun	*Hedychium ellipticum*	Timber	Zingiberacease	
Lampate	*Duabanga grandiflora*	Timber	Sonneratiaceae	
Lalikath/ Latikath	*Cornus ablonga*	NTFP	Cornaceae	
Mahauwa/ Mahuwa	*Madhuca Longifolia*	NTFP/timber	Sapoteceae	
Masala	*Eucalyptus comaldulensis*	Timber	Myetaceae	
Paan/ Pan/ Loro	*Ehretia laevis*	-	Cordiaceae	
Padke	*Albizia odoratissima*	Timber	Fabaceae	
Parijat	*Nycatanthes arbotristics*	NTFP	Fabaceae	
Peepal/Pipal	*Ficus religiosa*	Ornamental	Moraceae	
Pipla	*Piper longum Linn.*	NTFP	Piperaceae	
Rajbrikshya	*Casia fistula*	Timber	Fabaceae	
Sal	*Shorea robusta*	Timber	Dipterocapaceae	
Saj/Asna	*Terminilia alata*	Timber	Combretaceae	
Sati Sal	*Dalberzia latifoloa*	Timber	Fabaceae	VU
Simal	*Bombax ceiba*	Timber	Bombaceceae	
Sindhure	*Mallatus philippensis*	Timber	Euphorbiaceae	
Siris (seto)	*Albizia procera*	Timber	Abaceae	
Siris (Rato)	*Albizia leebak*	Timber	Abaceae	
Sisoo	*Delberzia Sisoo*	Timber	Fabaceae	
Taaki/ Tanki	*Bauhinia malabarica*	Fodder	Fabaceae	
Tatari	*Dillenia pentagyna*	Timber	Dillenianceae	
Teak	*Tectona grandis*	Timber	Verbenaceae	

Source: *Baseline Assessment Report, 2018*.

Forests of the project area ensure habitats for many wildlife species, including, at least, 45 mammal species, 5 reptile species, 2 amphibian species, more than 300 bird species, among them 24 threatened and endangered species, occur in forest habitats of the project area. The list of species, detected in the project area, has been provided in the biodiversity section of the Baseline Report (2018).

Figure 23: Forests and wetlands provide habitats for many species

The mitigation measures should address both: direct and indirect impacts at the different stages of road improvement process as well as cumulative impacts, which will appear with development of other closely located linear infrastructures in the proximity of highway, human encroachment along highway, including in KDP Road, agricultural and industrial

development in the proximity of native forest habitats. The presence of Parsa National Park and community forests contributes to the forest conservation in the region. However, areas along the road have been highly harvested by local communities in Terai region.

4.2.3. Aquatic Habitat

There are several potential impacts to aquatic resources during road construction and operations. These are direct disturbance and loss of biodiversity, pollution, draining of wetlands, contamination of watercourses with disposal materials and others. Many water-courses and wetlands are situated in the proximity of the Patlaiya – Kakarbhitta section. They can be severely affected at the construction stage, when disposal of significant amount of construction materials is required. During bridge construction it may be significant impact on the fish habitats and in Sapta Koshi on Asian River Dolphin habitats. During operation stage, impact of the roads on wetlands, rivers and streams is mostly cumulative and associated with use of water-bodies for production of construction materials (sand, boulders, gravel), exploitation of water-resources, discharge of polluted wastes, etc.

Importance to people: Aquatic habitats serve as a source of wellbeing for local communities, providing fresh water for communal, industrial and household needs, serving as a source of water for irrigation, ensuring many goods such as fish and edible plants, securing beautiful sites for recreation activity, serving also for many cultural and religious traditions and rituals. Aquatic habitats are very important in the Terai Region and in particular along KP section, because they provide habitats for many important species, ensuring livelihoods of local communities (fish, birds, mammals).

Regulatory requirements: Environmental Protection Act (1997), Soil and watershed conservation act (1982) and Water resources act (1992) and corresponding rules regulate protection of aquatic resources and fishery. Water Resource Strategy (2002), National Wetland Policy (2012) and Irrigation Policy (2013) address issues relevant the water quality and conservation of wetlands. However, the issues of preventing drainage of sewage into rivers and mitigation of adverse impacts on water-resources remain unsolved.

Surface water quality: is important to people, wildlife, fish, terrestrial plants and ecosystems. The surface water quality can serve as indicator of changes in aquatic ecosystems.

Figure 24: Aquatic habitats provide many services for people and serve as fish habitats

Key for ecosystem function: Aquatic habitats form local climate and provide water for existing ecosystem functions. They serve as migratory and dispersal corridors for many wildlife species: aquatic and terrestrial. Many globally and nationally threatened and endangered species inhabit wetlands, including 2 species of crocodile, more than 10 amphibian species, about 15 turtle species, many fish species with around 25 rare and threatened.

Fish habitat: Fish in the rivers and wetlands may serve as indicator group of species. Fish habitats can be monitored upstream and downstream areas, especially in the bridge construction localities with measurement of biophysical parameters (hydrology, flow characteristics, water and sediment quality, aquatic macrophytes and benthic invertebrate communities) and water quality parameters (dissolved oxygen, turbidity, pH, temperature, etc.).

Umbrella indicator: Asian River or Gangetic Dolphin presence and population assessment in the Sapta-Koshi River after construction of large bridge.

Figure 25: Gangetic Dolphin is an umbrella indicator in Sapta-Koshi River

Because rich hydrological network in the project area, the aquatic habitats along Pathlaiya – Kakarbhitta section are also diverse and rich, they are presented by 23 rivers, 101 springs, 3 canals, 17 artificial ponds, 1 wetland and 2 ditches, serving as habitats for fish, herptile (amphibian and reptile) species, aquatic and semi-aquatic mammals and birds. Aquatic habitats in the project area ensure inhabitance of many valuable fish species and many aquatic and semi-aquatic wildlife species, including critically endangered (CR) at the global level Gharial and Gangetic Dolphin. Road development can severely impact aquatic habitat with adverse effect on aquatic fauna and flora and deterioration of existing ecosystem services.

Springs in the study area originated from Churia hill locating at the North of the highway. Thus, majority of springs have low flow in dry season and are ephemeral type. Springs remain dry after

monsoon or when rainfall stopes. Artificial ponds are water logged and local residents are using them as buffalo bath. Neither fish nor herpetofauna observed in these sampling sites. Majority of fish species and herpetofauna recorded in the study are common or least concern species. However, amphibians and reptiles could bear little impact though no such amphibians or reptiles observed during study time. There are higher chances of road kill while amphibians and reptiles cross the highway. Moreover, reptiles crawl and speed of crossing is slower hence well-function wildlife underpass could mitigate the impact. Bridges present in the highway unanimously serve as wildlife underpasses. Despite this, maintenance of existing bridges and updating of existing bridges into new suggest to build wildlife friendly bridges and other cross-road structures such as culverts and reptile/amphibian tunnels to minimize the number of roadkill animals along the road, to prevent vehicle-wildlife collisions, to reduce movement barriers and habitat fragmentation along the road.

Aquatic habitats also support the number of threatened and sensitive wildlife species such as endangered Gangetic Dolphin, inhabiting Sapta-Koshi River, threatened mammals like Fishing Cat, Spotted Linsang, Oriental Small-clawed otters, many water-bird species, especially in the Koshi-Tappu Wildlife Reserve, threatened reptiles such as globally endangered Gharial and vulnerable Mugger Crocodile. Mostly all these species are threatened by habitat loss and transformation, loss of food base (fish resources), over-exploitation and pollution of water-bodies. There is chance to improve water-management with construction of new roads and establishment policies to prevent the high level of pollution through strengthening legislation, introduction rules that will prevent littering along the roads, and through better practices of drainage management, improved bridges, culverts and viaducts. It would be also important to consider standards for water- quality in water-streams adjacent to roads.

Upgrading of existing highway at Betana wetland will minimize the wetland area affecting biodiversity of the area. However, observation of the area and suggestions from social survey and focus group discussion with concerned local stakeholder suggest that diversion of highway will help to avoid the impact at that specific point. This will help to carry project without any hindrance at the wetland side. Aquatic fauna and herpetofauna observed are different in these districts. Thus, findings of survey describe the situation according to districts of the project area below in the following chapters.

The natural water flows should be maintained through adequate bridges, culverts and other drainage work. Such drainage works also ensure safety issues, preventing waterlogging and bank degradation along the rivers.

4.2.4. Threatened and Endangered Species

Threatened and endangered species VEC was selected to focus the assessment on the significance of adverse impacts using the species with highest conservation, ecological and societal values. Many species in the project area belong to the group of threatened species, globally and nationally. According to conducted analysis in the project area there were found 105 globally threatened or rare species, including 33 mammal species, 34 bird species, 12 reptile species, 26 fish species. The number of nationally threatened species even bigger: 188 species, including 39 mammal species, 84 bird species, 5 reptile species and 61 fish species.

Figure 26: Wild Water Buffalo and Lesser Adjutant represent threatened species in the area that can be affected directly and indirectly

Importance to people: Nature Conservation National Framework for Sustainable Development (2015) and Nepal National Biodiversity Strategy and Action Plan (2014) provide detailed description of aims and objectives on biodiversity conservation in country for next decades. These documents underline the importance of biodiversity for national and local economies. Wild plants and animals serve as source of biological resources providing food, fiber, fodder and many other products, they also serve for medical, ornamental, education, spiritual and cultural purposes. At the same time, biological species, and especially globally threatened and endangered species attract to the country significant number of visitors from around the World, contributing considerable resources for the conservation, ecotourism, hospitality sectors and overall development of the country's economy. Nepal is a lucky country, which can manage these important resources by sustainable ways, obtaining benefits for current and future generations.

Regulatory requirements for the environmentally sensitive VECs: Environmental Protection Act (1997) and National Parks and Wildlife Conservation Act (1973) are basic laws, ensuring conservation of plants, animals and their habitats in Nepal.

Potential for substantial project effects: Linear structures have been considered as one of the threats for biodiversity conservation, especially in the Terai Region with relatively high ratio of protected areas and rich species diversity. Roads can cause adverse effects on local flora and fauna during construction, maintenance and operation stages. Direct impacts appear as destruction of native vegetation during construction work, damage and loss of forest habitats due to site clearance, traffic noise and lighting, wildlife-vehicle collisions, destruction of habitats for labour camps, etc. Indirect impacts are associated with encroachment along the roads, increased level of hunting and poaching. All these impacts can cause depletion of flora and fauna, especially its vulnerable elements such as threatened and endangered species.

Key for ecosystem function: Many globally threatened and endangered species have not only intrinsic value, but serve as a high level consumer species in the food chains, securing right ecosystem functions. Globally and nationally threatened wildlife species have very high conservation value, usually this conservation value is also linked to their economic value as hunting or commercial animals and plants. These animals also have high education and recreational values. Many visitors plan to come

to Nepal to stay in protected areas that to see those species. The number of visitors increases each year and they contribute significantly to livelihoods of local communities around the parks, to regional and national economies and development.

Indicator species: are usually cover the set of species typical for community, indicating particular environmental conditions and serving as an early warning indicator of environmental changes. Such species also reflect the effects of disturbances or the efficiency of mitigation measures applied. The table of indicator species has been provided below (Table 4.4). In total 14 species were designated in the project area as indicator species, which might be affected by road upgrades and construction of bridges including 8 mammal species, 2 bird species and 4 reptile species.

Table 9: Indicator or VECs species selected from the set of threatened and endangered fauna occurring in the project area

Species	Status and population trends	Associated Issues
Asian Elephant *Elephas maximus*	EN (IUCN), EN (NE): <150 adults in Nepal	Several movement corridors may be affected during road construction and upgrades
Asian Water Buffalo *Bubalus arnee*	EN (IUCN), EN (NE): just around 150 animals in Koshi-Tappu	Population fragmentation and isolation, there is no movement corridors between Nepal and India, human-wildlife conflict
Gangetic Dolphin *Platanista gangetica*	EN (IUCN), CR (NE): declining	Indirect effect of bridge construction at Sapta-Koshi, decline of fish populations
Bengal Tiger *Panthera tigris*	EN (IUCN); EN (NE): Stable due to conservation efforts	Affected movement corridors in Parsa NP, disturbance, habitat fragmentation, effect on prey species
Nilgai *Boselaphus tragocamelus*	LC (IUCN); VU (NE): declining	Affected movement corridors and terrestrial habitats, disturbance, high road mortality
Chital *Axis axis*	LC (IUCN); VU (NE): declining	Affected movement corridors and terrestrial habitats, disturbance, high road mortality
Terai Grey Langur *Semnopithecus hector*	NT (IUCN); LC (NE): No population dynamics data	Affected movement corridors and terrestrial habitats, high road-mortality in project area
Indian Pangolin *Manis crassicaudata*	NT (IUCN); EN (NE): Decreasing	Affected movement corridors and terrestrial habitats, poaching, road mortality, barrier effect
White-rumped Vulture *Gyps bengalensis*	CR (IUCN); CR (NE): Declined	Can be attracted to roads for prey, possible road mortality
Bengal Florican *Houbaropsis bengalensis*	CR (IUCN); CR (NE): Declined	Indirect effects: habitat loss and fragmentation, poaching
King Cobra *Ophiophagus hannah*	NT (IUCN), VU (NE): decreasing?	Affected movement corridors and forest habitats, high road mortality in wet season, barrier effect, poaching
Golden Monitor Lizard *Varanus flavescens*	LC (IUCN), VU (NE): decreasing	Affected movement corridors and terrestrial habitats, high road mortality, poaching
Gharial Crocodile *Gavialis gangeticus*	CR (IUCN), CR (NE): increasing due to captive breeding	Affected movement corridors and aquatic habitats, habitat fragmentation, disturbance, effect on prey – fish species
Indian Softshell Turtle	VU (IUCN), EN (NE)	Affected movement corridors and habitats,

Species	Status and population trends	Associated Issues
Nissonia gangetica		habitat fragmentation, road mortality, barrier effect

Source: *Project Team, 2018*

All selected species might be affected during road construction and upgrades, but by different ways. Some of them will be affected directly by loss of habitats, movement corridors and by high road mortality rates. Others will be affected indirectly in the result of habitat fragmentation and population isolation, declining prey species or due to opened access to the area with increased hunting and poaching.

Umbrella indicator: Umbrella indicator for this area was identified as an Asian Elephant, which require movement corridors, crossing the Patlaiya – Kakarbhitta section in several places and needs the special coordinated strategies between several linear projects to ensure its movement corridors at the landscape scale.

Figure 27: Elephants are important components of the landscape in the project area, which need sufficient movement corridors

Potential for the analysis of existing and post-construction conditions: Indicator species, including globally endangered species, will be used for the evaluation of efficiency for applied mitigation measures, for example, for efficiency of proposed and established cross-road structures and wildlife movement corridors in the area. "Before" and "After" impact monitoring design is often used to explore effect of the road operations and efficiency of constructed cross-road structures on selected indicator species. There is a number of other methodical instruments that can be used to monitor effect of the road upgrades on threatened and endangered wildlife species during construction and road operations.

In total more than 670 vertebrate animal species can be found in habitats along KP section, including more than 50 mammal species, 418 bird species, more than 25 reptile species, 177 fish species, many amphibians. The biological diversity in the project area is rich and diverse due to landscape variety and different ecological conditions along the length of more than 360km road corridor. However, wildlife along the road is distributed very unevenly and can be observed mostly closely to specific areas such as critical habitat, forested patches of the road, in specific aquatic habitats and in wildlife movement corridors. Some animals, like monkeys and vultures can be b attracted to road by opportunity to find food and scavenge. Others will be directly disturbed or will lose their habitats in the proximity of the road. Third will be impacted by introduction of new exotic species, disrupted movement corridors and provided barrier effect.

Some of these species, for example, like gharial (*Gharialis gangeticus*), Bengal Florican (*Eupodotis bengalensis*), Gangetic Dolphin (*Platanista gangetica*), Clouded Leopard (*Neofelis nebulosa*), Tiger

(*Panthera tigris*), Asian Elephant (*Elephas meximus*), One-horned Rhinoceros (*Rhinoceros unicornis*), Barasingha or Swamp Deer (*Cervus duvauceli*), and Wild Buffalo (*Bubalus bubalis*) are preserved only in several protected areas and few critical wildlife habitats. All sites, where such species found, should be protected. All these animals were found in the project area along the proposed Kakarbhitta – Pathlaiya section and they need the special mitigation measures to minimize adverse effects of road development, direct, indirect and cumulative impacts. Some of these species may be identified as indicator and umbrella species to select mitigation measures, which will be suitable for other species in terrestrial or aquatic communities.

The area along the road was intensively developed during last 50 years in the time, when people from mountain regions moved to Terai after eradication of endemic malaria. Survey of the area showed that wildlife in many highly-populated areas is extirpated and replaced by few species, adapted to live in highly modified human environment. However, residual wildlife habitats along this section of the road still provide sufficient habitats and movement corridors not only for threatened and endangered species, but also for many other wild species, depending on the extent of natural habitats. Many local species of amphibians and reptiles still occur in natural terrestrial and aquatic habitats along the road and need special mitigation measures to prevent adverse effects on their populations and ensure their habitat connectivity for population processes, constructing or adapting existing engineering structures for road permeability.

Because East-West Highway in the project area operates for many years, wildlife poaching/trade is known in this region, but did not take the large scale, due to control and conservation of species within protected areas. However, domestic trade of pet species is quite developed. For example, parrots or other song or pet-bird species can be bought on the local market for 250-300 Nepali Rupees. Hornbill species (four species can be found in Eastern Terai region) are persecuted by local people in the project area for their beaks and other parts of the body that used in the traditional medicine (Basnet, 2005). Many ungulate animals are hunted for their meat (like deer, wild boar, nilgai and other antelopes). Over-hunting and poaching is actual problem in the project area that can be solved through enforcement of education and awareness programs.

Indirect impact on the threatened species is associated with land use change, driven by demographic and economic factors in plain Terai region after eradication of malaria and start of resettlement programs in 1960. Rapid population growth led to conversion of forests to cropland. Increased population density stimulated development of large urban and industrial centers. Many old growth forests were replaced by plantations with fast growing trees such as eucalypts (which are cut after 10-15 years) and teak (cut after 30 years). Plantations can be characterized by impoverished biological diversity; however, they still can serve as good corridors for wildlife migration. Old trees with cavities served as habitats for many species (for example, hornbills, woodpeckers, bears, squirrels, etc.) disappeared and natural habitats for mentioned and many other species were lost. So, remained natural habitats have enormous value for the protection of rich and diverse natural fauna and flora in the project area.

Thus, selected valued components from biological environment will serve for evaluation of impacts (including direct, indirect and cumulative) in the results of road upgrades and bridge constructions and for the estimation and recommendation the most suitable site-specific mitigation measures. The impacts will be mitigated as accordingly.

4.3 Socio-economic and Cultural Environment and Selected Valued Social Components (VSCs)

The selection of Valued Social Components was based on the review of the project description and collected Baseline assessment data on socio-economic aspects and review of the EIA for the Bardibas – Inaruwa section of the railway, planned in the southern part of Nepal, in Terai region. The Valued Social Components are recognized in the project area as land and resources use, population, infrastructure and services, economy and well-being, and community life. The summary of finding relevant to socio-economic and cultural issues is provided below.

Figure 28: Market area along the highway in Terai Region

According to District & VCD Profile of Nepal (2014-2015), 7,344,635 individuals inhabit 10 districts along the highway with 1,397,728 households and average size of family assessed as 5.4 persons. With existing population growth rate, the settlements along the road will grow rapidly, stimulating industrial development. Currently, agricultural rural population in the project area exceeds urban population, but urbanization is going fast, especially along the roads. Road upgrades are needed to facilitate urbanization process and industrial development and to reduce pressure on limited amount of agricultural land and natural resources of the Terai region.

4.3.1. Land and Resource Use

Land and resource use provide the basis for the prosperity and well-being of local communities. Land along corridor was transformed from forests into agricultural fields and then into urban and industrial, especially in district headquarters, industrial and market centers. Road construction facilitated establishment of businesses and creation of ribbon habitats along the RoW. According to conducted surveys, there will not be land acquisition along existing highway in the RoW area. However, there is a need for temporary renting of land during construction for labour camps, quarry sites, stockpiling and other areas, associated with construction work. Besides, there is a need in acquiring of the public and private structures, situated in the RoW area, including some households, located closely to the road, public structures and other public facilities, which will be destroyed or relocated. According to field surveys on assessment of affected infrastructure the scale of direct impact on households and public facilities has been provided below:

- The directly affected households and population of possibly influenced by KP road is 1249 households and 5971 individuals, including 3289 Male and 2682 Female population.

- The public structures within the project areas that potentially might be impacted: public structures - 206, bus stations - 108, temples - 66, bridges - 140, ponds - 30, parks - 6 holy trees - 885 and 35 cremation yards.
- Out of sample, other public facilities impacted will include: electricity poles 5329, drinking water supplies 937 and 839 electricity/ telephone cables.

As per World Bank ESF, ESS 5 provisioned that compensation is provided to situation of Permanent or temporary physical and economic displacement. the Nepal Land Acquisition Act (1974) also spells out about compensation. It is thus justifiable compensation for asset losing people is essential to uproot them from their place. There is required also to provide costs for regenerating sustainability after evacuating. Rights to the property and land are reflected in the Constitution of Nepal (2072 BC). The Land Act (1964), Land Acquisition Act (1974), Land Reform Act (1964), Soil and Watershed Conservation Act (1982), Public Road Act (1974).

Land Acquisition, Resettlement and Rehabilitation in Infrastructure Development Projects 2015 and other strategic documents address issue relevant to land and property acquisition. Other laws relevant to land use include Environmental Protection Act (1997), Forest Act (1993), National Parks and Wildlife Conservation Act (1973), Soil and Watershed Conservation Act (1982), Local Government Operation Act92074(B.S), etc. The Nature Conservation National Strategic Framework for Sustainable Development (2015-2030) also highlight issues relevant to sustainable land management and prevention of its degradation due to development of linear infrastructure in the country. Land use is highlighted in many sectoral and regional plan and programs, including Terai Arc Landscape Strategy (2015-2025).

Figure 29: Urbanization is a process, which going fast in the Terai Region

Indirect impacts of road development will appear mostly as land use change. More likely that improvement of transportation infrastructure will facilitate the urbanization process, especially along the road. Therefore, it is important to recommend planned urbanization, relevant to district development plans and industry development in the most populated districts. This socio-economic issue should be included in the regional development plans. In the current project, the direct impact area is considered as 150 m buffer each side of the road or 300 m stripe along the road. Indirect impact zone is considered as 10 km buffer each side of the road or 20 km stripe. The major land cover types in the project area are forests, agricultural areas and urban settlements. Only 2 districts (Dhanusha and Siraha) are highly populated with prevailing land use such as agriculture and settlements. Only forest and agricultural land present in Bara district, where Parsa National Park is located. Forest, agricultural land and settlements present in remained 7 districts. According land use analysis, settlements or built-up areas are also mostly located closely to the road, representing 8.0% in RoW, 7.2% in DIA and only 1.0% in IIA. So, more likely that road upgrades and

improvement will facilitate more urban development. At the same time, the high percentage of the built-up areas in the proximity of the road indicate that compensation cost will be high, especially in the highly populated towns and cities along the road and in each case the careful analysis should be done that to determine options for bypass in such areas.

Development plans and programs should include coordinated and well-designed growth of the organized settlements, markets, agriculture and industrial areas. Along with resettlement action plan, in cases of community and individual's displacement, people should get access to agriculture markets, and social services such as health, education communication and social security provision. Until now the local road neighbors have not sense the ownership over the road. The road has been observed as development, but always causing loses to people due to land acquisition, displacement and cash compensation once.

Mitigation measures for impacted property owners, including low-income households, may include avoidance, minimizing the project scope, or compensation. All displacements, relocations and compensations should be done in accordance with law and following to World Bank's ESS 5 (ESF). Public participation is important to ensure the justice, ownership of the road and transparent process of compensation.

4.3.2. Population, Infrastructure and Services

This VSC can be affected both positively and adversely such as access to services, health and sanitation, occupational health, road safety, changes in cultural practices, etc. Strategic issues associated with population are migration and displacement, increased population pressure on residential and market areas, increased chances of inter-group assimilation that in some cases can lead also to conflict situations. One of the most important issues in Nepal, associated with road construction, is development of ribbon unplanned settlements of migrant populations along the road with high chance of pollution that causes health hazards. Employment of manual labor without safety measures may create occupational health hazards as well as hazards to local road neighbors due to construction activities. Chances of accidents due to bad road condition are also high, especially during construction stage. Ignorance in applying safety measures for workers and road neighbors will cause long -term health hazards.

Sampling technics used during social survey along Kakarbhitta –Pathlaiya section allowed to assess current situation along the road.

- The average size of family of the sample HHs is 4.8.
- 3% population fall below five years of age, 76.4% of sample population fall between 15-59-year age group, which is known as economically active population.
- As per the findings of the survey, 7.4 percent of the sample population was illiterate and, just literate was accounted to 19 percent. However, 73.6 percent had formal education those attended schools and above.

The analysis of current population structure suggests that improvement of road may contribute more positively to the social development of local communities, providing more access to services (including education), ensuring more jobs for local communities, opening better access to markets and facilitating business development. However, several issues are also associated with adverse impacts on public infrastructure and services, including occupational health hazards, sanitation, public safety and security. Road safety is one of the most important issues, covered by many policies and laws, including Nepal Transport Sector Policy (2001), MoPIT Strategic Five Year Plan, Road Safety Action Plan (2013-2020), Public Road Act (1974), Motor Vehicle and Transport Management Act (1993) and other documents. The Nepal Constitution (20015) and Road Safety Action Plan (2013-2020) are the main documents covering health and safety issues, including occupational health hazards.

Figure 30: Safety issue are important along existing highway

Impacts on human health and safety may be from direct and indirect activities associated with road construction and operations such as injuries of workers during construction, pollution by gases and other contaminant elements, road accidents, including wildlife-vehicle collisions, pedestrian safety on roads, especially for school-kids, spread of diseases, etc. Road construction is one of the disturbing factors for public health and security. Using heavy equipment in busy roads may create occupational health hazards (road accidents, injuries and health problems due to noisy and dusty environment during construction, especially for sensitive groups – elders and children), local inflation due to increased prices for supplies, associated with increased consuming by road construction working force, loss of domestic animals, loss of public properties.

At the same time, during visits of project area in Patlaiya – Kakarbhitta section, it was noted that safety issues are very serious. First of all, there are no any special signs or speed limits in urban or other populated areas, there are no lights or zebras for pedestrians. There is a lack of special pedestrian passes along the roads even in highly populated areas. Only in one place, Damak there was built overpass in the market place area, but it is not used wisely and people is still crowding along the road. In many places domestic animals cross the road, creating problems for vehicle movement, in the case of four-lined road the livestock movement in such places will create big problems for motorist safety and general road safety. The alcoholic production is advertised everywhere along the road and multiple liquor shops provide opportunities for drivers to buy their production practically everywhere along the road. Obviously, that such practice may lead to careless driving creating road safety and security problems, especially along high-speed highway. Road-side dumping and littering is observed also everywhere along the highway, affecting aesthetic view of the urban and rural environment along the existing road and attracting to road wild animals (jackals, monkeys, mustelids, vultures and others) that can lead to the wildlife-vehicle collision problems.

So, the safety measures needed to be prepared prior to the construction is commenced. Supply of safety gears for the workers and proper education to use it is essential. Educating local people and to request

to cooperate construction work. Spraying water in the road, controlling domestic animals, proper management of public assets like schools, heath posts, and play grounds may be a minor remedy to reduce health hazards. Supply of food items, medicine, and cooking energy from outside market for the laborers and other working forces may help to check local level competition and inflation. Special measures are needed to maintain the road safety and to reduce accidents. Proper education to the drivers, sanction in driving license issuing through examination, control of pet animals, cleanliness of road, speed limit in the settlements and high-risk areas and installing road safety measures, traffic signs are necessary to reduce accident. Better road infrastructure (including safety measures like lights, overpasses, bus stopes, zebra and other facilities) will improve safety situation along the road. Public awareness and education campaigns for local communities and laborers about the traffic signs and road safety measures will ensure safety during construction and operations. At the project level, the mandatory provision of application of safety measures for workers and road neighbor communities should be done during construction work as well as at the operation and maintenance stages. In the school and hospital areas the sign boards are established for speed limits, but these areas are not monitored properly and vehicle accidents are common.

4.3.3. Economy and Well-being

This VSC can be measured by such indicators as employment and business opportunity, legal and institutional issues, cost of the road maintenance, sustainability. It is obvious that improvement of highway along Pathlaiya – Kakarbhitta section will bring more opportunities to people in the districts, but negative effects of development also can arise, especially during construction stages. Field survey conducted along KP section gave chance to collect data about employment and business in the sample population, mostly associated with road. The analysis of data showed:

- The monthly income of majority of HHs (22.9%) was NRs *<10000 and respectively, 28.8% HHs have income "between" 10,000 - 20,000, 25.7% have income in Rs. 20,000-30,000, 17.8% HHs has income between Rs.30000-50000 and 4.8% have income above 50000.*
- The assets holding trends are following: the users of television are 36%, Motorbike owing 18.1%, mobiles having 39.6% and 6.4% are telephone users.
- 104 (8.3%), 119 (9.5 %), 166 (13.3%), 550 (44%) and 310 (24.8%) HHs were found to have food sufficiency from own household agricultural production respectively for less than 3 months, 3-6 months, 6-9, 9-12 months and no agriculture products.
- The employment status of sample HHs indicated that 28.8% are engaged in government service, 51.3% work as private, 9.9% work in business, 2.2% occupied in agriculture and 5% have foreign employment.

Figure 31: Road construction work will provide employment and training opportunity for local people

So, this analysis showed that Employment and Business Opportunity are very important for local populations, because they create the basis of local economics. It is well known that roads provide opportunities for the development and expansion of local business and employment opportunities for local people from

increased urban areas, growing industry and modernized agriculture. The access to outside markets and open borders provide better opportunities to the investors and, thus, creates employment to the skilled and capable workers. Many areas along the Patlaiya-Kakarbhitta section turned into industrial centers, creating more job opportunities for local growing population. The access to wider market areas will provide a high possibility of agricultural extension and domestic tourism facilitation. Opportunities and strategies for local small-scale industries should be focused on reducing of rural poverty.

The Land Act (1964), Soil and watershed conservation act (1982), Public road act (1974) and Land acquisition act (1974) regulate land use and promote conservation of agriculture and farmlands. In the case of impact in tourism, the various laws can be relevant for the development of mitigation strategies including Ancient monument preservation act (2013), Environmental protection act (1997), National Parks and Wildlife Conservation Act (1973), Public road act (1974) and others.

However, improvement of KP section road may impact local agriculture and natural forests directly through damage of farmland and vegetation and indirectly through flooding and water-logging, discharge of sediments and dust emission. Earth works, quarries, disposal sites affecting topsoil and leading to erosion may seriously damage agricultural lands, especially in hilly areas. Loss of productive land and trees can affect livelihoods of local farmers. All these issues should be considered at the stages of EIA, road planning and design. It is also important to plan the road service centers in each district along the road. Such road service centers will provide opportunities for the development of local jobs and services, at the same time; they will create comfortable conditions for travelers ensuring presence of all important road services (gas stations, body workshops, small cafeteria and restaurants, restrooms, etc.) in specific places. Currently there is a lack of such services along existing highway. Creation of road service centers also will prevent or channel uncoordinated ribbon development along existing highway. The adverse impacts to touristic sites and tourism may occur during construction stage due to effect on aesthetic value of places and sites, located closely to roads. Appropriate mitigation measures include eliminating or minimizing the impacts.

4.3.4. Community Life

Although the road along Patlaiya – Kakarbhitta section was constructed several decades ago and local population is consisted of different ethnic groups and religions, road upgrades still can impact social, cultural and religious practices. One of the strategic issues associated with such impacts is increase in human trafficking and prostitution. It is envisaged that whatever the aforementioned problems are prevailing in society will have chance to be activated. It is obvious that the interaction among multicultural groups helps to cultural and social change. Change is required, if it is beneficial, but sometimes negative changes also occur due to poverty and ignorance of needs in mitigation. Gender issues and indigenous community issues should be considered carefully and integrated in the road development plan in accordance with local specific and needs.

The Nepal Constitution 2072 (2015), The Convention on Indigenous and Tribal Peoples (No.169) of ILO, National Foundation for the Development of Indigenous Nationalities (NFDIN) Act, 2002 address issues of the road impact on local and indigenous people, responding to requirements of the

Indigenous People Operational Policy of World Bank. The Land Acquisition, Rehabilitation and Resettlement (2015) and Land Acquisition Act (1977) regulate the questions of resettlement and compensation for the local and indigenous people in the area of impact.

Cumulative impacts of road development can affect the livelihoods of indigenous people through land use change and overharvesting of natural resources, depleting assets securing surviving of local communities. The project area is mostly settled by migrants from other regions of Nepal and India as well as indigenous settlers. Migration to this area began after the road was opened. Currently, the population structures show mixed and multiple cultural characteristics. In some areas, the primarily Terai origin population prevails, but in urban conditions different ethnic groups and casts are mixed.

During project operational stage there will be emerge risk of gender Base Violence and sexual harassment from wellas labor influx as there is a chance of human trafficking and prostitution for the short period of time. That to prevent and decrease such kind of issues it is needed educating of communities through participating local political bodies in social rescue activities. Involvement of community-based organizations will help to monitor such social problems. Strong local institutions like municipality or rural municipality might be responsible to control all negative social factors. Awareness about HIV and STD is needed for the migrant workers and the lower economic class people. Employment and sustainable income may be one of the measures to reduce HIV.

Figure 32: Construction of new road will provide more business opportunities for local communities

Community life may be affected by possible impact on social, cultural and religious practices. The road in Patlaiya – Kakrbhitta section does not affect any significant cultural heritage sites, which has historical or archaeological importance. It is obvious that in traditional society people observe different religious calendar days and worship different gods and goddesses each day. Small shrines of different gods and goddesses are constructed in each village as substitute of long distant temples of major gods and goddesses. These shrines are recently constructed at the road head where people have good space to be assembled and access to transport. Such shrines can be translocated in safe places. In Morang and Jhapa districts of project area, some people follow Christianity with ritual burial sites built along the road. In the case of road extension some of such sites may be affected. So, this issue should be addressed in consultation with local Christians.

CHAPTER 5: ANALYSIS OF ALTERNATIVES

Sound and sustainable ESA in road development projects involves consideration at least three alternatives: (i) "do nothing"; (ii) road improvement/upgrades: and, (iii) construction of new alignments. Within these basic alternatives also can be a number of other options for specific features such as changes of the road location or off-site activities associated with road construction (camp or disposal sites, etc.). For the KDP road section-specific ESIA, other alternatives will be assessed in the ESIA, including final routing, construction technology, sourcing of materials, etc.

At the feasibility stage, there are three alternatives presented forKDP Road. These are upgrading of the road to 4-lined highway, constructing new alignment and "do nothing" scenario. However, the number of options within these alternatives is quite sufficient and includes:

- New bridge construction, including design and construction of layered bridge through Sapta-Koshi River together with Railway Project;
- Consideration of by-pass areas in the urban centers of eastern Terai region;
- Alternative roads or shift of the road alignments to the "safe" distance in some environmentally sensitive areas;
- Coordination of road alignment locations with other linear structure projects that to avoid or decrease possible cumulative impacts or impact interaction between highway construction and those linear projects.

5.1 Existing Issues and Predicted Impacts in the Project Area on Valued Components

The VCs (Valued environmental and social component) approach was used that to select the most appropriate alternative. This VCs help identify alternatives that are most practical and sustainable, basing on their environmental and social "values" such as importance to people and support by various interested stakeholders, regulatory requirements and Environmental and Social Framework (ESF-2018) , potential for substantial project effects and for analysis of existing and post-construction conditions (impact monitoring).

Selected valued environmental and social components in current project include:

- VC1: Topography and Geomorphology - Bank slope conditions: (erosion);
- VC2: Natural drainage systems: (flooding, siltation);
- VC3: Soils: (erosion, top-soil damage and contamination);
- VC4: Ambient environmental conditions: (air and noise pollution; solid waste management).
- VC5: Environmentally sensitive areas: critical habitats, valuable ecosystems and wildlife movement corridors (number of direct and indirect impacts);
- VC6: Terrestrial habitat: forest areas;
- VC7: Aquatic habitats: wetlands and other water-bodies, fish species, river dolphin;
- VC8: Threatened and endangered species: Asian Elephant, 14 indicator species;
- VC9: Land and resource use;
- VC10: Population, infrastructure and services;
- VC11: Economy and wellbeing;
- VC12: Community life.

Impacts of road upgrades and bridge construction as well as the situation with "no project" scenario on those 14 VCs have been analysed that to compare both alternatives. The new alignment option was rejected early on and was not further analysed and developed due to its financial implication and non-viability and the long term adverse environmental and social risks and impacts on VECs. The analysis of general beneficial and adverse impacts on the environment and society in the project area has been conducted and presented in the Baseline Assessment Report (2018) following to traditional way of analysis of effects on physical, biological and socio-economic environment in the project area. In this chapter, the comparison of the impacts with implementation of project and upgrading of existing road to 4-laned highway and "no project" scenario as well as possible site-specific impacts on VECs and VSCs has been provided (Table 5.1). The project team also determined potential effects on Valued Environmental and Social Components in the case of road upgrades to 4-laned highway and in the case of existing road (Step 4 on the Figure 4.1).

Below the analysis of two existing alternatives through comparison of positive and negative impacts that can be observed at the pre-construction, construction and operation stages have been compared. Assessment of each alternative has been conducted through evaluation of existing and arising issues, and possible mitigation hierarchy, which will be required to avoid, reduce or compensate possible adverse effects and enhance beneficial impacts.

5.2 Alternative 1: "Do Nothing"

"No project" or "do nothing" scenario has been identified as a first alternative.
Using Valued Environmental and social component approach we can evaluate the option of "do nothing" and arising strategic issues.

Bank slope conditions are currently relatively stable, however, may be impacted by extraction of sand, gravel and boulders collection in the river beds along the road and by storm water during monsoon season. In the areas near existing bridges, the slope conditions are not good and threaten the current state of the bridges, constructed more than 40-50 years ago. The river beds have very high level of siltation, especially notable near bridges.

Natural drainage system is impacted in the result of cumulative impacts, associated with human encroachment and development of industry along the road as well as in the result of other linear infrastructure planning and ongoing construction. Existing drainage infrastructure is outdated and damaged. Many bridges need not only repairing, but replacement. The bridge at the Mahottari district was destructed during the last monsoon season, currently all heavy transportation (vehicles and trucks) crossing the river on the bottom, which is possible in the dry season, but can be dangerous in the new monsoon season. Outdated culverts may cause severity of new floods in the project area. Water-logging and river-bed siltation are other problems that should be solved. Water pollution is another issue, which is more linked to existing practices and need to be solved through coordination between different agencies. At the same time, there is also effect from the road on water quality, mostly associated with collection of construction materials and washing of cars in the rivers.

Soils are not very much impacted in the result of existing road operations, although exposure of dust in many sites is very high. Solid waste management along the road is another issue, which obviously impact environment around, including soils, in high degree, first of all, in the result of lack of waste management.

Ambient environmental conditions are highly impacted due to low capacity of the existing roads, high traffic congestions, low speed and high level of pollution. High exposure of dust and bad air quality are "visible" without special sensors, especially in the highly populated urban centers.

Environmentally sensitive areas are presented by three VECs (critical habitat, valuable ecosystems and wildlife movement corridors). All those VECs are impacted by existing roads and transportation due to lack of mitigation measures and cross-road structures. Planned construction of other linear infrastructures also will impact these areas. Currently, there is a high level of road mortality and threats of wildlife-vehicle collisions along existing corridor, especially with large animals. High level of human – wildlife conflicts in Koshi-Tappu area is also provoked by the lack of movement corridors for elephants and water buffalo, facilitating raiding of agricultural fields, especially in the dry season.

Terrestrial habitat is presented by forests, which occupy around 30% of the area at the landscape scale. Forests are highly impacted by unplanned human development along the road and by deforestation, associated with human development and demand in timber and non-timber forest products. Besides, planned construction of other linear infrastructures has impacted forests also in high degree.

Aquatic habitat is affected by pollution in the result of industrial activities associated with road operations. In the project areas, some rivers and associated aquatic habitats are impacted by pollution resulted by broken bridges and car movement through the river bottom. Observed currently very high level of siltation also impacts aquatic habitats, changing their biota, especially closely to bridges and in other affected water-bodies.

Threatened and endangered species in the highly populated project area mostly dependent on the presence of suitable habitats and can be found within protected areas (Parsa National Park, Koshi-Tappu Wildlife Reserve), within the territory of important wildlife habitats (Betana Wetland, Ratuwamui development Project) or within traditional wildlife corridors. All these habitats are mostly isolated by developed and developing human settlements and infrastructure, increased human encroachment along existing road. But those species are also affected directly by high road mortality rates in the proximity of environmentally sensitive areas. Besides, local population, especially indigenous people still depend on forest resources, including hunting and trapping of wild animals adding the pressure on the remained wildlife in the project area.

Land and resource use is a valued social component, which is already affected by uncoordinated ribbon settlements along the road and land use change, associated with human development in the result of forest land conversion into agricultural and urban lands. This process started in the eastern Terai region more than 50 years ago and still continues now. Currently, all suitable land is mostly settled by human

population. Population density is significantly increased in the region and there is a need in the modern fast road for further development. There is no adequate modern infrastructure along the road that makes it outdated and non-responsive to the modern needs of development.

Population infrastructure and services: is a valued component, which usually improved with road construction due to access to many services and benefits. Currently the urban centers are crowded and there is a need in improvement of road planning and design that to avoid adverse impacts on the existing settlements and infrastructure, high level of transportation in urban centers and high project costs. Current service structures along the road are mostly developed by private structures, they are not well planned and organized. The project area can be characterized by high level of migration, especially among youth, looking for job. There is a good job market in the project area, and not many proposals for employment and business opportunities.

Economy and well-being: is a VSC, which is usually benefits from road development. There is a problem of youth migration from the area due to lack of employment and business opportunity within the project area. Although, the existing road supports the number of existing jobs and small businesses, the lack of such opportunities results in the gender and social inequalities. Current road safety issues are unsolved along existing road and mostly relevant to the lack of road infrastructure and special facilities such as bus stops, signs, bus stations, cross-road structures, over-road passes, etc. One of the existing issues is a very poor management of road-sides and facilities, causing high level of pollution along the road. There are no enough infrastructures and special services for visitors to rest, for example, there is a lack of sanitation facilities.

Community Life is impacted by road in number of ways, including establishment of multicultural environment along the road, interconnections and cooperation between different communities. At the same time, negative concerns are relevant to lack of infrastructure and affordable transportation, lack of access to many services and benefits. The current road conditions also are characterized by very poor landscape aesthetics, mostly resulted by insufficient waste management, lack of reinforcement and by behavior of local residents. Lack of sanitation may cause water-borne diseases in the project area, such like cholera, hepatitis, typhoid, dysentery, etc. Existing water-logging due to low operations of the existing culverts may facilitate algae-blooming and loss of potable water quality.

Thus, the current conditions of the existing road do not respond to the modern standards of transportation and sustainable road concept, including safe and efficient transportation, presence of adequate road infrastructure and sufficient services for drivers and passengers. Besides, current conditions of the road do not take into accounts needs for pedestrians, bicycles and motorbikes. This road does not respond also to the needs for the regional economy development, in particular, relevant to facilitation of urban growth and industry development.

5.3 Alternative 2: Upgrades of Existing Road to 4-lane Highway

The second scenario is upgrading of existing 2-lane road into 4-lane highway, replacement of existing road infrastructure in accordance with modern standards, incorporation mitigation measures along the

road ensuring natural processes and responding to socio-economic needs, and construction the new bridges instead of outdated old. The same Valued Environmental and Social component were analysed that to explore opportunities for the road improvement.

Bank slope conditions might be impacted during bridge construction in the result of extraction materials for construction with slope erosion and other associated adverse impacts on river, water quality, fish and aquatic habitats. Mitigation measures should consider opportunity for collection of construction materials, at least, on distance in several kilometers from the area of construction. Appropriate mitigation measures also should be ensured to prevent negative impacts on environment in the result of material extraction after road upgrades for domestic needs. Taking into account the fragility of the sedimentary soils, the bio-engineering measures are needed in the bridge area to prevent bank slope destabilization and erosion in the result of transport operations.

Natural drainage system might be severely impacted in the result of new road construction or upgrades. First of all, the road construction may cause disruption and blockage of natural drainage systems and even change the water-flow, resulting in the threat of severe flooding in the monsoon seasons. Updated and well-designed drainage systems are needed to replace existing outdated culverts, small bridges and ditches, over-grown by thick layer of grass preventing free water flow movement. Runoff water and siltation may cause severe flooding as well with destruction of infrastructure (bridges) and adverse impacts on adjacent land such as agricultural fields or Sal forest. Taking into account, that in several project areas the existing road is located closely to the new constructing railway, the interaction between impacts or cumulative impacts are likely in such cases. They should be prevented through coordinated planning of drainage systems ensuring water flow through all planned linear infrastructures. Water-logging causes flooding in the monsoon season as well; this is a big problem in the Terai region with its wet climatic conditions. Water-logging may result in the standing water, which is destructive for valuable sal forest, or flooding of the area. Those issues also can be solved through planned and well-designed road drainage system, coordinated with other linear projects. Water pollution is more likely during road and bridge construction and labour camp operations. This issue may be solved through timely prepared Environmental Management Plans, selection of locations for labour camps and proper management and utilization of liquid and solid wastes during construction.

Soils might be impacted during road upgrades and bridge construction due to stockpiling of materials, establishment of quarries and camp sites. There are also threats of hazards due to spoil or chemical material disposal and construction wastes. However, all those temporary impacts on soil may be mitigated through selection of appropriate sites, protection of fertile top-soil, soil rehabilitation after construction work. Due to quite high level of barred landcover in the project area, there is opportunity to find appropriate places for quarries, stockpiling and camp sites without or with minimal impact on valuable fertile soils along the road.

Ambient environmental conditions will be impacted severely during road construction, including air pollution, dust exposure, high noise level and vibration, relevant to heavy machine operations and increased emissions. Prepared Environmental Management Plan should include measures ensuring

implementation of all mitigation measures to minimize adverse effects of road construction through application of existing practices and tools such as water spray on dusty roads during construction, established noise barriers near schools and hospitals, selected location for batching plants and other noisy equipment, etc. During road operations, the adverse impacts will be minimized due to improved road conditions and planned planting of trees and forests along the road.

Environmentally sensitive areas, more likely, will be impacted during road upgrades by adverse effects on valuable ecosystems, wildlife movement corridors and environmentally-sensitive habitats. Those VECs have been already impacted by existing road and transportation in the project area, however, during the road upgrades the impacts may be strengthened, especially taking into account planned construction of other linear infrastructures. At the same time, it is possible to establish effective and efficient communication and coordination mechanisms between several linear development projects that to coordinate mitigation measures at the landscape scale. So, it can be predicted interaction between impacts and severe effect of cumulative impacts on the landscape scale. Impacts on Environmentally-sensitive Habitats (Parsa National Park and Koshi-Tappu Wildlife Reserve) during road upgrades might be avoided or minimized through the application of mitigation hierarchy in the road-specific ESIA and coordinated mitigation measures between several linear projects. Impact on valuable ecosystems such as Betana wetland can be avoided through shifting of highway on 500 m – 1km from the wetland. Impact on movement corridors may be reduced through establishment of improved and coordinated cross-road structures, ensuring movement wild animals, and people and domestic cattle also in some cases.

Terrestrial habitat: will be affected directly during road upgrades through clearing of forest, tree and vegetation for construction with associated habitat loss and wildlife disturbance. Replantation will be required in 6 districts: Bara, Rautahat, Sarlahi, Mahotari, Morang and Jhapa. Compensation and rehabilitation mechanisms are well developed in Nepal. National law requires in such cases establishment of nurseries and replantation of lost trees in ratio 1:25. Bara district started a huge plantation initiative under the Forest Decade program. Cooperation with this program will help to rehabilitate expected loss of the forest area along highway. There are similar initiatives in other project districts as well, so, cooperation with local and regional authorities and forest user groups will ensure forest recovery in the project zone with including the compensatory plantation as required under the national law. The risk of forest fire can be increased during construction due to collection of firewood by workers. Clear identification of this issue in EMP, instruction of workers and providing of alternative sources of energy will minimize such threats. Use of forest products during construction by workers and after road upgrades by road-users through the improved access to resources might be mitigated by community engagement in forest management, awareness and enhanced enforcement mechanisms.

Aquatic habitat: might be damaged during construction of new bridges directly with many adverse impacts like pollution, changes in hydrology, habitat loss, disturbance of species, impact of fish species and local economy based on fishery. Koshi-Barrage area, located in the proximity of Koshi-Tappu Wildlife Reserve, more likely, will be severely affected. This area preserves the habitats of Asian River

or Gangetic Dolphin and many migratory and wintering water-birds, including several globally and nationally threatened and endangered. There are plans to build a layered bridge, which will respond to needs for railway and highway operations at the same time. Impact from the construction of bridge on Sapta - Koshi River hydrology and habitats, on buffer zone of Koshi-Tappu Wildlife Reserve might be enormous, but, more likely, less than from construction of 2 large bridges in different time. The coordinated EMP between railway and highway projects is needed to mitigate possible adverse impacts on fish, water-birds, aquatic wildlife and their habitat. It is expected also that pollution by construction materials will be significant and may impact water-bodies located along highway, including valuable wildlife habitats such as Betana Wetland. The probability of impacts should be assessed and proper mitigation measures proposed on the project planning and design stages of the KDP Road as well as during the implementation of the project through the proposed SESA. At the same time, upgrades of the road and construction of new bridges will give opportunity for replacement of culverts and other drainage infrastructure with new improved, responding not only engineering standards, but also needs in conservation of some aquatic and semi-aquatic species.

Threatened and endangered species may be impacted during road construction and operations by direct impacts such as wildlife disturbance, increased road mortality and hunting and poaching; the barrier effect of wider road also will be significant fragmenting existing habitats. Indirect and cumulative impacts are relevant to increased human activities along the road, increased competition for resources between wild and domestic animals, increased human-wildlife conflict, land use change, loss of habitats and connectivity among remained, etc. All those effects might be reduced by timely and coordinated planning, design and implementation of site-specific mitigation measures. Upgrading of the road gives chance for establishment of cross-road structures in several sections for wildlife and domestic animals, including fencing, and awareness raising. Hunting and poaching is a common practice in the project area now; this issue can be solved only through participatory approach, public awareness and education around parks. There is a need also in economic initiatives for local communities and especially indigenous people to reduce their dependence on forest resources or on sustainable use of such resources through leasehold and other programs.

Land and resource use will not be impacted severely during road upgrades. There is no need in land acquisition in the RoW. However, property and assets acquisition is still required and will be conducted in accordance with existing laws and practices. Usually, the new road construction is associated with ribbon settlement establishment along the roads and encroachment of road sides by rural population. However, such encroachment along the road already took place in previous decades, including in KDP Road. Current road upgrades will allow to coordinate further development of local communities between local and national authorities and plan special service centers along the road, located in highly-populated areas that to create business and employment opportunities for local communities. Eastern Terai region is heavily populated with population density around 400-persons per sq.km and much more in urban areas. The population pressure drives further development of this region and its transformation to more urbanized and industrial area. This process includes improvement of roads as one of the components of development. However, development of the region should be designed by national and regional strategies. One of such strategies, Terai Arc Landscape Strategic

Action Plan (2015-2025) includes issues relevant to sustainable human development in the region and conservation of the environment on the landscape scale. Coordination of work on highway upgrades with this strategy will be useful to prevent loss of valuable land and other environmental assets in the project area.

Population infrastructure and services: will be mostly benefited from upgrades of existing highway due to improved transportation and road facilities, road safety and higher road standards. At the same time, the present road passes several highly-populated urban centers and road upgrades will require acquisition of expensive assets. Besides, high-speed transportation in the city-centers will create the safety threat (road accidents) and high air pollution due to car combustion. Therefore, consideration of by-pass options will be beneficial in such cases. Currently, there is a shortage in the services and road service centers along existing Patlaiya – Kakarbhitta road. This function has been provided by small businesses grew along the road sides. Road upgrades provide opportunity to plan necessary road facilities, responding to needs of travelers and beneficial for development of local economies. Upgrades of the road will provide more opportunities for the users, especially vulnerable groups. At the same time, there is a chance of conflict between worker-outsiders and local communities. So, the priority for employment in the road development project should be given to local people, especially to youth that to increase local capacity (through training and knowledge sharing) and decrease migration pressure.

Economy and well-being: is also usually benefited from the road development. Upgrades of KP section will create employment opportunities for local people with such benefits as skill enhancement, increased economic income generation activities and some others. At the same time, there is a threat of adverse effects on vulnerable groups, such as prostitution and as well as Gender Base Violence.. Social management plans should include awareness and mitigation measures to prevent negative impacts on vulnerable groups, ensuring gender equality, opportunities for women employment and other associated measures. Other issues are road safety and impact on health and sanitation, especially during road works. This issue should be reflected in the management plans through providing of relevant training and instructions to all workers, ensuring safe environment during construction, individual protective measures (masks, casks, gloves, etc.), and first-aid kit in the labour camps. Camp sites should be established on safe distance from water-sources and follow to standards for liquid and solid waste management. During upgraded road operations, the improved road infrastructure and facilities will ensure better safety for motorists and passengers with adequate speed and other signs, places for bus stops, underpasses and overpasses for pedestrians, livestock and wildlife.

Community Life is an important Valued Social Component, which is not easy to measure with quantitative parameters. The upgrades of the existing road will benefit to community life through access to services and better transportation. There is a chance for social conflicts during road construction, but it can be predicted and minimized through local employment, communication and cooperation with local authorities. Cultural and religious assets.so it has to be need to make Stakeholder Engagement Plan (SEP) as per WB ESF might be impacted during construction (for example, Christian grave-yards in the Morang District). These issues should be resolved through

consultations with local people and interested stakeholders and coordinated decision making, relevant to relocation of cultural and religious assets. Landscape aesthetics along KP section currently affected by lack of culture for the waste management. Practically, piles of plastic and communal wastes can be spotted everywhere along the existing road. There are no current mechanisms or measures to prevent littering. More likely that the problem of landscape aesthetic should be solved not only through establishment of plantation along the road, but also through education campaigns and strengthen and reinforcement of low for littering in public places, including roads. However, placement of special garbage bins also can be recommended in public places (bus stations and stops, other public facilities) along the road. One of the adverse impacts of road construction is relevant to effect on poorest people and increase in prostitution in the construction areas with consequences like spread of HIV and other diseases negatively impacting local communities. Public campaigns, awareness and managerial instructions to workers in the project area may help to mitigate this issue.

Thus, the road upgrades may bring many beneficial and many adverse impacts, which should be measured and evaluated that to assess the current conditions and emerging issues, supporting the needs in the road upgrades and consideration of site-specific solutions for areas, which will require avoiding construction due to their values, nature or scale of impacts.

Analysis of Valued Environmental and Social Components for two alternatives proves that "do nothing" alternative is not a solution in the conditions, when the road was already constructed more than 50 years ago and not only does not respond to the needs of development, but can affect environment and society due to destruction of the outdated infrastructure. At the same time, site-specific alternatives should be considered that prevent predicted adverse impacts on existing urban infrastructure or valued environmental components. The consideration of site-specific alternatives has been provided below.

5.4 Site-specific Alternatives

A number of site-specific options have been studied related to the upgradation of KDP Road (also apply to KP corridor) from 2-lane to 4-lane with the objective of reducing further environmental and social risks and impacts of this chosen option. These options will be carefully assessed and studied in more detail in the ESIA for KDP Road at detailed design stage of the road.

5.4.1. New Bridge Construction

There is no doubt that new bridges should be constructed instead of existing, which are mostly damaged and outdated and can cause not only transportation delays, but also accidents with fatal consequences for people.

Mostly proposed bridges replacement will take place only for highway road. However, in the case with Sapta-Koshi River there is proposal to build a layered bridge, which will respond to needs of railway road and highway road construction and upgrades. Several options, proposed by railway engineers are presented below for information (EIA report, Vol. 14, 2017).

Alternative-1

The proposed first alternative of the railway alignment passes through upstream of Koshi Barrage, which are high flood zone and the sediment area. It has proposed 8.80 km bridge on the Saptakoshi River. Being outburst corridor of Koshi, the long stretches of the eastern side is also sensitive for frequent flooding due to weak river training; it may need bridge like structure across the long outburst river course section. Similarly, authority of the Koshi Tappu Wildlife Reserve has not positive cooperation to conceive such a sensitive railway project crossing along the southern side of its area. Moreover, the alignment will pass near to 500 meters distance from the Nepal- India border that has great strategic sense in the safety and security perspective of the railway service in Nepal.

Alternative- 2

The proposed second alternative alignment that turns left from the Mohanpur Station along the side of degraded forest and hillock like topography in the north. It passes along the side of frontier land, it will not benefit its periphery people due to forest area in one side. It can also affect the forest area in some extent across the section. Ultimately, it will also coincide with the same area for crossing over the Koshi River into the third alternative alignment section. Therefore, it is also not much significant alignment as like first alignment.

Alternative-3

The proposed third alternative which turns toward the north from the Rajbiraj Station and crosses nearby Koshi-Tappu Wildlife Reserve by 9.50 km bridge on Koshi Bridge. Though it is the longest alignment, it has great significance due to less sedimentation and hard bed rock. It has much better geological, hydrological features and the strategic point of view as well. Moreover, people of long stretches will also be benefited by this alignment. It runs from outer side of the KTWR area from the north. This alternative is accounted as the best alternative alignment due to above mentioned reasons Land and structures should be acquired for the construction of new bridge area.

5.4.2. By-pass Area in the Populated Urban Centers

In four districts there is a need for by-pass area due to highly populated urban centers. We'll list all 4 centers and give characteristic for each of them why by-pass is needed and what should be done in each case – please, provide relevant socio-economic information.

- Land acquisitions and private& public structures;

- Recommendations for future (15-50 years after)

5.4.3. Alternative Roads in Environmentally Sensitive Areas

Consideration of options near Betana Wetland; shift of the road alignment to some extent from the wetland to prevent adverse impacts.

5.4.4. Coordinated Linear Structure Plans and Mitigation Measures

Coordinated linear structure plans in specific areas: Coordination of road alignment locations with other linear structure projects that to avoid or decrease possible cumulative impacts or impact interaction between highway construction and those linear projects. The linear structures should be

located closer each other in environmentally sensitive areas to prevent disastrous impacts on biodiversity and society (loss of income from natural assets) and should coordinate construction and location of cross-road structures for people, livestock and wild animals, which should be more feasible economically and more efficient from environmental and social point of view. Such coordination should include locations and capacity of drainage structures, locations and parameters of cross-road structures, joint facilities in some cases, etc.

5.4.5. Summary of Additional Adjustments to Design

Site-specific alternative analysis was conducted that to assess opportunities to minimize environmental and social risks and impacts, which can appear at the stage of planning and design (during detailed design studies). It seems that several alternatives are feasible in term of risk minimizing on environment and society including:

- Layered bridge through Sapta-Koshi River, which is economically profitable, reduce environmental risks, associated with construction of 2 separate bridges, and respond to the social needs for modern transportation;
- Consideration of by-pass road construction in 4 districts will prevent high costs of land and property compensation in the city centers, contribute to better-quality environmental conditions due to less pressure from heavy trucks and improvement of traffic movement in city centers;
- Shifting of alignment on the distance from some environmentally sensitive areas (Betana Wetland) will prevent adverse impact of fast-moving highway on wetland biota and ensure income from this area to local communities;
- Coordination of linear infrastructure construction with other agencies and stakeholders will support improvement of such infrastructure development at the landscape scale and prevent large-scaled cumulative impacts and interaction of impacts with negative consequences for environment and society.

Table 10: Comparison of Predicted Impacts on Valued Components in 2-Alternatives Scenario

VCs	Identified Issues	4-laned Highway		"No project"	
		Beneficial	Adverse	Beneficial	Adverse
Bank slope conditions	River cutting, bank erosion	Controlled quarrying and borrow-pit operations Bioengineering measures applied to prevent bank erosion	Affected during bridge construction stage	No actions that in long-term scenario is not good.	Impact of sand, gravel and boulders collection in the rivers along the road
				Fertile soil layer for agriculture	Affect of river beds and fields
Natural drainage systems	Disruption and blockage of natural drainage	Updated and well-designed drainage systems	Block natural drainage during construction, change of water-cources		Outdated culverts and damaged bridges; threat of flooding
	Runoff water Siltation	Designed and coordinated solutions to prevent siltation	Cause of flooding and destruction of the infrastructure and adjacent land-cover area		Existing problem, especially around old bridges, damaging infrastructure and drainage systems
	Water-logging Flooding	Planned well-designed drainage system, coordinated with other linear projects	Possible water-logging during construction in the wet season		Existing currently due to other linear projects and outdated road infrastructure
	Water pollution	Special measures to prevent pollution during construction	Possible impacts during construction, especially in bridge area		Communal pollution, spillage of fuel-products to rivers in case of accidents
Soils	Hazards due to spoil disposal and construction wastes	Selected barred areas for quarries and other infrastructure; avoiding stockpiling in sensitive areas	Severe impacts at the construction stage, stockpiling of materials,		Low to medium impacts due to effect of transportation
	Soil contamination	Improved road	Possible impacts during		Exposure of dust,

VCs	Identified Issues	4-laned Highway		"No project"	
		Beneficial	**Adverse**	**Beneficial**	**Adverse**
		infrastructure and management preventing pollution	construction		wastes and other contaminants from the road
Ambient environmental conditions	Air pollution, dust exposure, high noise level, vibration	Established barriers near schools and other public facilities Water spray, etc. Selected locations for noisy machinery Improved road sustainability and less car combustion	Heavy machine operations during construction, dust and noise (temporary effects)	Surrounding forests prevent dust and noise spread on distance from highway	Road conditions are very bad, high exposure of dust and car combustion, lack of solid waste management
Environmental sensitive areas	Effect on habitats	Construction of wildlife passes as part of the project in wildlife corridors will improve wildlife connectivity and migration. Existing does not have any wildlife passes.	Possible impact during construction and operations		Several ongoing development projects in the area may impact environmentally-sensitive habitats
	Loss of ecosystems	Avoidance of road construction in proximity of valued ecosystems	Adverse impacts during construction and operations, loss of valued natural assets		Existing road impact valued ecosystems in certain degree
	Habitat fragmentation and barrier to wildlife movement	Improved and coordinated cross-road structures for wildlife, people and livestock	Disturbance during construction, wildlife-vehicle collisions in environmentally sensitive areas		Existing barriers prevent wildlife movement, cause high wildlife road mortality and human-wildlife conflict

VCs	Identified Issues	4-laned Highway		"No project"	
		Beneficial	**Adverse**	**Beneficial**	**Adverse**
Terrestrial habitat	Forest clearing and loss of habitat	Nurseries and replantation of lost trees 1:25	Loss of trees and forest habitat during construction	EIA mechanisms to prevent impact at the project level	Predicted impact on forest from other linear projects
	Use of forest products	Enforcement mechanisms, awareness, community engagement	Possible adverse impacts during and after road upgrades	Existing practices of sustainable forest management	Impact on forest from other development projects
	Forest fire	Instruction of workers, control, awareness	Increased threat of fire during construction	Control of forest areas in dry season, awareness	Forest fire occurs due to existing local practices
Aquatic habitat	Damage of aquatic habitat and water pollution	Taking materials for construction at least several km apart from the bridges	Possible impacts during bridge and road construction		Aquatic habitats impacted by broken bridges and direct transportation through river beds
	Disturbance of aquatic wildlife	Selected time for construction to avoid and minimize adverse impacts	High disturbance during construction, especially at Koshi-Barrage area	No current serious disturbances	Disturbances within unprotected areas due to existing practices
	Impact due to construction and other induced effects	Improved drainage infrastructure and design prevent siltation	Pollution by construction materials, disturbance, oil spillage, etc.		High level of siltation, especially near bridges, changing habitats
Threatened species	Wildlife disturbance	Planned and implemented mitigation measures reduce road effect	Increased competition for resources between wild and domestic animals	Increased Parsa National Park ensuring conservation	Human encroachment along the road; increased human-wildlife conflicts
	Wildlife road mortality	Identified and established wildlife cross-road corridors and other measures to reduce road mortality	Increased road mortality during construction and operations of high-speed highway	Identified natural wildlife corridors within project area	High wildlife road mortality, especially in proximity of sensitive areas

VCs	Identified Issues	4-laned Highway		"No project"	
		Beneficial	**Adverse**	**Beneficial**	**Adverse**
	Hunting and poaching	Landscape conservation strategies and public awareness programs around parks	Poaching can be increased during construction	Conservation of animals within protected areas	Existing around highly populated areas and in areas where people depend on NTFP
Land and resource use	Loss of private property and assets	No need for land acquisition in the RoW	Land and property acquisition, compensation, resettlement and rehabilitation	There is no need in land acquisition and compensation	Lack of adequate infrastructure along the road for transportation and passenger needs
	Ribbon constructions along the road	Coordination of development between local and national authorities	Encroachment along the road after upgrades and infrastructure improvement	Need in consideration of alternative alignments through highly populated urban areas	Ribbon development along the roads already started; the suitable land mostly settled
	Land use change	Increased urbanization, industrialization of the area and planning for land development	Loss of fertile land for infrastructure	Ongoing urbanization process may reduce pressure on land	Ongoing deforestation and conversion land into agriculture in the project area
Population, infrastructure and services	Lack and absence of by-pass options	Opportunities to improve road infrastructure in urban centers	High impact in the highly-populated urban areas		Lack and absence of by-pass options; traffic congestion in urban centers
	Unplanned development	Change in social structure and occupation	Lack of planning for road community structures (service centers)	Road services developed responding to human needs	Lack of road infrastructures (service centers, restrooms, bus-stops, etc.)
	Migration and immigration	Access for services to vulnerable groups, including indigenous	Possible negative impacts from outsiders		High level of migration for job from the project area, especially among youth
Economy and wellbeing	Employment opportunities	Employment and income generation for local labours	Gender inequality Effect on vulnerable groups	Increased urbanization and local development initiatives	Lack of employment and business opportunities leads to social and gender

VCs	Identified Issues	4-laned Highway		"No project"	
		Beneficial	**Adverse**	**Beneficial**	**Adverse**
		Skill enhancement Increased economic activities Women's enhancement	Prostitution and girl trafficking, etc.		inequality
	Road safety	Improved road infrastructure and facilities ensure better safety	Possible adverse impacts during construction	Low speed of the cars prevents more collisions with domestic cattle and wildlife	Current road unsafe due to lack of infrastructure and warning signs
	Health and sanitation	Use of protective measures during construction Improved public infrastructures (public taps, restrooms, etc).	Impact on health and sanitation during construction		Lack of sanitation facilities along the existing road, very poor infrastructure and conditions
Community life	Community wellbeing	Improved livelihood Access to services and better transportation Minimized social conflicts	Potential issues of conflicts associated with road construction work	Local communities developed urban centers and agricultural settlements	
	Cultural and religious assets	Increase in multicultural practices, relocation of assets	Influence of outside people, impact on cultural and religious assets and practices	Formed multicultural environment	
	Landscape aesthetics	Planning of green zones and tree plantations along upgraded road	Negative impact during construction		Poor landscape aesthetic outside of forest areas, large amount of solid wastes
	HIV and other diseases	Public awareness campaigns, improved opportunities for employment among	Likely spread of diseases		Water-born diseases spread is more likely due to water-logging and outdated infrastructure

VCs	Identified Issues	4-laned Highway		"No project"	
		Beneficial	Adverse	Beneficial	Adverse
		poorest			

Source: Project Team, 2018

CHAPTER 6: SIGNIFICANT ENVIRONMENTAL IMPACTS

6.1 Beneficial Issues

Apart from the need to mitigate the adverse impacts of the project the implementation of KP Road project will benefit the local communities and the region with numerous beneficial impacts and opportunities for socio-economic development and road safety. There are nevertheless, a range of opportunities open to local people, private sector and all other interested stakeholders to built-up and enhance positive impacts of the project.

Beneficial impacts due to implementation of the proposal during construction and operations of the project will be assessed and further enhancement measures will be suggested. They will be related mainly to improved transportation infrastructure, better road efficiency, increased safety and raise in the livelihoods of the local people. The likely beneficial impacts envisaged during construction and operation stages are:

6.1.1. Construction Stage

Increase in employment opportunity and generation of income

One of the beneficial impacts of the road during the construction stage is the creation of employment opportunity. The surrounding areas of Project site can provide a major portion of the human resources required. The Contractor of works should give first priority to local workers from the surrounding areas when hiring the workers. While employing the local people, priority should be given to the project-affected families/people and the employment should be given in the gender-balanced manner to the extent possible. However, some skilled labors and technicians would be still required from outside. The opportunity for the local workers to engage in the construction works shall not only give them opportunity to generate income but also a feeling of attachment to project.

Enterprise development and commercialization

The construction activities will not only increase the income sources of the local people, but will open opportunities for additional businesses such as the establishment of local tea stalls and 'dal bhat' shops. Also the established tea stalls and shops will foster their business with the influx of construction workers in the project area. An expanded local market will be created by the in-migration of workers. Local residents can take advantage of these new opportunities by expanding their existing local industries and establishing new ones. The consumption of local products such as vegetables, dairy products and meat products will be significantly increased, which directly create the opportunities for new income generation activities. As a result, a significant amount of cash from the project works will be channeled into the local economy and will generally foster the development of other micro-enterprises.

Skill enhancement

The local human resources will have ample opportunity to develop and enhance their skills on construction methods for roads as well as other civil structures. This would be a valuable benefit for the local manpower which they can use for generating income after the completion of the project works.

Increased market for local agricultural production

Vegetable cultivation, especially off-season vegetables, is suitable in flat area of Terai along with the normal season vegetables. The product is expected to substitute the huge volume of vegetables being supplied from other parts of the country and import. A large part of off-season vegetable will be sold to other parts of Terai and Indian market where there is no local production of vegetables including cabbage, cauliflower, radish, carrot and tomato during summer. Among the fruits and vegetables, peals/beans are being produced successfully and can be commercialized with introduction of modern technology and assured market.

Development of new infrastructure along the highway

The influx of workers in the project area likely to increase pressure in the existing public infrastructures such as drinking water taps, health posts, local market, education institutions, service institutions, etc., which will create the chance for development of new infrastructures. Moreover, the project will emphasis in improvement of adjoining road networks, irrigation facilities, transmission lines, water supply and sanitation, sewerage and drainage within the project areas for addressing the likely impacts to these infrastructures. *The nature of impact will be direct with high in magnitude, site specific in extent and long-term in duration.*

Improved road-safety through relevant installed infrastructure (bus stops, zebra crossings, lights, etc.) and other facilities

Road-safety measures for pedestrians and livestock are important in the heavily populated towns of the Terai Region. Road extension and improvement will provide opportunities to enhance road infrastructure through developed facilities and measures, ensuring road safety. Zebra crossings, signages and lights will be installed in all crowded intersections of major towns along Patlaiya – Kakarbhitta section. Places of bus-stops will be designed and installed in places, ensuring smooth transportation movement and safety of passengers and pedestrians.

Improved cross-road structures for people and animals

At present, there is only one overpass in the project area for pedestrians, which is not yet fully used. However, there are crossing points used by people, domestic and wild animals in several places along the road. At the feasibility study stage of the project, all those locations will be defined and necessary measures provided, ensuring road permeability, such as cross-road structures for people and animals (underpasses and overpasses, signals, signs, etc.), responding to local needs and ensuring safety.

6.1.2. Operation Stage

Improved transportation and connectivity between various districts, increased speed of transportation, reduced travel costs

The most important beneficial impact of the project is the improvement of the road, making the transportation of people and goods significantly more safe, smooth and fast. The upgraded road will ensure more comfortable journey, reducing in vehicle fuel consumption, wear and tear. Thus, the access improvement is a major and most important operational stage impact of this project.

The completion of the entire section of roads will benefits a large number of people travelling through the East – West Highway.

Easy access to local people of project Municipalities/Rural Municipalities with existing highway and other urban areas

The improvement of the access will have a significant impact on the overall enhancement of the economic activities within the immediate influence areas, wider influence areas and in the regional area. The economic activities include mainly the transportation of goods and products especially agricultural products, from rural areas to more urban areas. The beneficial impacts to the economic activities are also a major significant impact that affects the socio-economic condition of the people within the influence area.

The improved road will ensure continuous and smooth flow of products and commodities. It is foreseen that trade and business activities will be further promoted not only in this area, but also expanded to other areas, having links to this road.

This project will increase the availability of safe and quicker access, development of economic center, and increase in the economic level, which improve school education and promote higher education outside the project area. Similarly, the local people may spend more on health care, sanitary facilities, education facilities and other social services.

Tourism development and enhancement of local economy

The project area is rich in Cultural sites, situated within the alignment area. The National Park, Forest areas, temples and architecture are all representatives of the rich historical and cultural sites of the project area. Although the project does not consist of any important area of the world heritage sites; there are still other pilgrimage sites holding great historical and cultural importance.

There are numerous historic and touristic destinations in the districts along KP road section. Some of them are mentioned here. Kankali Mandir, Churiyamai Mandir, Gadhimai Mandir, Simraunagadh, Halkhaoriya Daha are the major touristic destinations in Bara district. In Rautahat district, Shivanagar, Paurai Brahmasthal, Rajdevi, Nunthar, Purenawa palace are the famous destinations in Rautahat district. Dhanusha district has various important places of pilgrimage for Hindus. Furthermore, there are several ponds and associated fishery in Dhanusha and Mahottari district. A major religious site of the district includes Jaleshwor Mahdev Temple. Major religious sites of importance for pilgrimage for Hindus of both India and Nepal in Dhanusha district include Janaki Temple, Dhanusadhaam and Vivah Mandap. It is also well-known for several ponds and among it the holy pond Parshuramkunda holds a significant religious and cultural value. While major tourist destinations include Janakpurdham, Janaki Mandir, Ram Mandir, Chisapani, Mahendranagar, Gangasagar, Dhanussagar, Dugthawatee and Aaragaja.

Similarly, the religious site of importance found in Siraha includes several temples around Manikdaha, a pond which was dug by King Manik. It is river shaped pond which is located north of Lahan and has dimensions of 1 km by 100m. In Saptari district, major sites of worship include Chhinna Masta Temple, Shambhunaath and Kankalini Temple. The site is well known tourist destination for Bird Watching, River Rafting and Wildlife at Koshi-Tappu Wildife Reserve (KTWR) as associated Ramsar Wetlands.

In Sunsari district, major religious places of Budha Subba Temple, Ramdhuni, Chataradham, Barha Kshetra, Bishnupaduka, Dantakali and Pindeshori. The well known touristic destination include Bhedetar, Koshi Tappu Wildlife Reserve, rafting on River Koshi and Paragliding above the hills of Dharan where tourists from Nepal as well as India come. Historic/touristic places in Morang are Ancient Palace of Birat King, Dhanpalgadhi, Rajarani Pokhari, Bagjhoda, Saptakanya Cave, whereas

Satasidham, Kichak badha, Arjun Dhara, Birat Pokhari, Kankaimai, Domukha are the major historic/touristic places in Jhapa district.

Industrial Development along the proposed alignment, opportunities for local industrial growth

When completed, improved road connectivity will bring the opportunities for the promotion of trade and business. All weather access facilities will enhance the trade and business because of round the year access and reduced transportation cost. The flow of goods from and to the project influence area will be continuous. Local products could be transported outside markets at low cost, thereby benefiting the producers. The local agricultural (rice, wheat, dal and beans) and horticulture products (citrus and tropical fruits) can be processed and transported. Thus, an improved linkage with other markets opens potential opportunities for the production of off-season vegetables.

Increase economic activities/employment opportunities

During the operation phase, improved road network will bring the new opportunities for the promotion of trade and business. All weather access facility will enhance the trade and business of various market centres along or around the road alignment with easy access and reduced transportation costs. These activities help to improve the living standards of people inhabiting areas within the project administrative units. Similarly, there will be number of new opportunities to the local population to get involved with income generation activities.

Agriculture refers to cereal crops such as paddy, maize, wheat, millet, mustard, pulses; cash crops and vegetables such as potato, cabbage, cauliflower, chilly, brinjal, pumpkin, gourd, bitter gourd; and fruits such as banana, mango, and lemon are the main source of income of the project areas. Also, the established local enterprises will get the chance to foster their trade increasing the production of goods. The flow of goods from and to the project influence area will be continuous. Local products could be transported outside markets at low cost, thereby benefiting the producers. The local agricultural (rice, wheat, dal and beans) and horticulture products (citrus and tropical fruits) can be processed and transported. Flow of goods from the project influence area will be a continuous process benefiting local producers with the transportation of local products for its promotion. The local agricultural and horticulture products that used to go rotten and be wasted previously can be processed and transported. Thus an improved transportation linkage with other markets opens potential opportunities for the production of off-season vegetables.

Appreciation of Land Value

The project area comprises a nationally significant watershed of Koshi and other rivers like Mechi, Kankai, Kamala and Bagmati. Implementation of project will change of land use in more commercial activities. Further, operations of the project and other project enhancement activities will avoid natural soil erosion, brings changes in farming systems, avoid over-extraction of water, overgrazing, deforestation as well as control measure for pollution. The project will further promote integrated use of land, vegetation and water in a geographically discrete drainage area for the benefit of its residents.

Empowerment of women and opportunities

Road transportation will benefit local women by providing improved access to market, social and other community facilities. Mobility will considerably increase while more efficient road transportation systems will be in place. Women, in specific, may therefore get into a better position to attend various service agencies such as hospitals, health clinics, training institutes, women development programs, etc. More frequent visit to such organizations will increase women's knowledge and awareness level. Empowering local people means having: Access to information, Inclusion and participation,

Accountability, Local organizational capacity. Informed citizens are better equipped to take advantage of opportunities, access services, exercise their rights, negotiate effectively, and hold state and non-state actors accountable. Participation addresses the question of how they are included and the role they play once included. Accountability refers to the ability to call public officials, private employers or service providers to account, requiring that they be answerable for their policies, actions and use of funds.

6.2 Adverse Issues

6.2.1. Physical and Chemical Environment

Pre-construction Stage

Land acquisition

Land will be acquired to establish labour camp and contractor's camp at the vicinity of the project area. However, the land acquired for the establishment of labour camp and camp for contractor will not be acquired for the overall duration of project period. As the construction work will be executed with the section wise package basis; land for the establishment of labour camp and contractor's camp will be acquired temporarily for the completion of certain package and section of construction work. Labour camps will be established according to construction packages; as there will separate packages for bridge construction, section wise track construction, slope stability and retaining works etc.

Other project sites such as project engineer camp station, construction material storage and vehicle parking areas, workshops etc. could also be established at the identified open spaces or bare areas with little economic values. Avoiding or ensuring strict monitoring of movement of labor in the wetland, bird migratory route or other type environmentally sensitive area is strongly recommended.

Lack of coordination with other infrastructure development projects

Several other linear projects have been developed closely to the project area, including construction of railway and electric line. The construction of new Nijgad international airport is planned in the proximity to Parsa National Park with access roads. The improvement and enhancement of East-Way Highway and Fast Track have been already started. All those linear and non-linear projects might interact with construction of Patlaiya – Kakarbhitta Road causing adverse cumulative and induced environmental impacts. The coordination and cooperation between projects should be established to prevent severe affects. Some steps were taken in this direction already. For example, construction of layered bridge for railway and highway over Sapta-Koshi River will prevent double work and adverse effects on hydrology, water and aquatic wildlife from two consecutive projects. However, more efforts should be done in this direction, especially in the areas, where linear structure are planned close each other and their effects can interact causing cumulative and induced impacts such as flooding due to problems of water-drainage through railway and highway located in proximity, if coordinated drainage system will not be developed, or extirpation of wildlife due to lack of coordinated cross-road infrastructure and high disturbance level. Coordination might prevent flooding of the area, destruction of landscape and adverse effects on wildlife.

Impact on existing communal, cultural and religious infrastructure in the project area;

Construction Stage

Temporary and permanent disruption and relocation of existing services and public utilities;

All the trails, transmission lines, road and irrigation canals will be affected directly with the construction of expansion of road alignment hindering crossing and direct movement of local people to

adjacent lands. As the road will be expanded and will not be allowed to enter into the alignment directly except from certain junctions or entry points. Locals are likely to be affected from collecting fuel wood and fodder from community forests in addition to having access to their cultivated land at some locations. Similarly, locals are likely to be affected from depriving transportation of agricultural products from one place to another, cattle movement between adjacent lands, daily movement of locals to market area and main headquarters etc. As the proposed road expansion passes through and intersects high tension power lines, local roads and tracks, highway, river canals, water supply pipelines and community tap stands, irrigation canals, electrical distribution lines/poles impart impact on such existing infrastructure that need special remedial approach during design and construction. Such damage to existing highway road surface, damage to culverts, etc., causes difficulty in local movements.

Construction activities on the project area are likely to cause hindrance to pedestrian and existing traffic flow if not managed properly. Whereas, the existing highway is likely be affected due to the transportation of construction materials. It is further expected that the condition of black top could be degraded due to massive to and fro movement of loaded construction vehicle resulting in its degradation.

Loss of physical and cultural structures and infrastructures

The Project road is an upgrading and expanding of the existing road. Hence, the project needs to acquire private property[6] (temporary structure exist within RoW) for construction of road formation width, where the RoW of the Highway is encroached.

Water supply facilities have been set up in the settlements of the project area distributing drinking water through PVC and GI pipes establishing water storage tanks at different locations. Locals are likely to be deprived from using water resources with the implementation of the Project if appropriate mitigation measures will not take properly.

Impact upon existing irrigation system mainly in Bagmati and Kamala river will also produce adverse impact upon existing irrigated farm lands reducing productivity, loss of production, loss of local livelihood and occupation, loss of property. Most of the irrigation infrastructures are earthen type with locally built systems are available in the project area.

Change in Land use and loss of productive top soil

Changes of land use due to the construction of expanded road alignment are mainly conversion of agricultural land, forest land, grazing land, public spaces and other forms of land use into built up area may result in numerous social and ecological consequences.

The proposed road will have a RoW of 50m width (25 m either side of the centre line). Land acquisition will have to be made for total RoW. The road alignment will pass through two types of lands, namely, private agriculture land and forest areas. The alignment does not pass through any hill areas.

[6] Private property indicate only temporary structure.

Slope Destabilization and Soil Erosion

Soil erosion is likely at new open cut sections during construction phase, where heavy mass of spoil will be generated. At the construction phase of the project the intensity of erosion can be envisaged high during rainy season.

Moreover, the weathered and eroded materials from the surface will be washed periodically. The problem of soil erosion although does not appear significant at present, but after the excavation for the slope the problem will be more severe.

Hazards due to spoil disposal and construction wastes

Since the road is an upgrading and widening project, substantial quantity of excess spoil materials will not be generated as cutting will be only minimal and thus spoil disposal problem is expected to be minimal. However, at localized sections, excess spoils may be generated which need to managed properly.

Disruption and blockage upon natural drainage, runoff water, siltation

Construction of the road likely to block natural flowing natural cross drainages flowing from chure hills on north to southern plain crossing road alignment rendering souring, erosion, water logging, ponding and flooding on the northern side. Direct disposal and deposition of excavated/construction materials at the side of the alignment area will affect the river courses to the existing vegetation cover on the agricultural land. As the proposed road alignment also passes through numerous small and large drainage systems along the route alignment at different chainage; direct disposal of excavated materials to natural drainages will produce adverse impact upon seasonal and perennial drainages affecting its natural and direct flow. Impact due to stockpiling and disposal of spoil, soil and other construction materials from road alignment have to manage properly in place. Heavy and intense monsoonal rainfall will result in flooding north of the alignment and can have direct adverse impacts on the East West Highway. This can be mitigated with adequate number of culverts as well as conservation of forests in the Chure/Sivalik Region.

Operation of crusher plants at the river banks likely to cause siltation and pollution of surface water. Further, siltation resulting from uncontrolled runoff from stockpiling will pollute cultivated land and surface water is the potential environmental impacts that are likely during the time of construction.

Construction of bridges generally carried out with the temporary flow diversion of river through narrow channel. However, the flow diversion likely to modify the natural flow of river water by concentrating flows at certain periods increasing the speed of flow. Such diversion of river may generate water depletion, water logging, and a concentration of water flow as well as increase the speed of flow, which will be erosive in nature. In absence of proper diversion management, a concentrated flow of diversion can lead to scouring, bank cutting, gullying and soil erosion at downstream land, which in turn can cause slope instability and trigger landslides. Such activity should be prohibited during pre-monsoon season and winter season of migratory birds and done in close coordination with Koshi Barrage Management as well as KTWR conservation officials.

During rainy season the excavated material if deposited haphazardly along river banks will be washed out affecting downstream settlements and cultivated lands due to sedimentation.

Pollution of Water Resources

Construction activities such as cutting and filling, disposal of construction waste and spoil, road track width excavation, etc., might increase in turbidity of streams and rivers nearby. As proposed road

alignment crosses most of the river course and direct disposal are likely. Improper sanitation of workers or local inhabitants, (e.g. lack of appropriate sanitary facilities, defecation in open field) disposal of wastewater from labour camps, unauthorized washing of vehicles and unauthorized/unsuitable garbage dump sites are likely during construction stage. Moreover, haphazard disposal of spoil upon rivers along the proposed road alignment will further degrade water qualities of rivers nearby it. Haphazard disposal of spoil will further increase turbidity and rise in river bed.

Contamination of Soil

Construction activities such as cutting and filling, disposal of construction waste and spoil, road track width excavation, etc. also can affect the soil quality, especially in the actively used agricultural areas for wheat and cash crop production.

Quarrying of Construction Materials

Uncontrolled quarrying by contractors from non-approved sources is a damaging activity, which must be controlled. The extraction of materials from inappropriate places or in excessive amount can seriously damage the local environment. For example, quarrying from a high slope and fragile terrain can result slope instability; extraction of sand and gravel in excessive amount from river can cause riverbank cutting, erosion, and changes of river regime. This will eventually affect the local environment in terms of erosion, flooding of cultivated land, damage to community infrastructures, affect road and road embankment itself and eventually affect the entire livelihood of local people. General scouring of river beds resulting in endangerment of bridges and continuous degradation of the river regime are potential impacts of quarry operation.

The proposed road construction activity will require establishing several crusher plants. Stone crushing plants are temporary work sites, occurring during construction of this road project. They are normally established near quarry sites from where the stones are derived. Crushing plant as well as concrete batching plant sites are high risk areas for accidents and injuries. Also, there will be continuous flow of heavy vehicles for carrying the materials to construction sites. If their path is along school and busy market area, there will always be potential risk of serious accidents. River flow regimes are likely to be changed if extraction of sand and gravel in excessive amount from river bed and river banks.

Stockpiling and transportation of Materials

Construction materials are usually stockpiled for relatively short period without covering. It is often done on riverbeds or riverbanks, forest area, open spaces, and cultivated land. This situation may lead to environmental degradation in of air pollution, land pollution, pollution of surface water, and permanent changes of land use, if not rehabilitated after work complete. Standing crop or future cultivation on such land is disrupted. So, while stockpiling construction material following area should be avoided.

- Place where considerable vegetation is available.
- Low land inundation Forest area where folding and water logging is prone
- Agricultural field where folding, water logging is prone.
- Settlement area where excess road will be blocked inundation with materials
- Prime habitat as sites of migratory bird breeding habitats

Air Pollution, dust exposure, high noise level, vibration

Excavation, Track width opening and formation will be carried out operating drill machines, excavators, load and unload heavy vehicles etc. Air and noise pollution due to operation of such

machines is likely throughout the vicinity of the project alignment. Although, the majority section of proposed road alignment within the flat Terai terrain comprises of flat lands; air pollution are likely with the operation of machines and vehicles especially during dry season.

During the construction stage, the operation of the construction equipment and heavy vehicles and machinery will generate air pollution while works like site clearing, excavation, cutting, filling, leveling, compaction etc. is conducted. These works shall cause dust and air pollution to the entire surrounding areas. In addition, during wet season, the road will be muddy and cause nuisance to vehicles and pedestrian traffic. However, these effects will be for the short term period only, especially during dry seasons.

The road construction activities are likely to increase noise level and cause vibration during operation of the heavy construction equipment. Noise disturbance cannot be avoided because these activities will generate the noise level beyond acceptable limit of 70 dBA. There are some schools along the road and they are likely to be affected by the noise and vibration problems. The operation of the heavy construction equipment is likely to cause vibration in the vicinity of the construction site. Such construction activities is likely to develop damages or cracks due to the vibration caused by the operation of the heavy equipment, which need to be monitored and checked, especially near bazaar areas.

Further, bitumen heating and asphalt plant operation, if located nearby the site, will generate significant amount of smoke and pollute the air. Bitumen heating emits considerable amount of gases such as SOx and NOx, which will have adverse impact in the environment. Though such pollution will be for the short term and temporary, the level of pollution may be significant.

Potential hazards caused by bitumen and other toxic chemicals

Bitumen is a hazardous material, which is used for road surface dressing during construction and maintenance period. It has also environmental consequences during its heating and mixing with aggregates before its application as surface dressing material.

Bitumen and other chemicals of road sealing usage are highly inflammable. Unless it is stored safely and handled correctly, it may become source of fire hazard, and incidences become common.

Bitumen and other chemicals of road sealing usage are highly corrosive when it is hot. Prior to its spread over road pavement for sealing, its viscosity needs to be altered to a condition of 'appropriate fluid' either using cutback or heating. Altered bitumen can cause skin irritation, burns to its handlers unless adequate protection measures (safe boots, gloves, goggles etc) are put into practice.

Fuel, lubricants, oil, acids and other chemicals used for road sealing purpose are of petro-chemical products, which being highly environmental unfriendly does not react as do biological process but deactivate and impair it on the site where it is spilled. These products if not safely stored on the stockpile site can cause peripheral damage.

During vehicle and equipment's maintenance and repairing and washing, used lubricants may be spilled nearby water-sources which may cause adverse environmental pollution.

Similarly, the operation of crushing plants, batching plants etc. likely to causes inconvenience to nearby settlements in terms of air and noise pollution. Excessive noise and dust from the plant will create disturbance to nearby settlements, school, health posts etc is likely during the construction.

Occupational Health and Safety of Labour, Community Health & Safety and accidents

As labor forces require undertaking works especially in heavy equipment operations, tree felling, transporting and translocation of heavy construction materials etc. they are prone to various risks and health hazards in absence of works undertaken without adequate safety measures. Other potential impacts to health are respiratory, eye disease due to exposure to dust, gas emissions during pavement works especially in bitumen works.

Occupational Health and Safety of labors during construction of the proposed road will be significant issue. Labor Management Plan will be developed in accordance with ESS 2(ESF) of the project will need to allow to the Labor Management Plan. First aid facilities for the workers should be provided at working sites as well as at labour camp sites. Similarly, Health and Safety of the local people will be another significant issue during construction stage of the project.

Awareness programs to local people should be provided regarding environment health and safety. Furthermore, handling, transportation, storing and use of different Machines, equipment and petroleum product will be other issues of safety during construction. It is recommended that contractor will further comply with the Safety Plan developed in the detailed design stage. During construction, existing local tracks and vehicle tracks will be affected and may need to be either closed temporarily or synchronize with the construction vehicles. Construction activities on the project site are likely to cause hindrance to pedestrian and existing traffic flow if not managed properly. Although, this is not likely to be a major problem; it could affect the passage of the existing traffic. Therefore, a Construction Traffic Management Plan should be developed in the detailed design stage that will comply by contractor to maintain flow of construction vehicles without hampering good flow of passenger vehicles.

Road safety issues during construction works will be significant to construction workers, passenger vehicles and pedestrian ie. Walking alongside or crossing the road. Safe handling of construction vehicles and equipment during construction phase will be an important issue for contractor. Collection and transportation of construction materials, disposal of spoil from excavation will be executed smoothly during construction. Existing East-West highway and other Highway will not be disturbed during the time of construction of this road. Road safety of the highway will be ensured by managing existing traffic properly.

Issues related to establishment of labour camps and contractor's camp

The labor/contractor camp will be established near to construction site. If such work camps are situated near to settlement areas, it is likely that social problems will arise, such as, social conflicts, crimes, prostitutions, gender-based violence, sexual abuse and exploitation, and spread of communicable diseases. The outside workers are more likely to create social conflicts and cause a sense of insecurity and un-safety among the local people. In addition, environmental problems due to generation of wastes and ill sanitary conditions may also arise.

Other major issues of concern with the establishment of labour camp are likely to be uncontrolled open defecation by construction workers, unmanaged disposal of toilet wastes into watercourses, natural drains. Surface and ground water contamination is likely if sewage and other sanitary waste dispose haphazardly in the entire project area.

At present, there are natural water sprouts and shallow well and tube wells that are functioning at numerous places along the road alignment and are a main source of water supply for drinking as well as daily uses and the local people are depended to such sources.

In addition, the existing drinking water facilities will be inadequate for large number of workforce in the vicinity during the construction phase. During the construction period, a large number of construction workers need to be mobilized. Water is required for water sprinkling during construction of road pavement works to avoid excessive dusts and for compaction of pavement layers, in large quantities.

Road construction site is also nearby densely populated settlements and market centres and there will be extra pressure on drinking water and the sanitary facilities. If the proper sanitary condition is not maintained in the work camps, water may get contaminated and water borne diseases may increase. In addition, water quality may get degraded if the construction materials such as bitumen, cement slurry, oil, diesel etc. are leaked into the water bodies.

At present, there are tube-wells functioning and providing a main source of water supply for drinking as well as daily uses and the construction works will not affect them. Similarly, the construction activities may require some hazardous material, which will be stored in the proper place and disposed of safely after usage. Furthermore, haphazard disposal of solid and liquid wastes from the construction camps will likely degrade the soil and water quality.

It is likely, the earth work in embankment may affect the ground water flow of the springs and /or wells in the vicinity of the construction area.

The haphazard disposal of construction waste will adversely affect the sanitation environment in the area and this problem need to be minimized through regulatory measure and public awareness programs.

Solid waste management issues

Operation of labour camps can cause significant impact upon ambient environment, if camp operation will not planned in advance. The main issues of concern are unmanaged disposal of solid and liquid wastes into watercourses, natural drains and improper disposal of storm water and black water in the cultivated land and village areas. Particularly, open disposal of waste will lead attraction of wildlife to the area and result in disturbance.

Operation Stage

Slope instability

During operation phase, the flood plain around the bridge and road embankment may be destabilized due to improper drainage, grazing and vegetation loss.

Water, Air and Noise pollution

There can be air, water and noise pollution due to the increase in the number of vehicles during operation phase. Increased vehicular movement will result air pollution due to vehicular emission and dusts. Similarly, due to ribbon settlement and establishment of small shops along the road alignment, local people and passenger may throw the waste material on the road. This will result water pollution. The noise of horns arising from the vehicles can be a nuisance at the sensitive spots.

Issue related to Road Safety

After the completion of the upgrading works, the road traffic will increase because of better road width and surface, the vehicles would move in a higher speed. This is likely to increase road accidents of vehicular collisions, and collisions with pedestrians and road-crossing people and animals. Road crossing for school-going children will be especially dangerous, and parents have expressed their worry also.

Cross drainage outfall and flooding threats, water- impoundment in specific areas during monsoon season

The road embankments are constructed across the flow direction of natural drainage, so the obstruction to natural drainage and waterlogging is possible at certain sections. The design team should take this into consideration by appropriately locating cross-drainage structures.

Direct impact due to water logging or surface runoff upon public and private lands, water resources, and natural drainage is likely during operation of the road project. Similarly, direct disposal of surface lead off drains from road upon private cultivated lands and properties will have adverse impacts of soil erosion. Surface runoff and road side lead off drains will have significant adverse impacts upon public and property. Runoff and lead off drain constructed in inappropriate location likely to trigger further soil erosion and cutting at the basement area of the road alignment as well as inundation and siltation of private and cultivated lands.

The most important concern nearby bridge sites is bank erosion and damage to a part or the complete width of the road alignment during high flash floods. This could result in several days of traffic disruption. The possible bank erosion sections of the river are especially along the river banks where alignment situated close to major rivers.

Leading to water logging, ponding on the north side of the alignment due to embankment height since the natural drainage pattern of the project area is on North to south direction that road alignment will cross by.

Unplanned development along the road alignment

Ribbon settlement is one of the common features in Nepal. It means the development of settlements, shops and food stalls along the roadside soon after the construction of road. The existing trend is to settle along the road for economic opportunities. Besides conventional convenience; increase in land value adjoining the road and land speculation are important drivers for such undesired and uncontrolled development. Negative consequences of ribbon settlement are the blockage of road, encroachment of right of way, delays in private and public transports, increment in accidents, hindrances for maintenance works, haphazard garbage disposal and poor sanitation that may result in undesired landscape aesthetics, and reduction of the overall road capacity.

Climate:

Various studies done in consultation with Department of Hydrology and Meteorology (DHM) show that climate change induced threats would affect differently people living in various regions in Nepal, their socio-economic development, biological diversity and other sectors. The results of such climate change induced threats are increased risks of floods, landslides, glacier outbursts, drought and other natural calamities. The climate change threats are determined through an analysis of past extreme events and trends and through climate modelling and downscaling of future climate and hydrology against various scenarios.

The identified major threats are:

- Increased total rainfall causing increased riverine floods and increase in average river levels;
- Increase in number and intensity of storms causing increased frequency and intensity of rainfall;
- Increase in intensity of rainfall causing increase in flash floods and debris flows;
- Increase in the likelihood of Glacial Lake Outburst Floods (GLOF) due to increased ice melt and increased rainfall;
- As a result of the increase in total rainfall and in the intensity of rainfall an increase in the number of landslides.

The study area does not consist of Glacial Lake. Except the threat of GLOF, the other threats pointed out above are likely to occur. Increased rainfall intensity will create more floods affecting drainage structures, bridges, road pavement, driving condition and visibility. High Flood Level (HFL), waterways, scouring of bridge foundation etc. will take place. Similarly, increased rainfall will trigger more landslides and mudslides along the roads causing frequent road blocks.

Geology and Topography:

Conducted analysis indicated that proposed road alignment passes on the loose soils of the fluvial sediments of the Indo-Gangetic Plans. The road alignment is located south of the Main Frontal Thrust in Nepal. Drift geology showed that road alignment lies on residual and old alluvial soil deposits. The slope stability in rocks of the progect area should be stable and stability of soil conditions are good. However, there is possibility of bank erosion along the rivers. So, it is not expected that it will be problems in the project area, relevant to slope instability or landslides.

Riverbeds provide various construction materials, which will be sufficient for road construction. It is recommended to extract materials, at least, one km upstream from each bridge along the highway.
Biological Environment

6.2.2. Biological Environment

Most of the forest and biodiversity related impacts have been quantified to the extent possible. The possible impacts from the proposal during these three phases, pre-construction, construction and operation phases are presented in the succeeding sections.

Kakarbhitta - Pathlaiya road segment pass across numerous rivers, springs, irrigation canals and culvert bridges. Additionally, there are wetland, ditches, water bogs and ponds (natural and artificial alongside the highway providing the habitat for aquatic and herpeto-fauna. Study carried in almost 99% of water bodies alongside and across the highway as far as convenient accounting 219 sites. This includes 79 culvert functioning bridges, 107 sites in 101 springs, 9 sites in 3 canals, 4 rivers, 17 artificial ponds, 2 ditches and 1 wetland. Majority of springs are ephemeral type since springs originated from Churia Hills located at the north of the highway. These springs remain dry when rainfall stopped. Similarly, majority of ponds are seasonal formed by logging of water. However, rivers such as Bagmati, Kamala, Koshi and Kankaimai are permanent and inhabited by fish.

Expected that the road expansion and improvement will generate some beneficial socio-economic and environmental impacts including:

- Employment and income generating activities for local communities (forest clearing, maintenance of road-sides, planting of nurseries and trees along the upgraded road, etc.);
- Improved road infrastructure to ensure safety for pedestrians, domestic animals and wildlife through established traffic lights, signs, underpasses/overpasses and other cross-road structures, fencing, etc.;
- Enhancement of technical skills through engagement of local staff, training and knowledge sharing to forest management and biodiversity conservation basics;
- Introduction of best practices for re-forestation, solid-waste management along the road, improved drainage preventing vector diseases;
- Opportunities for tourism development and enhancement of local economy (Parsa National Park, Koshi-Tappu Wildlife Reserve),

Adverse impacts have been analyzed for pre-construction, construction and operation stages.
There will not be any significant adverse impact upon biological environment during preconstruction phase. However, after the inventory and approval of the EIA study, exact number of cutting trees will be counted again before these are sent for approval for cutting permit from the Cabinet of Ministers.

The analysis of impact on the biological environment, during the construction stage, indicates that the impact of forest clearance, cutting of trees, clearing bushes, shrubs and herbs and loss of biomass will be high. Disturbance of natural habitats and wildlife, including hunting and poaching, is a second issue on significance followed by use of forest product by construction workers. It is likely that some habitats will be lost during the construction. Such habitats might be compensated later with establishment of replantation (1:25) to the forest area.

During the operation stage, indirect and cumulative impacts of the road development on forest habitat, forest products and wildlife will be very high. It is expected that impact on forest resources will increase with possible extraction of firewood and timber due to better access to resources. Road will fragment habitats and create barriers for wildlife movement. Spillage of oil and diesel is assumed to have severe impact on aquatic life. Biodiversity might be affected by loss of habitats, increased pressure on forest resources due to new access zone along this alignment and increase in fire, associated with higher population pressure. These issues should be addressed accordingly in the Environmental Management Plan More likely that traffic intensity and high speed of moving transportation will create more disturbances for wildlife, including higher rates of roadkill animals.

The project activities during *construction phase* comparing to *pre-construction* and *operation phases* have a number of adverse impacts and affect environment directly. It is essential to understand forest management systems prevailing in the country. Forest management approach in Nepal is participatory, where people participate directly in managing forests. The Community Forestry is the most known participatory approach through a community forest user group (CFUG). Leasehold forestry, Protection

Forest and Religious Forestry also follows the similar principals. In Collaborative Forestry, forests are managed through DFO's direct involvement with local people. There are privileges specified (according to an approved forest management plan) for distant users' also in collaborative forest management. Government Managed Forests are governed by the DFO, but local peoples have privileges over certain products. The District Forest Offices are directly involved in facilitating the management of all above forests.

i) Pre-Construction Stage

Extension of existing KP highway (construction of new alignments and bridges) will affect the biodiversity. *Pre-construction*, is a stage of collection and sharing of information in favor of the project. In addition, to access the forest during ESIA study, forests will be weeded and bushes cleared. Together with others crucial information ESIA tem will conduct a detailed study on biodiversity and survey experts will collect other crucial information, ESIA study team will conduct study and groups of experts and others visit the forests, wetland and other areas along and around the alignment. The visit will be in all affected forests. Some important activities of the stage are:

Sharing of information with CFUG, DFO and other stakeholders regarding potential loss of trees and forest land:

Though the trees are not harvested, administrative process required before and during forest inventory, the proponent share information regarding the project impact and acquisition of forest land for the highway. This step could affect the households within DIA and ZOI, hence various sharing forums such as FGD, KII and other gatherings in and outside the forests are made. A visit to all affected forests and alignment of the KP section is made. On this stage, the experts from the proponent explain what kind and location of the forests are affected.

Process of acquiring cutting permit and land for the project:

A letter from the Ministry of Physical Planning Infrastructure and Transport (MPPIT) with the approved ESIA report is send to the MOFSC for cutting permit of the trees and other biomass within, and availing the forest land for the project. MOFSC writes to the DOF and DNPWR for verification. The process is forwarded to the district level offices and protected area affected. The district offices write to concern management groups for verification. Together with the district authority, the management groups will make a field visit to justify the findings of the ESIA. A total enumeration is made. The district authority will send details of trees, other biodiversity and forest area affected to the DOF/DNPWR which finally is send to MOFSC. MOFSC then sends the details to the "Cabinet of Ministers (COM)" with request to a cutting permit of the trees and availing the forest land affected during highway expansion.

Identifying (Enumerating) and Tree Cutting:

There will not be significant impact on forest resources during the *pre-construction phase* of the proposed road upgrading works, other than clearing of bushes and shrubs to make way for studies such as forest inventory and alignment survey. The hammering will be carried once the approval from the COM is available. In this activity, district level forest authority and other affected forest managers including community forest user groups, Collaborative forest management group, district forest office, proponent and others related will identify all affected trees and will participate during the process of "hammering of the trees".

Loss of bushes and scattered trees due to site clearance:

It was found that during the highway expansion, proposed alignment, within the ROW, will traverse a linear distance of 169.61 km of forest clearing some 341.36 ha of forests with most affected Government Managed Forests (45%), followed by Community Managed Forests (31%). For a better access, scattered trees, bushes are cut and weeds removed. Details are presented in table 6.3 at district level and more details in Annex 6A. From forestry perspective, most affected districts are 6 out of 10 where highway traverse. The project districts are i) Bara, ii) Rautahat, iii) Sarlahi, iv) Mahotari, v) Dhanusa, vi) Siraha, vii) Saptari, viii) Sunsari, ix) Morang and x) Jhapa. Among them, Bara, Rautahat, Sarlahi, Mahotari, Morang and Jhapa have most rich biodiversity along the project area. Bara is the most affected district with 89.6 ha followed by Rautahat. Mahotari is the least affected district. In total 341.36 ha of forest has been estimated to be affected, both sides of the MRM. Of all the districts, most affected district is Morang. Table 6.1 shows district level area affected and more details can be found in Annex 6A.

Table 11: Forest area affected in the project area will be updated

SN	Name of Districts	Affected	
		Linear distance of Forest (km)	**Area of Forest (Ha)**
1	Bara	44.80	89.6
2	Rautahat	44.44	88.89
3	Sarlahi	21.73	43.45
4	Mahotari	17.97	35.94
5	Morang	26.52	53.04
6	Jhapa	14.15	30.44
	Grand total	**169.61**	**341.36**

Source: Field Survey, 2017

The Community forests are most affected (67.5%), followed by Government Managed (14.3%) and Collaborative forests (9.1%). A total of some 77 different ownerships (or management groups) were affected. Please refer to table 6.2 for more details

Table 12: Affected forests and management regimes

SN	Forests	District							
		Bara	Rautahat	Sarlahi	Mahotari	Dhanusa	Morang	Jhapa	Total
1	Community	4	9	6		1	29	4	52
2	Collaborative	2	1	1	2		1		7
3	Government	3	2	2	1		2	1	11
5	Religious						1		1
6	Protected Area	1							2
7	Sagarnath FPDP			1	1				2

8	Jadibuti -pvt						1		1
9	Conserved/Potential CF						1		1
	Total	10	12	10	4	1	35	5	77

Source: Field Survey, 2017

During the *pre-construction phase* of the project, there will be several visits to these affected forests to study the nature of the forest, its type and other parameters. Forestry expert visited these forests with a team comprising of assisting foresters, forest managers and DFO staff to document affected number and kind of trees, its size and volume, Biomass and Carbon and area of forest that will be cleared for the upgrading of the MRM. The attention was paid to study, if there are any special blocks comprising endangered or threatened trees species and/or other flora that necessary action could be proposed. Similar visits were made by other experts on Terrestrial Wild animals, aquatic wild animal and flora, herpeto-fauna, and avifauna distribution in the project area. The study identified that most affected forest type was Sal Forest Type followed by Terai Mixed Hardwood Forest Type.

Table 13: Distribution of affected forest area (ha.) from forest management perspective

'Districts	*Community Forests*	*Collaborative Forest Management*	*Government Forests*	*Parsa National Park*	*Sagarnath and Ratuwamai Forest Development Project*	*Jadibuti Area*	*Total*
Bara	12.84	23.91	25.78	27.07			89.6
Rautahat	27.34	21.39	40.16				88.89
Sarlahi	12.86	14.76	1.07		14.76		43.45
Mahotari		15.57	2.13		18.24		35.94
Morang	40.58	2.12	7.13			3.21	53.04
Jhapa	11.65				18.79		30.44
Total	**105.27**	**77.75**	**76.27**	**27.07**	**51.79**	**3.21**	**341.36**

Source: Field Survey, 2017

According to study, 341.36 ha of forest land will be cleared to expand Kakarbhitta to Pathliya section of MRM. This, however, will take place in other segments of KP corridor but not in KDP Road. This forest land will no more be available for forestry again. There remains possibility of this area increasing, if proposed bi-pass and Twin Bridge has to be accessed in the Saptakoshi River. Present study was carried all along the existing MRM. A detail study for the bi-pass and new twin bridge proposed is yet to be studied. The new bridge proposed is 800 m north of present barrage at Saptakoshi. This will be a twin bridge accommodating Nepal Railway and MRM.

Wildlife disturbance in ecologically sensitive areas

KP Sections accommodates 14 km of Parsa National Park, Bara district and 2 km of Koshi-Tappu Wildlife Reserve in Sunsari district. Further about 1 km of Betna Wetland in Morang district and 0.5 km of the Bat habitat of Ratuwamai Plantation Project in Jhapa district. During ore-construction phase, frequent visits to these forests might disturb the wildlife present in the ecologically sensitive area. The most affected project districts are Jhapa, Morang, Mahotari, Sarlahi, Rautahat and Bara. Important species are Elephant, Tiger and other threatened animals.

Destruction of wildlife habitats and movement corridors during site clearance

During the construction of a new road, loss and fragmentation of suitable natural habitat and high poaching pressure are the main threats to biodiversity conservation in Nepal. Fragmentation of habitats has limited the dispersal and recolonization of rare species such as tigers. Fragmentation of habitat has also increased the amount of forest edge, increasing predation and competition from exotic and pest species. Many of the national parks and reserves are too small and too isolated to maintain populations of many larger/mega species.

Consideration of landscape in general: west section of the road

The alignment passes through the sub-topical zone, foothills, also known as the Bhabar tract, along the southern part of the Himalayas. It traverses through the Terai region, mostly while in Saptari and Sunsari districts of the project area. KP section was constructed through the forests, which now have grown towns in the eastern blocks of the alignment, project districts such as in Jhapa, Morang and Sunsari. Western Blocks are still largely occupied by forests, mostly in Bara, Rautahat, Sarlahi and Mahotari. These districts have Terai Mixed Hardwood Forests and Morang and Jhapa districts have most luxuriant and fastest growing Sal Forests, as this is the most monsoons receiving area of the country. Dhanusa, Siraha, Saptari and Sunsari represent the agricultural land which is a part of the main agricultural growing land of the country.

ii) *Construction Stage*

At this stage of the project, most environmental destruction takes place. Clearing and removal of standing poles and trees within the ROW together with regeneration, seedling, saplings, climbers, grasses and NTFP being harvested to build and expand the highway. This process will be accomplished by DFO, together with the forest managers. The DFO is assisted by the proponent to keep the record of the trees and poles hammered. The proponent will also help DFO in training the forest users/managers in harvesting, sectioning, hauling and pile/store/yard the timber harvested, which is handover to concern later.

Clearing of Forest and loss of vegetation and grazing area

Trees (and poles) within the 50 m of ROW will be harvested for the construction required for expansion of the highway. According to inventory only six districts of ten are affected. Dhanusa, Siraha, Saptari and Sunsari districts of the proposed alignment will not have major forests affected. MRM was built around 50 years ago and there is no evidence that these areas were used by wild animals. Small grassy species along the road are periodically grazed by cattle, this area can be calculated easily using GIS technique. However, during establishment of labour camps, opening up of borrow pit /quarry areas and construction of access routes to such sites, forests will be cleared and trees and poles will be cut. Loss of such vegetation during making of access roads and other activities has not been studied. A total of 72,092 trees with Diameter at Breast Height greater than 10 cm will be lost. According to forest inventory, Morang is the most affected district followed by Jhapa and Rautahat. Corresponding value for volume, biomass and carbon has been calculated for needed activities. Together with the removal of 72,092 trees, a sizable number of seedling/regeneration and saplings will

also be lost. Large number of various grasses, climbers and other flora will also be eliminated from this area. Estimated number of seedling/regeneration lost is 2,776,789 and sapling 296,820 (Table 6.4).

Table 14: Summary of loss and replacement plantation

Name of District	Total loss of				Replacement plantation	
	Trees	Tree Volume	Biomass	Carbon	Sapling required	Area required
Bara	7078	3600.68	5478.53	2355.77	247730	110.59
Rautahat	10666	3036.31	3990.93	1716.10	373345	166.66
Sarlahi	5215	1715.97	2412.26	1037.27	130393	81.48
Mahotari	5534	1246.6	1709.80	735.21	193690	86.47
Morang	28373	1283.41	1608.50	691.66	993055	443.33
Jhapa	15226	529.84	592.21	254.65	532910	237.91
	72092	**11412.81**	**15792.23**	**6790.66**	**2471123**	**1126.44**

Source: Field Survey, 2017

In total 341 ha of forest land will be lost and cleared. Cleared forests are of Terai Mixed Hardwood East of Saptakoshi River and Sal Forests in Morang and Jhapa districts. Roadside plantations will be totally affected.

Use of forest products and fuel wood by the construction workers during construction activities

Established labour camps might impact the forests, and forest vegetation might be degraded due to harvesting of trees for fire wood. If such activities take place, it will be additional burden to sustenance of forest. Using of wood for the boiling of bitumen is also very likely. Together with harvesting, trampling of soil also has equally harmful effect on floral biodiversity. Visiting forests for fuelwood, construction wood, and other activities will harden the forest floor making it unsuitable for regeneration. Regeneration of grass, seedlings and other tree species may be difficult, linking it to herbivorous animal for grasses. In the long run other animals as well will also be affected. Illegal harvesting and trading of trees and other forest products are also likely.

Hunting and poaching of wild animals by labors

Labor and workforce and other people involved may be involved in illegal collection and selling valuable NTFP, hunting wildlife, birds and other forms of activity harmful to biodiversity in the project area. Digging pits, putting nets, using heavy logs as arrows to kill mega animals are some other activity used in hunting wild animals. Therefore, considering these potential impacts, it is necessary to take suitable measures to minimize or overcome these. These activities could be more in Morang and Jhapa.

Forest fire

The labor camps if not properly managed, they may haphazardly use fire, cigarette left overs, matchsticks, etc. Forest fire can be human induced and natural. Natural fire hazards are most likely along the Bhabar tract, east of Saptakoshi River. Forest fire is common in the Siwalik and Bhabar tract. The labors, if they do not care to put the fire off, may cause serious damage of forests by fire affecting wild animals and flora.

Impact on wildlife

The proposed expansion of K-P section of East-West Highway will pose multiple impacts on diverse ecosystems and wild fauna, if provisions for appropriate mitigation measures are not made. The number of possible impacts on wildlife and its habitats are described below:

Loss and Disturbance to natural habitat and critical natural habitats

Loss and fragmentation of natural habitat, high grazing pressure and poaching are the main built-ups and threats to biodiversity conservation due to construction of this expanded MRM. The alignment passes through Parsa National Parks. The total section of the road only 14 km lies within the border of the Parsa National Park area; Koshi-Tappu Wildlife Reserve, Betana wetland and other environmentally-sensjtive areas will not affected by the upgradation og KDP Road. Wildlife movement corridors in Parsa National Park can be affected. Upgrading activities along highway, felling of trees, digging of ground may cause disturbance to wildlife and their movements on road stretch crossed by natural forests. In addition, different kinds of noises from machinery may disturb wildlife harbored in local natural forests, including their free movement and hunt for natural prey, thereby posing threat to ecosystem supporting them (Ch. 21+400 – 21+500, 33+340 – 33+600, 35+000 – 35+400). Bara, Rautahat, Sarlahi, Mahotari, Morang and Jhapa will be the most affected districts. A very visible environmentally-sensitive area is the bat habitat in the main gate area of Ratuwamai Plantation Project. This forest has been found providing an excellent habitat for bats. A huge colony of Indian Flying Fox (*Pteropus giganteus*), including *Pipistrellus sps.*, *Megaderma lyra* and *Scotophillus heathi* were found in this forest, living on eucalyptus tree. The total number of bats in this colony is more than 5,000 pairs. Because the habitats of these bats are located within the ROW, they can be directly impacted by the highway expansion. Removal of roosting trees will have devastating impact on the bats as they strategically select trees for colonies. Environmentally-sensitive habitats, including roosting areas fir bats, will be avoided to the fullest extent following mitigation hierarchy.

In KDP Road that passes through the southern border of Parsa National Park that has recorded presence of one critically endangered species, the Chinese pangolin *(Manis pentadactyla*) and two endangered species, Wild Asia elephants (*Elephas maximum*) and Royal Bengal tiger (*Panthera tigris tigris*), a critical habitat screening was conducted as part of the ESA following the criteria set forth in ESS6, IFC PS6 and IFC PS6 thresholds. The screening indicated that these critically endangered and endangered species are widely distributed in South Asia and the Himalayas and given the small area considered as Ecologically Appropriate Area (EEA) (i.e., 300m Direct Impact Area of KDP Road), the upgrading of the existing road segment is not expected to affect the global population of these species. Also based on screening, it appears that there are no critical habitats within the EEA/DIA of the project. This will be further studied and validated in the Biodiversity Assessment as part of ESIA at the detailed design stage of KDP road

Habitat fragmentation and barrier to wildlife movement

Following habitats and wildlife movement routes are likely to be affected after expansion of the highways where modification on highway alignment is not possible in existing context and where ESMP will not be implemented properly, including the Biodiversity Management Plan (Table 15).

Table 15: Wildlife corridors likely to be disturbed

Area (points)	Lat/ Lon	Significance	Road Segment
Migratory route between Dudhaura and Balganga bridge	N27.17668 E085.04626	Elephant movement corridor/route (north-PWR and South-CBFM)	KDP
13 kilometer (Pathlaiya-Nijgadh) bridge/causeway (within the proposed upgrading section)	N27.16701 E085.10745	Elephant Migratory (MRM crossing point) route	KDP
Pasaha River	N27.16795 E085.07177	Frequent movement elephants and other mammals	KDP
Causeway after 13 kilo	N27.17105 E085.11956	Elephant movement route	KDP
Piluwa Migratory Route	(200m east from Piluwa APF check post) N27.16959 E085.06973	Movement of deer, wild boars	KDP
1st, 3rd and 4th Causeway (Nijgadh – Chandrapur)	1st causeway N27.15022 E085.25257 3rd Causeway N27.13709 E 085.32729 4th cause way N27.13571 E085.33694	Elephant Movement routes	KDP
Water hole after 4th causeway (Bag Daha) around 200m	N27.13492- E085.34106	Water source for deer, wild boar, Nilgai	
Water Pound (after Chandi river)	N27.11340 E085.37112	Habitat for Migratory birds and drinking source for small mammals in dry summer	KDP
Bank forest (Sagarnath Plantation (green belt in south and area of collaborative forest in north)		Around 22 Km long forest patch Habitat for small mammals including cat species	KDP
Koshi Barrage		Wild buffalo and other animals from Koshi Tappu Wildlife Reserve crossing point	Birtamode- Kanchanpur
Betana Wetland	N 26.65917 E 087.43173	Habitat for migratory birds and other aquatic animals	Birtamod-Kanchanpur
Ratuwamai plantation (North of Highway)	Ratuwamai (N26.65535, E87.70474) Kankai (N26.65665 E087.87198)	Habitat of Bats	Birtamode-Kanchanpur
Surunga Forest area (attached to Highway)		Biodiversity and Migratory route of small mammals and reptiles	Birtamode-Kanchanpur
Forest area of Charali, Jhapa		Elephant movement route (trans-boundary + residential)	Kakadbhitta-Birtamode

Source: Field Survey, 2017

Impacts on wildlife due to Spoil disposal and quarrying materials:

Unmanaged disposal of spoils may cause blockage of natural drainage, create artificial marsh land in summer, cover forest or vegetation and create open bare ground space. Similarly, during construction, clearance, excavation of slopes, foundations of structures not only generate huge debris but also decrease scenic beauty of the area. Large amount of construction materials such as boulders, sand and aggregates are required for pavement, retaining walls, gabion walls and other structure construction. Such materials usually are often extracted from nearby rivers or quarry sites. The extraction of materials from inappropriate places or in excessive amount can seriously damage local environment, wildlife habitats, accelerate soil erosions, and cause landslides in quarry sites.

Impacts on wildlife due to Camp sites and Storage depots:

Establishment of camps for labor, asphalts heating sites, deposition of sand and aggregates will encroach either forest areas or agriculture lands. Regular residents of labor camps will alter movement of not only diurnal wildlife but also nocturnal wildlife. Poaching of wildlife by labors from outside is likely to occur. In addition, these camps will alter drainage, produce solid wastes, waste waters and change the forest cover composition in the long run.

Disturbance to biodiversity and wildlife and Effect on Road-side Habitats

At the construction stages, animals inhabiting all critical habitats along highway will be impacted by disturbances associated with construction activities. Some of them, like bats in Ratuwamai plantation will be affected directly through removal of roosting trees or Betana Wetland through destruction of wildlife habitats in the direct impact zone. Others, like biodiversity of Parsa National Park and Koshi-Tappu Wildlife Reserve, may be affected indirectly – by increased barrier effect, pollution and loss of connectivity.

14 km road is boardered in the Parsa National Park of this KDP section. There are identified 3 wildlife crossings within the Parsa National Park. The Park is sensitive for the biodiversity and wildlife aspects.

Damage of aquatic habitats with the construction of bridge foundations along the Rivers

During the construction stage, there may be significant impact on aquatic wildlife and herpeto-fauna. Fish species will be significantly affected during construction of bridges over the rivers. Erosion from poorly constructed and rehabilitated sites can lead to downstream siltation, ruining spawning beds for fish. Constructions of flows at water crossing can make the current too fast for some species. Roads may also serve as barrier to movement of migratory aquatic species, especially where culverts are used. Higher number of fish species is recorded in Sapta Koshi river compared to other rivers. Building twin bridge in the Sapta Koshi river will impact the aquatic wildlife. Construction of bridges on Bagmati, Kamala and Kankai River will significantly impact fish species in the rivers. Uplifting of water filled ditch for building of foundation of bridges mix with water increasing water turbidity inducing impact to phytoplanktons and zooplanktons of the rivers. Increased water turbidity will decrease phytoplankton number and reducing food availability for fish. One fish species, i.e. Longfin freshwater eel/Indian mottled eel (*Anguilla bengalensis*

bengalensis) observed in Bagmati River is under vulnerable category in IUCN Redlist of Threatened Species. Gangetic River Dolphin inhabiting Sapta-Koshi River is also globally threatened.

Disposal of excavated materials from water bodies may increase turbidity of water and result in reduction in dissolved oxygen content. During construction, more construction vehicles will be moving on the road section. So, it is common to see the inappropriate driver practices connected with vehicle washing in the rivers, which can cause local water pollution by leakage of fuel, lubricants and hydrocarbons. This will affect the life forms in the water body and the hazard/pollution also affect people and animals using these as drinking sources downstream. Continual water pollution will also affect the aquatic biota, with subsequent negative consequences for fisheries and the economic return of fisher folks, depending on these natural resources.
There are altogether 72 rivers and rivulets in the KDP section. The aquatic environment got impacted due to the construction activities of the bridges.

Impact on aquatic life due to siltation and other hydrological changes
In the area where labor camps are in operation and during construction phase activities like fishing will increase. Direct disposal of wastes into rivers from the camps will have threat to fish and herptile species. In order to minimize the expected impacts alternate arrangement such as provision of meat, waste bins and septic tanks, soak pits constructed as per site requirement before release to water bodies. It is likely that fishing may increase as the labors get the information, therefore, timely suggestion about prohibition of fishing is necessary and provision of alternative delicacy could avoid fishing.

Impact on Herpetofouna:
During the construction phase, higher influence of human activities takes place. Almost all the river/springs west of Bagmati River were intermittent type. These springs are devoid of aquatic and herpetofouna. Local people informed of the presence of frogs and rat snake in these rivers/springs and in the periphery (i.e. within 2 Km alongside the existing highway) which are very common species, therefore the effect on herpetofauna will be insignificant. However, excavation for new road, cutting and filling activities and continuous widening of road width with vehicular movement along the proposed road alignment will have significant impact upon small species such as frogs, lizards and snakes. If in the case of appearance of reptiles or and amphibian worker should be recommended not to apply any kind of actions that cause harm to animals or even have momentary halt in construction work. These animals will depart for the disturbed.

Spillage of oil, diesel in the river due to accident, washing of machinery in the rivers:
Road and bridge side accident and vehicle drop, direct disposal of waste into the river will have impact upon aquatic habitat. There are many natural drainages and major rivers along the alignment and the major ones are Bagmati, Kamala, Saptakoshi and others. Any sort of vehicle accident or drop of vehicle and spillage of diesel along these streams will have direct impact upon aquatic life. As sand wash points increase the turbidity at local level, washing of vehicle, occasionally does not matter but a point if created can have impact. It was recorded at the wash out or spillage from the

barrage, east of Sapta Koshi barrage. These activities not only have effect on the aquatic life, but also on the land being irrigated from the streams.

iii) Operation Stage

Impacts on forest resources

Road opening to public transportation and others following its upgrading works completion exerts indirect pressure on forests and forest resources through illegal extraction of firewood and timber. Timber mafia also surfaces up and become active as and when demand for the timber grew up from the outside. Good trafficable road conditions motivate them to take advantage of opportunity and earn money illegally.

Illegal felling of trees and Firewood

Increased edging of forest block due to fragmentation and harvesting of trees for MRM expansion will ease in access to the forests during the operation period. More likely that illegal harvesting and smuggling of trees, timber and non-timber products will increase in the time of road operations due to easier access to valuable forest products such as sal (*Shorea robusta), (Acacia catechu)*, and other trees with high price in the market. Illegal harvesting and trading of forest products and activity such as tree felling, wood cutting, illegal export of timber wood is common in the Terai districts. High potential remains in the districts such as Bara, Rautahat, Sarlahi and Mahotari districts. No forest will remain untouched with such activities. Significant impact is envisaged in government managed forests compared to Community, Collaborative, Private and Leasehold forests. During the early operation period, not only illegal felling, but encroachment of forests land can be observed also. Encroachment of forests is not a new situation in Nepal Terai region. Gradual encroachment into remaining parts of fragmented forest periphery could be seen, if proper measures are not taken. The population size of such encroachment grows rapidly in the Terai area.

In this process of illegal operation, local and distant transport vehicles are used to transport illegally harvested firewood. Firewood being most needed forest product by larger population in the Terai and elsMRMere, firewood is a cash-crop for the illegal traders. Thus, this expansion may exert indirect pressure on forests and forest resources through illegal extraction of firewood, timber and other non-timber forest products fetching higher value. Good trafficable road conditions may motivate them to take advantage of opportunity and earn money illegally. A proper monitoring of forest by responsible managers of forests may control over these illegal activities.

Forest fire:

Before monsoon, there is immense possibility of fire in the forest naturally. Forest fires are likely due to haphazard put out of cigarettes and matches by the persons travelling during the operation period. It is also possible that the cowboys put forest floor on fire to grow fresh flush of grasses for the herds of cattle, which is a practice in the Terai, they graze in the forest. Such impacts are more likely in the forests in Chure and Bhabar tract, where even the sal forest is more deciduous. Forest fire is also put by the hunters to corner the wild animals and bring out from their hides. All the illegal and natural phenomenon of forest fire will not be controlled by just putting few signs along the alignment, it also requires training the users and other managers of the forests to fight back the forest fire.

Fragmented wildlife habitats and permanent barriers for wildlife movement, especially for medium and small-sized species (amphibians, reptiles, small mammals, etc.)

Activities such as felling of trees, clearing of vegetation, digging of ground may cause disturbance to wildlife and their movements on road stretch within the natural forests. Such activities and human interferences have direct impact on the biodiversity as a whole. It is important to manage the devastated forests after it had been hit badly, trees felled, access roads made, soil, sand and gravel and dumped and chemicals spilled over the forest floor have to be normalized and brought back to normal natural conditions. Several activities connected in the process are in action together with cleaning and maneuvering forest floor for better growth and a good habitat is on process. Heavy, high speed and fast riding vehicles after upgrading the MRM may cause wildlife population converge into clusters to seek their safety or get segregated by force. Affected wildlife species such as common leopard, langur, leopard cat and others may either converge or leave the habitat. These species are listed as protected species in national listing and listed in CITES.

Increased wildlife road mortality and wildlife–vehicle collisions in the environmentally sensitive areas

It is essential to strictly control over-speed, noisy vehicles and speed in and around the critical forests area to have the wild animals undisturbed and reduce animal vehicle collision. Control over this disturbance can be minimised by educating the drivers as well, so signs and other informative displays will help. It is proposed to fence the expanded highway in the sensitive areas. Movement of wildlife, reptiles and amphibians in the forest area is high. Building of a fence restricts the movement of, especially medium and small-sized species (amphibians, reptiles, small mammals, etc.). As the expansion do not fragment existing habitat but fencing can create a barrier between the forests. Special passing is developed along the points specified (table 6.11, 6.12). Tables specify the size of underpass and the small mammals, amphibians, reptile friendly passes.

Hunting and poaching of birds and wildlife:

With improved road, there will be better access to traditionally remote areas that can lead to increased hunting and poaching on valuable wildlife species. On the other hand, management of overpopulated species becomes very essential for the health and avoiding competition for food and water under control of the Wildlife Authorities. Poaching of wildlife, especially endangered species such as Tiger, Rhino, Bear, Gharial and others is adversely affecting conservation efforts. The control of poaching outside protected areas has proven to be very difficult.

Increased disturbances for threatened and endangered species:

Important sites those harbor wildlife species are Koshi Tapu Wildlife Reserve, Parsa National Parks, Betana Wetland community forest, Belbari Pathari forests and Charali forests. These forests are inhabited by important animals which are threatened and endangered and the expansion and operations of highway will directly impact them. It is expected that highway operations may affect such species as Wild Asian elephants (*Elaphas maximus*), Royal Bengal tigers (*Panthera tigris tigris*), Gauri gai (*Bos gaurus*), Dhole (*Cuon alpinus*), Golden Jackal (*Canis aureus*), spotted deer (*Axix axis*), barking deer (*Muntiacus muntajak*), hog deer (*A. porcinus*) and wild boars (*Sus scrofa*),

one horned rhinoceros, water buffalo (*Bubalus bubalis*). Several threatened bird species may be impacted including Swamp Francolin and Bengal Florican as well as many reptiles and amphibians. Increased grazing pressure from livestock has largely displaced wild herbivores. Many wildlife mammal species have been adversely affected by grazing disturbance. Mammals and birds from the parks could be found roaming or passing through the MRM and proposed expansion. Nearby forests serve as corridor for wild elephant migration and seasonal movements from India to Nepal. Expansion of the MRM will affect these animals and birds in the area, as buffer zone of this reserve is traversed by the MRM.

Increased human – wildlife conflicts:

Prevention wildlife movements, barriers and loss of connectivity create problems and stimulate increasing the human-wildlife conflicts. Elephants and water-buffalo in the conditions of decreased habitat connectivity often ride agricultural fields looking for food. The number of human – wildlife conflicts in such areas has been increasing significantly. This problem should be solved through several initiatives, including improved and accessible for animals movement corridors.

Road safety concerns in wildlife crossing area:

The proposed alignment comprises significant length of community, collaborative and other forests and other vegetated areas especially at the beginning and last section. Parsa National Parks, Sagarnath, Ratuwamai and Belbari-Pathari forests and adjacent vegetated area are the major forests existing along the alignment where wildlife encounter is obvious. Road crossing by wildlife in search of water along the alignment in search of water sources is very likely. After upgrading of existing highway, traffic volume as well as speed of the vehicles will rise. These roads will be more challenging barrier than now for safe crossing and will be a major source of mortality affecting populations of reptiles, amphibians and mammals. Several animals including monkeys will have high chances of getting killed at the time of crossing the highway. The increased number of vehicles, high speed of such vehicles will deny access to critical habitats. Further, for the safety of the human and wildlife, the project will erect large fence along the forests along the alignment and habitations to minimize unwanted movement of human and wild animal. Present practice of free movement of wild animals and human will be checked.

Increased competition for resources between and within wild and domestic animals

Fragmentation and fencing of forests and wildlife movement corridor will segregate the animals to a smaller area comparatively. Mega animal like tiger habit/instinct is such that they do not tolerate the presence of others tiger in their territory. They in such situations have been found to have fought to death (CNP case, May 2018). In addition to it, in case of other wild animals, they have to share the food resource available, which they do not like and animal instinct such as fighting, moving out of the habitat, etc have been observed. It is hence necessary to primarily avoid the grassland if possible, create grassland, create waterhole, leaking spots and developing connectivity through underpass or overpass are some of the measures that can ease resource crunch and playground.

Impact on aquatic life due to vehicle drop, spillage of oil, diesel and washing of machinery in the rivers

Direct impact upon aquatic habitats during the time of operation is minimal. Road and bridge side accident and vehicle drop, direct disposal of waste into the river will have impact upon aquatic habitat. Any sort of vehicle accident or drop of vehicle and spillage of diesel along these streams will have direct impact upon aquatic life. Aquatic environment along the streams/river corridor is likely to be affected due to road side accident during the time of operation. Such impact has been envisaged largely at the bridge locations along the alignments.

Damage of aquatic habitats and disturbance of aquatic wildlife:

Major portion of highway stretch in Bara, Rauthat, Mahottari, Sarlahi, Morang and Jhapa districts have forests, which is habitat of wildlife including snakes, turtles and other amphbians. As the movement of wildlife, amphibians are high in the forest area, there is a higher chances of road kill of amphibians and reptiles during operation phase since reptile crawl and speed of crossing is slower. Thus, well-function underpass is necessary in the highway stretch along the forest area to mitigate the impact. Bridges present in the highway unanimously serve as wildlife underpass. Despite this, maintenance and improvement or new bridges are needed in the site where bridges exist. It is suggested that develop these bridges as underpass with amphibian, wildlife and reptile friendly manner to minimize road-kills. **Bhamara Khola Bridge (Bara district) in the stretch could be an appropriate example to consider.** There are higher chances of road kill at Amuwa Khola and Bankhe khola. These two sites are in the forest area, movement of wildlife is expected, and thus wildlife underpass is necessary to mitigate the impact.

Introduction of exotic and invasive species in the environmentally pristine areas:

The species selected for plantation are all those which are growing naturally in the Terai and Bhabar tract between Pathliya and Kakarvitta section, in close coordination with the forest groups managing the affected forests and regarding the exotic species, it should be well tested with all the aspects of the species reacting to the Nepalese nature. Some species other than those growing naturally for replenishment plantation are *Eucalyptus camaldulensis* and other *Eucalyptus spp.* Another exotic species that have performed well is *Tectona grandis, Bakino.* Both these species are fast growing and good pole, furniture wood and best firewood. There are some pine species also (Amatya 1963). Among the native species are *Dalbergia sissoo, Dalbergia latifolia, Shorea robusta, Acacia catechu, Michelea champaka, Terminalia spp,* etc.

CHAPTER 7: SOCIAL IMPACTS

7.1 Socio-economic and Cultural Environment

The expansion of this Pathaliya-Kakarbhitta section will have both positive and negative impacts on socio-economic and cultural environment:. The positive impacts are associated with the improvement of the road, access to the road facilities, increased economic activities, opportunities for training and business development, education and health facilities, participation in development activities, employment opportunities and open chances for people migrated from the rural to urban areas for the better access to services and opportunities. But on other side of the coin, there are many negative social consequences during the pre-construction and construction periods and in post-construction period too. It has impact on social cultural environment, cultural contamination, and impact on natural resource such as drinking water, dust, noise, and pollution, which brings different disease (water borne diseases, diarrhea, typhoid, dingo, etc.). During the construction period, local people may have an intercourse with migrated people then there will be transfer of the diseases such as HIV/AIDS/STD and Hepatitis "B" and it wil have an impact on girl trafficking and affect livelihood, marginalized groups, vulnerable groups, and thus will have cumulative positive and negative impact.

7.1.1. Commercial & economic activities

The road expansion would increase commercial activities. Exchange of goods and services would be carried out mainly in city market center from the rural areas. There are several traders in the market along the road side areas with wide range selling of products including foodstuff, clothes, beverages and household goods among other products.

7.1.2. Education facilities

There are primary, secondary and higher secondary schools that are functioning properly. But, they are not well equipped and lack essential infrastructures like library, playground, proper building and classroom, teaching materials and refreshment training to the school teachers. Villagers have not understood the importance of education. Therefore, Secondary Schools are not maintained properly and financed by the municipality or rural municipality budget and villagers themselves through household contribution since the local government has neither the adequate funds nor could it provide for teachers.

7.1.3. Transportation facilities

The project area is located in many municipal and rural municipalities with in the project implementation districts. After the expansion of this project, KP highway can facilitate in transportation in many connected districts and intersection of highway. This expansion of highway will help in an availability of communication facilities (telephone, postal services etc), business development and economic activities.

7.1.4. Strengthening of local economy

Local economic benefits from the project are those, which accrue to employees and the wider community, over and above the benefits accruing from alternative income generating activities. Similarly, during the construction phase, the generation of local employment opportunities will act

as a catalyst to stimulate the local economy. Increased income in the area will encourage the formation and growth of local businesses, which will in turn create new indirect employment opportunities. Similarly, the availability of cash from employment and provision of goods and services will result in opportunities for investment. As a result, new shops, hotels and residential structures will be established to meet the demand of the construction related population for essential commodities.

7.1.5. Local employment, training and business opportunities

Due to the semi-urban and rural municipality of the project site especially in an area of high poverty levels, the project will have significant positive economic and social impacts for the marginalized communities in the project area.

The people from affected area stand to gain benefit in terms of job creation and income generation. During construction period, the project will give first priority to recruit required employees from the local area. Both skilled and unskilled workers willing to work in the project will be selected from the project affected families and local areas as far as possible. There will be an employment opportunities for the local community during the construction and operation phases of the project such as masons, carpenters, cooks and indirect spins-off, such as livestock and fish trade, ecotourism, etc.).

7.2 Adverse Impacts on Socio-economic Environment

The socio- economic negative impacts of the project will be triggered mainly by the increased population in the project area following the commencement of the proposed project. As the local community and other people from outside the project area respond to employment opportunities, the project area will witness an increase in human population in this remote area. This influx of people is likely to lead to a number of negative socio-economic impacts including livelihood, cultural contamination, increased incidences of diseases, increased insecurity and community conflicts, challenges of labour force management, increased accidents, and occupational hazards.

7.2.1. Impact on private and public structures

The Government of Nepal already acquired the land within 50 meter ROW even though regarding of migration and to survive their livelihood people had made temporary structures for the different business purposes such like tea shop, haat bazar and daily livelihood goods. Most of the concrete private building has been made on beside of 50 meter Row. Even though some private structures such as toilet, wall and structures passage need to be acquired for this project as well as many public structures such as temple, cremation yard, pond, public tap, bus waiting also need be acquired. The structures impacted by this project are RCC, Kacchi/Tahara as well as community structures too.

7.2.2. Commercial trade by alcohol beverage

During the field visit many alcohols hoarding board were hanging at house and posting at different place of this KP section. Hence, there were a lot of foodstuffs, in restaurant with beverage items so there might be transaction or business activities of alcoholism.

7.2.3. Indigenous people and vulnerable and disadvantaged groups

Indigenous people, dalits and women need to be considered as vulnerable groups in the project area. These groups are expected to experience the same physical and economic impacts experienced by the larger population largely due to the same economic livelihood patterns and engagements. However, due to low level of marketable skills and lack of proficiency in competencies of these vulnerable groups it is most likely that many of these groups in the project area will be in a disadvantageous position. Hence these groups might have necessity of employment opportunities during the construction phase. Where the Environmental and social assessment of project identifies specific individuals or groups as disadvantaged or vulnerable, the borrower (Clint) will propose or implement differentiated measures so that adverse impact do not fall proportionately on the disadvantaged or vulnerable and they are not disadvantaged in sharing any development benifits and opportunities resulting from the project.

7.2.4. Health and sanitation issues

Health and sanitation issues (water-born vector disease transmission)

During the construction the road would be made dusty and noisy in the road areas so that it may bring waterborne diseases which can significantly impact the community. During construction, the project area will witness an increase in population due to an influx of workers and service providers. The increased population will further strain the local water supply, health, and sanitation facilities, especially around the construction camps. In addition, lack of proper sanitary measures and increases in water pollution and waste can lead to outbreak of epidemics and diseases such as jaundice and typhoid, particularly among the elderly, women, and children. The influx of a labor force from other areas will probably spread sexually transmitted diseases, including HIV.

This polluted environment influences the water pipe, drainage and natural water resource. When people are infected by a waterborne disease, it creates huge financial burden for their treatment. The financial losses will be lost mostly in medical treatment and medication, costs for transport.

7.2.5. Road accidents

During the construction there might be road accidents hence there is need of a safety measurement and counseling to the community. After completing, this highway the vehicles will run in high speed and the road accident may increase. The main reasons for this road accident are the extremely dense road traffic and the relatively greater freedom of movement given to drivers. More accidents involving heavy goods vehicles (especially coaches and lorries with trailers), occurring as well as the obligation for drivers to adapt their speed, which affects stopping distances, to the traffic and weather conditions (rain, ice, fog, etc.). The wildlife animals are also in road accident by bus and other during out field visit period. The prevention of road accidents is also extremely important and will be ensured by strict laws, by technical and police controls, ongoing training for drivers and speed breakers mechanism in this road improvement.

7.2.6. Cultural contamination

During the construction and implementation of this project ,there is a need to facilitate an interaction of people of different cultures in the project area. Although the local community is fairly a conservative society, influence from outsiders is likely to impact negatively on the local community cultural norms and practices. To some extent, there will be changes in community values, clothing,

behavior and other attributes. Based on experiences from other projects, the project workers from different cultures are likely to introduce unfavorable social behavior including theft, increase in the consumption of alcohol, production of illegal brews and introduction commercial sex among other vices. This will promote cultural contamination in the project area leading to long-term erosion of the normal community way of life.

7.2.7. Transfer the HIV/AIDs/STDs

The influx of people in the project area and environment is likely to increase the incidences of diseases. The situation will be aggravated by the entry of commercial sex workers into the area following the commencement of project activities. There is therefore the risk of contracting sexually transmitted diseases (STDs) especially the dreaded Human Immune-deficiency Virus / Acquired Immune-deficiency Syndrome (HIV/AIDS) among the project workers. This could have serious health implications for the project workers and the local community in the project area and surroundings. With regard to the influx of commercial sex workers into project area following the project activities, the project should be prepared for an increase in the prevalence of HIV/AIDS. To prevent the spread of HIV/AIDS in the project area, the developer and other stakeholders including the administration, community leaders, opinion leaders, and other stakeholders must organize and support education programmes to increase awareness and change public attitudes towards HIV/AIDS and other sexually transmitted diseases (STDs).

7.2.8. Labour Influx

During construction of road, large number of human resource will be engaged. Among them labor force is in significant number of human resource. Management of labor force is very difficult part of contractor. It was noted that the discrimination wedge and other facilities exist. Gender Base Violence, during construction is another serious issues. GBV emerge particularly as a result of labor influx. There are several causes of this social problem in Nepal. Regarding of the poverty and lack of job opportunity and good education, it is very easy for the broker to share them with the temptation of good income. They take the girls with them and sell them. So they are easily persuaded by the traffickers. Still many people, especially women, and girls, are not aware of girl trafficking so during the expansion of road or beyond broker can encourage them for handsome salary and sell out them in near border or out of the country. Hence this project should put awareness program for the community and all stakeholders.

7.2.9. Human – Wildlife conflict

The basic scenario of this highway is that there is human wild life conflict, i.e conflict between people and animals as one of the main threats. During field visit time the wild elephant had entered into the community and killed locals' people. The elephant had destroyed crops, livestock, property and sometime their lives into this project area. If adequate solutions to conflict are not provided local support for conservation also declines as people lose their crops, livestock, property, and sometimes their lives in each month and year. Hence human wild life conflict needs to be considered in this project area.

7.2.10. Water-logging Issues

During the monsoon season the highway road embankment has created water logging problem at this project area. Due to steep slopes and intense monsoon rainfall from chure region, soil erosion mainly by water, is the major land ruin in process in terai area. Some areas are affected by deposition and water logging. Water logging is creating huge problem during the monsoon period in depression of the terai region and make flood prone areas. These floods damage the fertile plains land by huge concrete and sediment terai region. This soil erosion is main issues in terai region as well as landscape aesthetics.

7.3 Management Issues

The road is envisaged to be constructed with labor-intensive technique as per the intent of the Proponent. The management issues associated in this project will be of two pronged: one with local people working as unskilled labors, and second is contractor. The work will also include several stakeholders including Consultant, NGOs/CBOs, sub-contractors etc. Thus, following management issues needs to be addressed throw ESS2 Labor Management Plan.:

7.3.1 Management of labor force

This project management should make good effort in place mechanisms to deter the work force from engaging in cutting of trees for fuel wood, charcoal burning, and building material and for any other purposes. Due to the sensitivity and vulnerability of the project area, the developer / contractor should use pre-fabricated material (which can later be retrieved at the end of the project) in building the labour camps. This will deter the labour force from unnecessary cutting and trampling of vegetation and enhance the protection of the scanty natural vegetation of the project area.In order to maintain a healthy environment for the labour force, the project management should put in place suitable measures to clean the environment associated with labour camps. This will include proper disposal of human waste.

7.3.2 Gender sensitization

Gender sensitization in first instance, tends to change the perception than men and women have of each other. It creates a mindset in men that no longer sees in women the stereotypical image. The impression that women are a weak and unequal entity no more clouds the minds of common man. Rather they are seen as responsible and equal partner in socio-economic development and capacity building to the gender. Gender sensitization programmers are generally organized for groups of people. The major aim of such program is to bring a definite orientation in thinking, practices and approach of individual concerning gender about their right and duty, labor cost, health and safety security too.

7.3.3 Establishment of child care & Health and safety care centers

During the construction, female worker will be engaged so there is need of child care center which will be established in the construction site for sake of convenience of lactating mother on consensus decision of groups. Regarding this situation there would be conflict with male and female worker. Hence, the care taker will be responsible in taking care of dependent children of lactating mother workers in the construction site.

7.5 Enhancement and Other Issues

Enhancement issues like protection of springs/spouts, bar-peepal chautaries, gumbas and other issues (formation of public tap stands, construction of vegetable market sub-center, etc.) need to be considered. Any other issues that are not incorporated in this report shall be incorporated in the final ESA. ESA Report shall be prepared based upon baseline data collection and public interactions.

CHAPTER 8: ASSESSMENT OF CUMULATIVE IMPACTS

8.1 Specific assessment of the Road Segments along the KP Corridor

A site-specific ESIA for the KDP section, including bridges, will be conducted by an independent consulting firm during the detailed engineering design phase based on this ESA. This will be included as one of the future actions/commitments to be reflected in the Environmental and Social Commitment Plan of the SRCTIP.

8.2 Scenario-based Analysis of Environmental and Social Impacts

The development of project on the upgrades of Patlaiya - Kakarbhitta alignment and bridges is planned in the fast emerging region, where several linear projects have been considered and currently they are at the stages of design or implementation. Doubtless, that several large linear projects and other development initiatives will have huge impact on environment, which can lead to disastrous consequences for local economy, community livelihoods, and to the loss of important environmental elements.

Cumulative impact assessment (CIA) is an approach to an Environmental Impact Assessment, which aims to consider the effect of multiple actions or impacts on environment. CIAs are undertaken, where there is a likelihood of significant impacts from more than one activity or when it is necessary to inform broader planning scheme, often at the regional scale.

There are several different types of cumulative impact approaches including:

- Cumulative impact of combined elements of a single project;
- Combined effects of a proposed project and previous actions;
- Cumulative impact of multiple projects on a single environmental value or assets.

Causes of the cumulative effects may be different and relevant to:

- Space: when environment is disturbed by similar activities or different activities producing similar effects (for example, several linear projects in the Terai Region within the same boundaries);
- Time: when impacts are so close in time that effects from the one action do not dissipated before the next occur (For example, regular discharge of liquid wastes into the river alternate ability of river for resilience);
- Interactions: when several agents combine, causing stronger impact (For example, compounding dust and noise effects disturbing wildlife and affect habitats);
- Indirect impacts: arising as a result of direct effects and include impact of activities facilitated by project (For example, direct barrier effect of the road bisect wildlife habitats

into parts; but following habitat fragmentation is indirect impact on ability of population survives).

There are five tasks for scoping CIA to spatial and temporal extent. Those tasks are presented below with associated project materials and brief description.

8.1.1. Issue identification;

In the current ESA project, the issues were identified and presented in Baseline Assessment Report. The expected cumulative impacts counted 14 issues arising in the result of the Pathlaiya-Kakarbhitta section improvement. The most important among them are:

- Facilitated development and land use change;
- Increased urbanization and human encroachment along the road;
- Changes in social structure and occupation;
- Water-logging along the road due to barrier impact, siltation and impact on aquatic life;
- Fragmented wildlife habitats and migration corridors and as a consequence increased human-wildlife conflicts, especially in biodiversity rich areas;
- Changed esthetics of the landscape, loss of biodiversity and land productivity due to interaction between various adverse impacts on the landscape scale, associated with lack of coordination between several linear infrastructure development projects.

8.1.2. Selection of environmental values or sensitive receptors (VECs approach);

Valued environmental and social components (VECs) in current project were identified in consultation with interested stakeholders, including affected communities, conservation NGOs, District Forest Officers, staff of Parsa National Park and Koshi-Tappu Wildlife Reserve.

Selected valued environmental and social components in current project include:

- VC1: Topography and Geomorphology - Bank slope conditions: (erosion);
- VC2: Natural drainage systems: (flooding, siltation);
- VC3: Soils: (erosion, top-soil damage and contamination);
- VC4: Ambient environmental conditions: (air and noise pollution; solid waste management).
- VC5: Environmentally sensitive areas: critical habitats, valuable ecosystems and wildlife movement corridors (affected by number of direct and indirect impacts);
- VC6: Terrestrial habitat: forest areas;
- VC7: Aquatic habitats: wetlands and other water-bodies, fish species, Asian River Dolphin;
- VC8: Threatened and endangered species: Asian Elephant, 14 indicator species;
- VC9: Land and resource use;
- VC10: Population, infrastructure and services;
- VC11: Economy and wellbeing;
- VC12: Community life.

All valued components were in details described in the Chapter 4. They also were used for identification and characterization of issues, arising and predicted impacts and mitigation measures in the previous chapters. Some of the selected valued environmental and social components and

their indicators will be analyzed, when carrying out a CIA as sensitive receptors such as Critical Habitats (Parsa National Park and Koshi-Tappu Wildlife Reserve), threatened wildlife species (Gangetic River Dolphin, Asian Elephant and 12 other selected indicator species), wildlife movement corridors, natural drainage systems, etc.

Prioritization of VECs has been done in the Chapter 4 of current project following to specific questions such as importance of selected components for people, regulatory requirements, potential for substantial project effects, key for ecosystem function, indicator species, umbrella indicators, potential for the analysis of existing and post-construction conditions, etc.

8.1.3. Setting of boundaries – spatial and temporary

Spatial boundaries for current ESA project are described as Right of Way (RoW), Direct Impact Area (DIA) and Indirect Impact Area (IIA). Spatial boundaries of the project were identified at the stage of Baseline Assessment Report Preparation. The study of direct impacts was focused mainly on the 150 m buffer zone from each side or 300m road corrido, representing the direct impact area. Indirect impact area was defined as 10 Km buffer at each side from centerline of the road or 20 km corridor, which will be considered in terms of indirect and cumulative impacts of highway and other linear structures development in the scenario-based analysis below. This area is also considered as indirect area of project influence, where indirect impacts alternate ecological connectivity of landscapes.

Spatial boundaries of the project selected for CIA allow to consider the migratory corridors and wildlife habitat ranges in the project area, which are more likely will be affected by multiple cumulative impacts, associated with implementation of several linear and other development projects in the area. Cumulative impacts on environmentally sensitive areas and selected indicator species also will be considered.

Temporary boundaries are defined as start of existing highway operations (50 years ago), current stage and foreseen future after 10-15 years.

8.1.4. Identification of other activities in the Project Area

Not only Kakarbhitta – Patlaiya Highway upgrades and bridge construction is planned in the region, but several other linear projects have been planned or already at the stage of implementation, including:

- Mechi-Mahakali Railway;
- Fast Track road;
- Birgunj – Patlaiya Road;
- Patlaiya- Hetauda – Narayanghat stretch of MRM;
- Nijgadh Airport;
- Hulaki – Marga Road;
- Banepa – Bardibas Road;
- Electric line;
- Postal road.

Brief characteristics of each of those planned structures and projects has been provided below.

Mechi-Mahakali Railway: Bardibas – Inaruwa section of the Mechi-Mahakali Railway is planned in proximity of the KP section and in some areas the projected railway line is located just on distance in 1 or 2 km from existing KP section of highway. A railway line which connects Central region of the country with Eastern region, two major cities namely Janakpur in Dhanusha District and Rajbiraj in Saptari District, runs more or less parallel to the existing East-West Highway. Bardibas – Inaruwa section lies between the Latitudes 26.98149°N and 26.59305° N and the Longitudes 85.85282° E and 87.11234° E in the Koshi, Sagarmatha and Janakpur Zone of the Eastern and Central Development Region of Nepal covering some parts of Sunsari, Saptari, Siraha, Dhanusha and Mahottari Districts. Mechi-Mahakali line connects to India in six locations through link and the link line for this sector connects up to Bardibas station (EIA report, Vol. 14, 2017). This project is on the construction stage by sections. The railway line location was designated and the earth work started.

Fast Track Road: The KTFT project connects the four districts of Kathmandu. Lalitpur, Makawanpur and Bara which links Kathmandu Valley runs from the middle hills areas of the Bagmati Zone to the Terai in Central Development Region. The road originates at Sano Khokana (1300 m) in Lalitpur district in the Valley and runs along the Bagmati River (for the first 30 km) crossing it near to Naikbandi in Soukhel VDC. From the exit of the river from Siwalik hills (km68) up to the East West Highway the alignment follows the right bank of Bakiya Khola. In this stretch the alignment runs about 1km from the right bank of the Bakiya Khola through dense Sal forest. The KTFT meets East West Highway south of Nijghad (150masl) near the Unasi watering hole (SESA Strategic Option Analysis of Alternatives Report, 2017). Currently the project is at the pre-construction stage. The area is cleared for road construction by Nepali Army.

This Fast track road connects the KDP section near to the Bakaiya river forest area.

Birgunj – Patlaiya - Hetauda – Narayanghat stretch of MRM: Presently, this road section comprises only two lane road with width varying carries way from 5.5m to 7.0m. This road starts at Birgunj (ICD) and joins at Pathlaiya, Ratomate at Hetauda and ends at Aptari (2.4 km north of Narayanghat). Construction work started from Birgunj to Patlaiya with 6-laned alignment to be constructed. From Narayanghat to Pathlaiya (NP) there is only single alignment and no alternatives are available. There are two alternative alignments between Birgunj and Pathlaiya. First alignment is Pathlaiya-Parwanipur-International Border, which is older alignment and is a part of TRP, which passes through busy market area of Birgunj and faces huge congestions. The second alignment is Pathlaiya-Parwanipur-ICD/ICP (International Custom Department/International Custom Post). The Birgunj (ICD)-Parwanipur Road Section was recently constructed under ADB assistance to two lane standard in order to divert the traffic from busy market area of Birgunj. From Parwanipur, the road alignment follows TRP up to Ratomate (Hetauda). The length of road stretch between Parwanipur and Ratomate is 39.8km ((SESA Strategic Option Analysis of Alternatives Report, 2017).

8.1.5. Initial identification and estimation of potential cumulative impacts

The analysis of cumulative impacts is focused on VECs in the project area. There are several methods to determine cumulative impacts. In the case of Patlaiya – Kakarbhitta Road, the first step

in identification of cumulative impacts is determination of degree for overlap of spatial and temporal boundaries among several linear projects in the area.

Cumulative impacts may be additive or compounding. Additive effect is observed, when the same impact is strengthened due to impact from several stressors (for example, impact on the elephant movement corridors from railway and highway in the same area). Compounding impacts are observed when 2 or more impacts are combined, for example, road mortality, barrier effect and fragmentation effect for animal movement from several linear projects.

More likely, that intensive development of the region and construction of several linear infrastructures will affect natural elements of the environment such as physical and biological VECs as well as social. Considering determined issues and responding to the number of questions, we can identify potential impacts and area of their influence. This step helps us to identify general and site-specific effects and their interactions relevant to life of one or several projects.

More likely, that first three issues: effect of facilitated development, land use change, increased urbanization and human encroachment will interact each other. Those issues have a large-scale impact to all project area with such cumulative effects as changes in social structure and occupation, industrialization of the region, acculturalization with significant impact on indigenous people and vulnerable groups. So, the first three issues let allow to select **the general project area** for further consideration of changes, associated with development, and evaluation of effects on 4 selected Valued Social Components. The last issue, changed aesthetics of the landscape, loss of biodiversity and land productivity due to interaction between various adverse impacts on the landscape scale, associated with lack of coordination between several linear infrastructure development projects is also relevant to general project area and can be solved through coordinated decision-making.

Water-logging along the road is a serious issue in many areas resulting the risk of flooding, hydrological changes, siltation, impact on aquatic and terrestrial habitats, barrier effect for the natural drainage and flow of rivers, rivulets and streams. Special attention to this effects should be paid in the areas, where several linear structure constructions may strengthen adverse impact on natural environment and social infrastructure. This issue is most severe in **Sunsari District** (Inaruva and Itakhari area), where the elevated railway and highway lines interacting may increase the additive effect of flooding, impacting natural environment and social life.

Wildlife habitat fragmentation and impact on migratory corridors are site specific and, more likely, impact environmentally sensitive areas within the project boundaries, rich with biodiversity. Expected potential impacts of fragmentation are increased wildlife road mortality, population isolation, loss of species diversity and abundances. The cause of fragmentation is presented by increased barriers, appeared in the result of several linear project interactions, habitat loss, disturbances, access to the area for hunting and poaching, increased pressure on forest and aquatic resources. Cumulative impacts of interactions will be additive and compounding in nature. In the project area such VECs as Parsa National Park and Koshi-Tappu Wildlife Reserve, valuable ecosystems – Betana Wetland, elephant (and other animal) movement corridors and threatened indicator species will be affected. **Parsa national Park, Koshi-Tappu Wildlife Reserve, Betana Wetland and Elephant Movement Corridors** are selected to identify stressors and design adequate strategies in the project area.

8.1.6. Significance of potential impacts

There is a number of approaches for a project-initiated cumulative impact assessment. Some of them require basic understanding of environmental receptors and potential impacts, others – understanding the cause and impact relationship between actions and environmental receptors, third – descriptive spatial data or detailed data about all impacted variables. Several methods could be appropriate for present analysis of CIA.

The method of interaction matrices is grounded on basic understanding of environmental receptors and potential impacts, covering the region of interest and life of project. It allows to include all relevant environmental receptors in one analysis. This method is useful for initial scoping that to identify, which receptors will be cumulatively impacted.

Impact modeling requires understanding the cause and impact relationship, covering the region of interest and life of the project. This analysis includes single or multiple environmental receptors, depending on actions considered. It is exploring cause and effect relationships, identifying where several projects impacts may combine.

Spatial (GIS) analysis needs descriptive spatial data (for example, land cover classes). It covers any spatial scale, for which data are available. It is usually focused on the analysis of single environmental receptor, but can generate visual representation of all possible impacts within the area of interests. It can provide also quantitative output.

Other methods – detailed survey or numerical modeling – are time consuming or require numerical data for the analysis in the models.

Due to lack of available data, the impact modeling is a preferable method in the current study. In the previous sub-chapter there were selected possible scenarios of environmental impacts and social and environmental receptors for the analysis. In this sub-chapter, the project team will identify all external natural and social stressors affecting the priority VECs for each scenario within the project area. Determined scenarios are presented below:

1. General project area: cumulative impacts of land use change;
2. Sunsari District: natural drainage management issues;
3. Parsa National Park (fragmentation issues);
4. Koshi-Tappu Wildlife Reserve (population isolation and human-wildlife conflict issues);
5. Betana Wetland (barrier effect and loss of biological productivity);
6. Elephant movement corridors within the project area (permeability of linear structures);
7. Bridge over Koshi-Barrage (impact on Gangetic Dolphin and fish populations).

The questions for the assessment of possible cumulative impacts have been presented below:

- What is the existing conditions of each identified VC or sensitive receptor?
- What are the indicators used to assess the conditions?
- What are appropriate thresholds for environmental values without predetermined thresholds?
- What are the key potential impacts that could affect long-term sustainability or viability of the VECs or sensitive receptors?
- Are there known or predictable cause-effect relationship?

- How close to the relevant thresholds are the cumulative impacts and their significance?

Impact modeling approach and answers to the listed above questions were used that to conduct Cumulative Impact Assessment (CIA) for 7 identified areas of the project.

1. General Project Area

Valued environmental and social components for general project area were described in Chapter 4 of the current report. The general project area is under development scenario since 1960s (the time of immigration people to Terai Region for expansion of agriculture). Since that time land use change and large-scaled development of the region have been already happened. At the current stage, the process of transformation the agricultural lands and residual natural habitats into urban and industrial areas is ongoing and it will continue independently from upgrades of highway due to increased growing population pressure. However, upgrades of highway may strengthen adverse effects on land use change as well as enhance beneficial impacts. The major impacts of development affect valued social components such as land and resource use, population infrastructure and services, economy and well-being, community life. Several linear projects have been proposed to facilitate economic growth of the region and relevant problems, improve well-being and community life. But, there is a need in coordination efforts between several projects to prevent destruction of aesthetic features of the landscape, loss of biodiversity and land productivity.

Extent of agricultural, forest and built-up area was selected as a sensitive indicator of land use change effect. Impact of the highway development on the land use is measured as extent of forested and agricultural lands in the direct and indirect impact area. The extent of forest is 22.64% and 32.78% in DIA and IIA, respectively. The extent of agricultural area is 59.78% and 52.9% in DIA and IIA, correspondingly. The extent of built-up area is 7.23% and 1.75% in DIA and IIA, respectively.

Forest provides many beneficial services in the project area, ensuring many goods and benefits for the growing population. Forests in the area ensure aesthetics of the landscape, secure biodiversity richness and abundances, support land productivity through the nutrient cycles. At least 30% of forest in the landscape is needed for normal functions of the ecosystems that to guarantee resilience of the system.

Unplanned or ribbon urban development is one of the adverse potential impacts, effect of traditional forest indigenous forest communities and their life style, gender issues and threat of increased communicative disease are issues associated with community life. Unplanned development may seriously impact the life of local communities and effect viability of forest ecosystems.

Cause-effect relationship is known and predictable. Basing on the understanding the nature of the impacts, it is possible to mitigate them through coordinated planning of urban extension along the road such as organized service centers, designed integration policies for indigenous people and poorest in the area, awareness relevant to gender issues and regarding potential adverse impacts of the ribbon settlements, employment and business opportunities for local communities coinciding with sustainability of the road operations and surrounding environment.

Current deforestation process in the Terai region is closed to its threshold. Afforestation programs and associated activities are highly needed. Coordination of planning for the development of local

communities along Patlaiya – Kakarbhitta section is very important for the long-term viability of the road.

Land use change issues will be addressed in the initial ESMP for the project area.

2. <u>Sunsari District</u>

Water-logging and threat of flooding were identified as serious issues in several areas along existing Patlaiya – Kakarbhitta section. In Sunsari District, those issues can be strengthened due to interaction of impacts from highway and railway construction and operations. Railway in Sunsari District is located parallel and quite close to highway (1-2 km distance between both linear constructions). Valued environmental components, which may be impacted, are presented by natural drainage system, which can be highly impacted, forest in the area (especially Sal Forest, which does not grow on the marshy or bogged soils and have chance to degrade in the case of repeating flooding events). Valued social components such as community life, economic wellbeing and land use also can be impacted severely due to flooding threat, possible economic losses of agricultural crops and valuable forest and land use change.

Indicators of this stressor conditions are landscape characteristics in flooding prone area, natural drainage systems and capacity of engineering drainage to manage water-flow in the critical seasons, number of flooding events, affected forest and agricultural areas, impacted households and local communities.

Calculated and predicted storm water inflow in the monsoon season in the years with highest precipitation and threat of flooding events can serve as a threshold of the cumulative impact of water-logging.

Cumulative impact of water-logging is described above as a threat of destructive flooding, affecting local communities, highway and railway infrastructures and their sustainability. Low repetitive flooding can affect the growth of sal forest and agriculture and may impact local economy and wellbeing as well as terrestrial wildlife habitat causing succession process.

Insufficient drainage systems along highway and railway, lack of coordination for their placement to ensure save drainage of storm-water and prevent water-logging are main causes that can adversely affect sustainability of both linear structures.

This issue can be addressed in the site-specific environmental management plan through planning of coordinated drainage system between two projects: extension and upgrading of highway and construction of railway.

3. **<u>Parsa National Park</u>**

Parsa National Park just recently (in July 2017) obtained a status of national park. Simultaneously, its area was extended to the north, ensuring more wildlife habitats and sufficient territory to secure ecosystem processes at the landscape scale through improved conservation activities. The Park supports populations of one critically endangered species (Chinese pangolin) and two endangered species, Wild Asia elephants and Royal Bengal tiger and other charismatic species, including 12 indicator wildlife species. The herd of elephants roaming in the park, crossing the roads in several specific places, one of which was identified as an elephant corridor (or wildlife movement hotspot).

Based on a critical habitat screening conducted as part of the ESA following the criteria set forth in ESS6, IFC PS6 and IFC PS6, Parsa National Park while has recorded presence of critically endangered and endangered species, is not considered critical habitat. Applying the IFC PS6 thresholds indicated that these critically endangered and endangered species are widely distributed in South Asia and the Himalayas and given the small area considered as Ecologically Appropriate Area (EEA) (i.e., 300m Direct Impact Area of KDP Road), the upgrading of the existing road segment is not expected to affect the global population of these species. Also based on screening, it appears that there are no critical habitats within the EEA/DIA of the project. This will be further studied and validated in the Biodiversity Assessment as part of ESIA at the detailed design stage of KDP road

Several indicator species (Nilgau, Chital, Terai Gray Langur, Golden Monitor Lizard and King Cobra) have been affected directly by operation of existing roads with high road mortality rates. Predicted impacts of fragmentation and isolation could be even more serious. As it is mentioned above, the Asian Elephant was selected as an umbrella indicator. Numbers and population density of the indicator species in the Park will specify the road upgrades and new infrastructure construction cumulative impacts. Population density of indicator species has been assessed by scientific staff of the Park, implementing wildlife monitoring programs.

The road permeability can be selected as appropriate thresholds of the environmental health in the areas surrounding Park.

At present, two roads (Patlaiya - Kakarbhitta and Birgunj-Patlaiya-Hetauda-Naraiyanghat) already operate in the area. One of them (Birgunj-Patlaiya) is currently under construction, widening from 2-lane to 6-lane highway. Kathmandu-Terai Fast Track road, located along the northern boundary of the Park, is at the construction stage. The fast track road has already open and the further construction activities are under progress. The Nijghad Airport is at the stage of planning, and It has several environmental issues. the decision about its construction already was taken. Thus, at least, three linear infrastructures (highways) and airport with access road might significantly change landscape features and seriously impact the integrity of the Park's area, its valued environmental components and their viability.

Cause – effect relationship in the case of Parsa National Park is predictable as impact on ability of wildlife populations to disperse across landscape and colonize new areas, high wildlife road-mortality, threat for motorists from wildlife-vehicle collisions near the Park's area, increased pressure of ribbon settlements along the road, landscape and habitat fragmentation, improved access to natural area with increased pressure of exploitation forest and non-forest products, etc.

In the case of several planned constructions (including upgrades of 2 highways, construction of new highway and construction of airport) the impact on the Park can be disastrous if adequate mitigation measures will not be implemented through coordinated decision-making between several projects. Special cross-road infrastructure is needed along the road section from Birgunj to Hetauda in the elephant crossing area. Taking into account that area on the east from Patlaiya – Nijghad section of the highway will be transformed for the construction of airport and forest will be mostly cut, this section will serve as a "trap" for wildlife in the case of road crossing, because wildlife habitat on the east from the road will be destroyed. This scenario suggests building a barrier (fence) along the Park territory on the distance from Patlaiya to Fast Track to prevent wildlife movement to the "trap" area.

All these issues should be reflected in the site-specific ESMP for Parsa National Park and surrounded area as well as in strategic plans and policies of the Government.

4. **Koshi-Tappu Wildlife Reserve and its Buffer Zone**

Koshi-Tappu Wildlife Reserve is not impacted directly by the upgrading of highway and construction of railway in the area. However, indirect impacts are likely due to isolation and fragmentation causing adverse effects on environment and society. Koshi-Tappu Reserve is only a site in Nepal, where the Wild Water Buffalo is still preserved. Many other animals inhabit its specific grassland-wetland-forest ecosystems. At the same time, a Buffer Zone of the reserve, providing movement corridors for many wildlife species, will be affected directly. All species inhabiting the reserve also occur in the Buffer Zone. Several species, which rarely can be found in the reserve, inhabit the buffer zone. One of such species is a Gangetic Dolphin, occurring in Sapta-Koshi River. The current situation in the reserve and its buffer zone cannot be characterized as "optimal". High development pressure impacts the reserve and its buffer zone area. The Wild Water Buffalo is isolated in the reserve due to lack ability to move along the flooded lands to the similar wild areas in India. Northern territories from the reserve are developed for agriculture, so, wildlife from the reserve mostly moving to south from buffer zone, and within this way the animals need to cross highway, often with fatal consequences, especially in winter season, when fogs decrease visibility on the road. Human-wildlife conflict is another problem existing in the reserve and its buffer zone. Due to insufficient area, animals often raid neighboring agricultural fields, destroying harvest of local farmers. The compensation program operates in the reserve. However, the threat is not only in the harvesting of fields, but in the cases when large animals – wild buffalo and elephants – kill the people. Both – aquatic and terrestrial habitats – will be impacted in some degree in the results of highway extension and upgrades and construction of railway line in the area. There is a need to solve all predicted effects of projects through coordinated solutions of development between infrastructure authorities, conservation authorities and local communities. One of the solutions might be to increase the area of the reserve through purchase of land from local communities and resettlement of local farmers.

Indicators of impact on aquatic habitat of Sapta-Koshi River are fish and Gangetic Dolphin. Indicators of impact on terrestrial habitats are selected indicator species. Both - aquatic and terrestrial habitats - will be impacted in some degree in the result of construction, interactions between linear projects and further development of the region in this highly populated area. Practically all selected threatened species (Table 4.4) and their population status in the Koshi-Tappu Wildlife reserve may serve as indicators of cumulative impact from the extension of road, construction of railway and bridges.

In the case of Koshi-Tappu, identified and functioning wildlife corridors between the wildlife reserve and other natural areas in the region should serve as appropriate thresholds of population viability in the highly fragmented and isolated landscape. At present, many species use the Sapta-Koshi River Valley, associated wetlands and flooded areas for movement through landscape. With road upgrades, construction of railway and new bridges the wildlife corridors may be affected: disrupted or altered with fatal consequences on the viability of the umbrella indicators (Gangetic Dolphin and Asian Elephant) and other indicator species, especially Wild Water Buffalo and Gharial Crocodile.

Cause – effect relationship is predictable as increased isolation of the Koshi-Tappu Wildlife Reserve and preserved species, occurring in the reserve, impact of bridge construction on fish and aquatic wildlife with long-term disturbance, habitat loss and pollution affecting food chain. Increased isolation of large mammal species in the reserve may cause more often human-wildlife conflicts with fatal consequences for people and animals. With starting of operations of two linear infrastructures the risk of wildlife – road collisions and wildlife road mortality will increase as well.

Indirect impact on Critical Wildlife Habitat (Koshi-Tappu Wildlife Reserve), direct impact on aquatic habitat and threatened wildlife species will be very significant and may threaten further existence of large mammal species in this highly populated area. Situation in the wildlife reserve is already critical, taking into account high level of human-wildlife conflicts and it may become worse with construction of new roads. Specific initial EMP is needed for the reserve and its buffer zone. It is necessary to coordinate the bridge construction with railway project to minimize adverse impacts and harmonize establishment of mitigation measures in the buffer zone of the Koshi-Tappu between railway and highway to ensure movement corridors for large species.

5. **Betana Wetland**

Betana Wetland is located very close to highway and it will be impacted directly in the case of highway upgrades and extension. Currently, this wetland serves to community needs, ensuring irrigation of 1500 hectares of adjacent agricultural areas, providing multiple benefits like fishing and recreation for local communities and visitors. Around 20,000 people visit this area annually, the Community Board provide to visitors such services as recreation activities and ecological education. The center, established near Betana wetland, supports recovery and rehabilitation of road-affected animals. At the same time, the wetland serves as a Habitat for 4 turtle species (which are mostly globally threatened), many bird and mammal species and as a spawning site for many fish species, ensuring surviving of 18 local species. It is an important site for conservation of many indicator species (including Asian Elephant, Nilgai, Chital, Terai Grey Langur, White-rumped Vulture, Golden Monitor Lizard and Indian Softshell Turtle) in the highly populated landscape. At present, this is only a place in the area, where such rehabilitation center operates.

The road permeability can be selected as appropriate thresholds of the environmental health in the proximity of Betana Wetland. Upgrades and extension of Patlaiya – Kakarbhitta road will disrupt integrity of the wetland and associated agricultural systems and may affect the viability of indicator species populations, especially slow moving animals such as turtles.

The most sensitive receptors are turtles in the case of wetland. Their populations will be affected directly by increased road mortality and indirectly by habitat fragmentation and isolation. It is expected that mortality of other wildlife species, associated with this wetland, also will be bigger.

Cause – effect relationship for Betana Wetland is loss of its integrity and ecological value, both for indicator species and local communities.

This wetland and its management system with engagement of local communities serves as an example of best environmental management practices in the region, therefore it is important to keep integrity of the wetland through avoiding of highway upgrades in the proximity of the wetland. The new location of the highway should be coordinated with local stakeholders, addressing wildlife conservation issues (established drainage system, allowing movement of fish species from the

wetland to other water-bodies, underpasses and viaducts for amphibians and reptiles, including local turtle species, planned side-road ensuring exit from the highway to the community wetland center and recreation site).

6. **Elephant movement corridors**

At present, there are several elephant movement corridors in the project area. Construction of several linear structures in the project area might impact the movement corridors with effects of fragmentation and isolation for elephant populations that may cause increased human-wildlife conflict in the agricultural areas, which is already observed in some areas, adjacent to Patlaiya-Kakarbhitta Road. Seasonal movement of Asian Elephant herds in three designated corridors along KP section road serves as an indicator to assess impact of the road upgrades and extension and possible cumulative impacts, relevant to construction of other linear structures in the area. At present, all three identified corridors, including Parsa National Park, Belbari-Pathari Forest and Charali Forest Area, support movement of elephants across landscape in Nepal. Only in Charali Forest area, the movement is interrupted by construction of electric fence between India and Nepal to prevent movement of elephants and human-wildlife conflict within Nepal agricultural villages, located in the proximity of border. In the case of road upgrades and extension, the is a risk of increased elephant – vehicle collisions and human-elephant conflicts in the fragmented and isolated elephant habitats. Elephants and their movement corridors represent indicators to assess conditions and cumulative impacts on the landscape scale. The ESMP, including the Biodiversity Management Plan, that applies the mitigation hierarchy should manage risks and impacts on wildlife collisions and road kills.

Opportunity for elephants to move through landscape from Parsa National Park to Indian border in Charali Forest Area and in Belbari-Pathari Forest may be defined as threshold for further existence and viability of wild elephant population in Nepal.

The major potential impacts are relevant to construction of several linear structures in the project area and lack of coordination between projects that to ensure cross-road facilities (underpasses and overpasses) for further elephant movement within existing corridors.

Predictable cause – effect relationship is associated with several linear infrastructures, interrupting movement of elephants through landscapes in highly populated areas, habitat fragmentation, loss of natural forests and connectivity within remained patches of protected areas and other landscapes of high ecological value for elephants.

Cumulative impact might be very serious in the project area. The elephant movement corridors may be destroyed in the south-east of Nepal without coordinated policy and solutions. There is a need in consultation with environmental organizations to find the most appropriate solutions and joint coordinated efforts to plan and design cross-road structures to mitigate adverse impact of linear infrastructure and secure safe connectivity between remained elephant habitats between Nepal and adjacent territory of India.

7. Bridge over Saptakoshi River

Koshi-Barrage area, where current bridge located, is ecologically rich. Many aquatic species and fish support local economy and wellbeing. Travelers can observe from the existing bridge many

local fishermen and dolphins harvesting fish in Sapta-Koshi River. Upper part of the river with many small islands creates perfect conditions for breeding, migratory and wintering water-birds. It was designated as Ramsar Site and Important Bird Area of international importance. Aquatic habitat, fish, waterfowls and water-birds, aquatic wildlife with Gangetic Dolphin identified as Umbrella Indicator serve as sensitive receptors and selected indicators of possible impacts on the river and aquatic environment.

Construction of two new bridges (for railway and highway) may significantly impact aquatic environment with adverse effects impacting community life and aquatic habitats with all their biotic organisms. Possible pollution, disturbances and other negative effects of construction might completely destroy ecological integrity of aquatic ecosystems, their long-term sustainability, threatening aquatic wildlife and viability of umbrella indicators, affecting fish populations and other environmental elements. Ecological misbalance in this area may also cause social problems and income generation by local communities, living in the proximity of river and depending on aquatic resources.

Predictable cause – effect relationship is associated with loss of high productivity of aquatic ecosystems of Sapta-Koshi River and relevant worsening of community wellbeing in the project area, especially if construction of two large bridges will be provided in the different time intervals with long-term effects and threat for the resilience of the aquatic ecosystems within the huge area up-stream and down-stream.

Adverse effect of two bridges construction can be reduced through construction of one layered bridge, responding to the needs of highway and railway operations.

CHAPTER 9: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN[7]

9.1 Management Strategy

This ESA is a first step to screen and preliminarily assess environmental and social risks of the proposed upgrading of KDP road from 2-lane to 4-lane. Based on the ESA, there appears to be no show stopper in the proposed upgradation of KDP Road. The option to upgrade the existing road within the existing 50-m RoW as opposed to constructing a new road or new alignment has taken into serious account key environmental and social risks and impacts and potential show stoppers. If designed and implemented properly following mitigation hierarchy, risks and impacts can be managed.

Moving forward, the ESIA at detailed design phase of KDP road will assess in greater detail the E&S risks and impacts of the road works based on final design and alignment. The ESIA will include a detailed biodiversity assessment that focuses on project risks and impacts on Parsa National Park, its biodiversity and transboundary movement of wildlife. An Environmental and Social Management Plan (ESMP strictly following the mitigation hierarchy will be developed and will include a Biodiversity Management Plan to address risks and impacts on biodiversity and wildlife. If biodiversity offset is required based on the ESIA and biodiversity assessment, this will be included in the Biodiversity Management Plan and will be implemented. Similarly, other E&S risks and impacts and mitigation measures will also be covered in the detailed ESIA/ESMP. The ESA has identified 8 wildlife crossing points along the KDP road segment for which wildlife crosses will be included in the detailed engineering design (the chainage for wildlife crossings are: 250+400, 272+400, 276+100 , 285+700 , 329+300 ,362+200 , 364+400, 357+800) and will be implemented as part of the KDP road design. Other measures such as fencing will also be studied in the ESIA and included in the ESMP. The monitoring done by WWF-Nepal on the wildlife passes built under the Bank-funded Narayangyat-Mugling (NM), the first of its kind in Nepal, demonstrated that these wildlife passes can be effective measures to allow unimpeded migration of small, medium to large mammals as well as reptiles. Properly designing the passes by wildlife experts in consultation with project engineers, WWF-Nepal, Department of Environment and the Department of National Park and Wildlife Reserve is a key to effective design, construction and operation of these wildlife passes. The Manual developed by DoR with Bank support on designing Wildlife-Friendly Infrastructure will be used in the final design of these passes.

A cumulative impact assessment will be carried out during the detailed design phase of KDP road as part of the ESIA. In addition, a Strategic Environmental and Social Assessment will be conducted for the entire Mahendra Highway/East West Highway during project implementation to assess the long-term risks and impacts of the upgradation of the entire Mahendra Highway and to come up with and implement well-coordinated solutions and management to these long term and

[7] A KDP road-site specific ESIA/ESMP will be prepared for the KDP based on the final alignment and detailed engineering designs which are not yet available.

cumulative E&S risks related to the upgrading of the entire Mahendra Highway/East West Highway. These future commitments are recorded in the Environmental and Social Commitment Plan of DoR.

The ESMP for KDP Road will apply the mitigation hierarchy and will include mitigation measures, monitoring plan, capacity building, responsibilities and reporting system and environmental and social costs. In addition, the ESMP provides measures to address GBV issue at project level. The key issues regarding the labor will be managed in compliance with National Labour Act, 2017 and Labour Rules 2018 and WB ESF 2018 through comprehensive Labor Management Procedures and Occupational Health and Safety Plan (OHSP). Established GRM will help to lodge grievances and its resolution. Worker Camp Operation Plan and Worker's Code of Conduct will be prepared to discourage or minimize GBV. The ESMP obligates the contractor, upon mobilization, to prepare the Contractor's (C-ESMP), which shall be prepared prior to the commencement of construction activities. The C-ESMP shall include OHS plan, Water and Waste Management Plan, Influx management Plan, Workers camp management plan, Traffic management and road safety management Plan, Quarry/borrow area management plan, and Site restoration Plan among others in accordance with the GoN and IFC&WB workers accommodation guidelines.

A separate RAP will be prepared to address land acquisition and physical and economic displacement as a result of land acquisition. All losses (private and public assets) will be compensated with replacement costs as per RAP in accordance with ESS5 and GoN requirements. A Resettlement Policy Framework was prepared and disclosed by DoR to guide the preparation of a RAP for KDP Road.

Risks and impacts on ethnic minorities/indigenous peoples will be assessed in the ESIA and a Vulnerable Community Development Plan (VCDP) will be prepared, if required, based on the Vulnerable Community Development Framework (VCDF) prepared and disclosed by DoR. If Free and Prior Informed Consent (FPIC) is required, it will also be secured during the preparation of KDP road following the VCDF that has provisions for FPIC.

9.2 Objectives of Environmental and Social Management Plan

Initial/preliminary ESMP is prepared as a part of an ESA report and will be the basis for developing the ESMP at detailed design phase of KDP Road. This ESMP aims to:

- Comply with applicable environmental requirements of the Government of Nepal.
- Comply with World Bank's related ESF requirements.
- Achieve sustainable and environmentally and socially acceptable development interventions for transmission line development.
- Inform the GoN involved agencies and the future contractors on environmental management strategies and social impact mitigation measures.
- Inform the site-specific ESMP for each road section based on detailed engineering design.

To achieve these objectives, four actions have been taken in formulating the ESMP:

- Measures were outlined for adoption in project planning and design to avoid, reduce, minimize or compensate adverse impacts on the environment and affected communities

- Specific mitigation measures were formulated to avoid, reduce, minimize or compensate the adverse impacts of the pre-construction, construction, and post-construction phases of transmission line development
- A plan was prepared to monitor the implementation of the mitigation measures and their effectiveness in combating adverse impacts
- An institutional mechanism was established for ESMP implementation, monitoring, and reporting.

9.3 Summary of Potential Environmental and Social Impacts

The project is expected to generate several beneficial impacts, especially at the national and regional levels, by providing reliable and better transportation facilities. Potential adverse impacts on the environment and the public, which are mainly limited to the construction phase, have also been identified and are listed below.

9.3.1 Construction Phase

- Although every effort has been taken in selection of road alignment as existing alignment will be followed for the upgrading in most of the parts to avoid impacts to ***properties,*** it is expected that Some temporary shed /hut will be affect which was seen in ROW may cause permeant or temporary physical of economic displacement. to be address this issues as per ESS 5.
- Gender based violence child labor and OHS is another major risk during this stage. The GVB Action Plan and OHS Plan will be required to be prepared and implemented by contractors.
- Dispute between local community and to outsider labor to use of primary supply like source of drinking water, Fuel wood, etc will exist. It will be need to prepare Labor Manage plan as per ESS2 to mitigate Labor related risks.
- The quality of ***surface water*** of the water bodies close to the project construction sites may deteriorate if erosion products and silt, construction materials (e.g., borrowed fill material, sand, construction waste, water used in construction activities), and domestic effluent from work camps are allowed to reach the receiving water bodies, especially during rains.
- ***Air quality*** may deteriorate due to emissions and dust from hauling construction materials and equipment.
- ***Noise and vibration*** levels in and around the construction sites could increase as a result of operating construction machinery and during material loading and unloading.
- ***Soil*** in excavated areas may erode and be carried away by runoff; there may be erosion in slope terrains.
- ***Wetlands*** may be adversely affected by the installation of towers or substations, placement of construction waste, exhaust emissions, and increased noise levels, which may affect sensitive flora and fauna inhabiting the wetlands.
- Handling, storage, and disposal of ***hazardous materials and wastes*** may also contaminate the surrounding environment if accidentally released or disposed of incorrectly.
- ***Greenhouse gas emissions*** from construction equipment are anticipated. Further, the removal of significant amounts of biomass from vegetation clearance within RoW of the road could release currently sequestered carbon into the atmosphere.
- There may be impacts to ***rare and endangered species habitats and wildlife corridors.***

- Some ecosystem services, primarily damage to ***water recharge areas*** or affecting the ***availability of non-timber forest products*** may occur.
- The location and operation of work camps and temporary yards may not only damage the immediate environment but also contaminate the surroundings with waste.
- Changes to ***land use*** may occur, for example, in a reduction of available agricultural and forest lands.
- The ***occupational health and safety*** of construction workers may be affected adversely due to hazardous working environments such as steep slopes and remote areas.
- Impacts on ***communities*** during the construction phase could also result from construction workers eventually developing conflicts with the local community, from the spread of vector borne and communicable diseases, including HIV/AIDS and STIs, trafficking of persons, including youth and women, and disruption of services, shifting of utilities, traffic-related accidents, labor influx, health and safety, etc..
- Some ***cultural features*** such as visual and aesthetic resources and touristic resources may be affected in spite of efforts to avoid these features during the routing process.

All the above potentially adverse impacts of the construction phase are localized spatially, are temporary and short in duration, and can be mitigated by employing best construction management practices and mitigation measures, which are detailed in the following sections. Proper plans and engineering designs that take into consideration environmental and social aspects will avoid or minimize most of the potential adverse environmental and social impacts of construction.

9.3.2 Operations Phase

Relatively few long-term operational adverse impacts are expected from the road upgrading projects.

9.3.3 Environmental and Social Safeguards

Although several objectives have been cited, the main purpose of formulating the ESMP is to recommend a set of environmental and social safeguard measures to address the potential adverse environmental impacts of the project. The following prioritization mitigation hierarchy was adopted in preparing the safeguard measures.

1. **Avoid** the occurrence of adverse environmental and social impacts
2. **Minimize** the adverse impact
3. **Mitigate** the adverse impact to its full extent
4. **Compensate** when mitigation is not adequate.

9.4. Mitigation Measures

The following approach was used in formulating the mitigation actions for the project. The proposed mitigation measures should be:

1. Pragmatic – measures should be readily implementable, effective, and practicable
2. Efficient – measures should effectively achieve the objectives within the limits of available information, time, and resources

3. Adaptive – measures should be flexible so they can be adjusted to the realities, issues, and circumstances of the project without compromising the ultimate objectives

The incorporation of mitigation measures into the project designs should be the part of the design process and should be included in the design cost itself. The mitigation actions to be implemented during the construction phase will be part of the construction activities and their costs should be included in the construction costs.

This section contains a description of the environmental and social management approach/strategy to manage risks and impacts.

9.4.1. Design Phase

The project-related/project-specific environmental and social impacts will be assessed in detail during the detailed engineering design phase and ESMP will be prepared to address impacts at different phases of the project. The ESIA and ESMP will be based on this ESA and Initial ESMP.

9.4.2 Pre-Construction and Construction Phase

Impacts are mainly construction related such as pollution, occupational health and safety, community health and safety, acquisition of structure and resettlement, labor influx and associated social risks and impacts, including social conflicts, gender-based violence. There will also be impacts on biodiversity especially in road sections that traverse through biodiversity areas and wildlife migration corridors.

The main group of project affected persons (PAPs) consists of land owners whose land lies along the road alignments, and members of community forest user groups (CFUGs), who may lose some of their current forest resources. Land and other property will be acquired accordance with the Resettlement Policy Framework and subsequent Resettlement Action Plans.

The Project Implementation Unit of DOR will be adequately staffed and trained. Supervision Consultant will also include Environmental and Social Development Specialists.

The contractor will be required to appoint qualified Environmental Specialist, A Social Development Specialist and a Health and Safety Specialist, whose duties throughout the construction period will be primarily connected to environmental and social management of the sites. The Contractor will also prepare a Contractor's Environmental and Social Management Plan (CESMP) detailing the ways and methods that will be employed in the implementation of the ESMP during the construction phase.

9.4.3. General Environmental and Social Management Requirements

The Contractor shall abide by the requirements of the ESMP, which is appended to and is a part of the Contract. The Contractor shall develop a Contractor's Environmental and Social Management Plan (CESMP) for approval by the CSC, PIU Engineer and the World Bank prior to start of the construction works.

The Contractor is advised that all sites where the contractor will establish its plant yard and other installations shall be subject to environmental and social impact assessments and must be covered

by an acceptable CESMP, must be permitted in accordance with all applicable permitting requirements, and may be subject to a RAP.

9.4.3.1. Environmental Management

General Provisions: The Contractor shall take all necessary measures and precautions to ensure that the execution of the works and all associated operations on-site or off-site are carried out in conformity with statutory and regulatory environmental requirements of the Government of Nepal and the Standard Specifications, where the more stringent shall apply. The Contractor shall take all measures and precautions to avoid any nuisance or disturbance arising from the execution of project activities. This shall, wherever possible, be achieved by avoidance of the impact at the source rather than mitigating an impact after it has been expressed.

9.4.3.2. Protection of Natural Resources and Places of Cultural Value

Depletion of water resources
The Contractor shall liaise with the Engineer on issues related to water use and obtain all relevant water-use permits. The cost of obtaining permits shall be deemed to have been included in the Contractor's rates and prices in the Contract.

Protection of Trees
The removal of trees and other vegetation shall be kept to the minimum necessary to accommodate the permanent works as indicated by the project drawings. The Contractor shall coordinate this with local authorities, including Community Forest User Groups, and shall be responsible for ensuring that any exposed surfaces are revegetated as construction progresses in accordance with instructions of the Engineer.

Fire Prevention
The Contractor shall ensure that fires do not start within the site or around as a result of the execution of the works. The burning of any waste causing noxious emissions, such as, but not limited, to vehicle tires, is prohibited. The Contractor shall have available at all times suitably trained personnel with adequate fire-fighting equipment to deal with fires. The Contractor shall provide fire protection and fighting equipment to any parts of the works where there is a particular fire hazard.

Protection of Environmentally Sensitive Areas

The project ESMP that will be developed based on the detailed ESIA, including the Biodiversity Management Plan, will be used by the Contractors to prepare their C-ESMP. The requirement of developing and implementing the C-ESMP, including measures to protect and conserve environmentally-sensitive areas, will be spelled out in the bidding documents, work contracts and reflected in the ESCP prepared by DoR and negotiated and agreed with the Bank.

The Contractor shall take all reasonable measures at all sites under his control to prevent spillage and leakage of materials likely to either cause pollution of or interference with the supply of water.

Where the Contractor is conducting works that may cause silting, flooding and erosion of beds and banks, the Contractor shall take all reasonable measures to prevent such events and shall be liable

for the consequences of any damages and reinstatement. Such measures shall include, but not be limited to, the provision of bunds or berms around fuel, oil and bitumen storage facilities, and oil and grease traps in drainage systems associated with vehicle and plant washing bays, servicing and fueling areas.

The Contractor shall provide, maintain and remove on completion of the works, settling lagoons and other facilities to minimize pollution due to the Contractor's operations including, but not limited to quarrying, aggregate washing, concrete mixing and grouting.

Appointment of Environmental Specialist, Social Development Specialist and Health & Safety Specialist

The Contractor shall submit for approval the names and details (full CVs) of his proposal for the ES, SDS and HSS before site mobilization. The Specialists shall be responsible for day-to-day issues of environmental and social management and health and safety risk management. The Contractor shall obtain approval of such person being appointed, who shall be in position to carry out his duties prior to works activities commencing on site, except as may be agreed in exceptional circumstances in writing with the Engineer.

Safety Induction

The Contractor, while in possession of the site, shall be responsible for the safety measures undertaken in accordance with the Specifications to protect the workforce and staff of the Contractor's own staff as well as the Engineer's supervision staff. The Contractor shall conduct in this respect safety induction courses for all personnel involved with the works and who are required to supervise any activity prior to their attending any part of the works.

9.5 Recommended Special Specification Causes for Environmental and Social Protection during Construction

9.5.1. Contractor's Environmental and Social Management Plan (CESMP)

The site-specific CESMPs are required for construction activities; they shall provide the implementation vehicle of specific mitigation activities applicable for a particular site. Each Construction Contractor will be required to provide updated site-specific CESMPs (including parallel plans and procedures) as part of their obligations under their contracts. All site-specific CESMPs are required to strictly follow and comply with the environmental, social, health and safety requirements of DOR and national legislation, as well as ESMP, WMP, OHS Plans, other applicable documents and regulations.

9.5.1.1. Objectives of Site-Specific CESMPs

The Construction Contractor(s) will be required to update the site-specific CESMPs in accordance with the format provided in this ESMP. Site-specific CESMPs shall be structured as follows:

- Site-specific CESMP document providing identified site-specific mitigation measures, and refining organizational and operational procedures for the implementation of site-specific mitigation measures, including implementation timeline and specific reporting requirements.
- Parallel plans and procedures developed as a part of CESMP and elaborating complimentary environmental, social, health and safety management measures and indicating the responsibility for implementation, technical details and how implementation will be

monitored. Parallel plans and procedures developed as a part of each CESMP shall include a Site Establishment Plan, H&S Plan, Emergency Preparedness Plan, Chance Finds Procedure, Stakeholder Engagement and Consultation Plan (including a grievance redress mechanism). Grievance mechanism should be deve are expected to develop these ploped as per ESS2 lans and policies in order to properly manage their construction activities in accordance with the ESMP and other relevant documents, and in compliance with requirements of World Bank ESS 2 and national legislation as discussed in the ESA

The site-specific CESMP documentation has the following objectives:

- Provide the environmental and social policy of the Construction Contractor(s).
- Provide operational and emergency procedures, developed to address the environmental aspects and risks associated with the construction activities.
- Provide details on approaches and measures and appropriate Personal Protective Equipment (PPE) and other equipment, for handling hazardous waste generated on each site.
- Provide details on communication and reporting, as well as contacts of site supervisors nominated to control and guide works involving disturbance of hazardous materials and waste.
- Clarify the implementation and operation of the site-specific CESMPs to ensure that structure and responsibilities are assigned, workers are trained, aware and competent, and that there is proper communication, documentation, operational control and emergency preparedness and response.
- Provide organizational and technical procedures for implementation of the CESMP to ensure that construction activities associated with potential environmental and social impacts are carried out in a controlled and responsible way.
- Provide checking and corrective action through monitoring and measurement.
- Provide mechanisms for maintaining adequate records of corrective actions to allow effective monitoring.
- Provide mechanisms for maintaining effective two-way communication between Construction Contractor(s) and the community and stakeholders.

9.5.1.2. Preparation of the Site-specific CESMPs

The Construction Contractor(s) shall establish the site-specific CESMPs for each project, including the following:

A. Management Acknowledgements
B. Organization & Staffing
C. Communications and Reporting
D. Environmental, Social, Health and Safety Provisions.

The Construction Contractor(s) shall prepare and submit the contractor's site-specific CESMPs to Supervising Engineer, CSC and the World Bank for review and approval, including relevant parallel plans and procedures within a specific time of the works commencement date as specified in the Contractor's contract. The Supervising Engineer may require periodic reviews, including updating of the CESMPs during the construction works.

The site-specific CESMPs shall provide a statement attesting the Construction Contractor's understanding of, and means of ensuring due compliance with, the statutory regulations relating to construction work in Nepal, specifically regarding compliance with:

(a) All current environmental laws and regulations, related to the following, but not limited to:
- Noise
- Vibration
- Air pollution
- Water contamination
- Solid and hazardous waste disposal
- Waste disposal
- Sanitary conditions (water supply, sewerage, wastewater disposal, etc.)
- Protection of public traffic
- Historical, cultural and archaeological monuments/sites
- Resettlement, land acquisition, servitude, temporary use of land and compensation, etc.

(b) All occupational health and safety legislation including, without limitation, the rules and regulations of Nepal and the authorities having jurisdiction. These provisions will be included and regulated through the H&S Plan.

9.5.2. Organization and Staffing

(i) Organization Chart

The site-specific CESMPs shall include an organization chart identifying (by job title and by the name of the individual) the personnel to be engaged solely for environmental protection, health and safety control.

9.5.3. Communication and Reporting

The site-specific CESMPs shall explain the proposed interaction and communication procedures between construction personnel and environmental protection, health and safety staff, including:

- Communication facilities
- Routine communication and reporting systems
- Stakeholder engagement and consultation activities.

9.5.4. Environmental, Social, Health and Safety Management Provisions

The site-specific CESMPs, including parallel plans and procedures, should include at a minimum the methodology and resources to meet the following requirements:

- Relevant staff training and orientation
- Stakeholder engagement and consultation, and information dissemination
- Maintaining vehicle access to the communities
- Maintaining pedestrian safety and access to the facilities in use
- Pollution and safety control (including spill prevention, dust abatement, noise, handling of hazardous materials and waste, etc.)
- Provision of welfare and sanitation facilities to workers
- Provision of health care to workers and treatment for injuries and infections

- Assessing importance of, and reporting and investigating, chance historical, cultural and archaeological finds
- Actions during incidents and emergencies
- Inspection, monitoring and reporting requirements.

Health and safety requirements will be further specified in the OHS Plans to be developed by the Supervising Engineer, which provide detailed instruction regarding the development and implementation of H&S Plan and other H&S related documents and reports.

All plans produced by Construction Contractor(s) will need to be approved by the Supervising Engineer ahead of implementation to check for consistency and confirm that committed mitigation activities have been adequately included and accounted for by the Construction Contractor(s). Approved environmental and social documents developed by Construction Contractor(s) will be shared with DoR and World Bank for monitoring purposes.

In accordance with World Bank E&S Standards, the Construction Contractor(s) are obliged to implement all reasonable measures with regards to soil erosion, water and air quality, noise and vibration, solid waste, hazardous materials, wastewater discharges, health and safety hazards, labor and working conditions. In a similar way, the Construction Contractor(s) are obliged to implement risk management strategies to protect the beneficiary communities from 1) physical, chemical, or other hazards associated with sites under construction, 2) hazards associated with the increased traffic, and 3) communicable and vector-borne diseases associated with the population of workers.

Other plans and policies to be developed by Construction Contractor(s) as a part of CESMPs to implement mitigation measures specific for each construction site and ensure compliance with environmental and social requirements, may include but are not limited to the following:

(i) Site Establishment Plan

Following the Contractor's mobilization, the Site Establishment Plan is to be prepared in map format with relevant details to guide site preparation, management, closure and restoration activities.

The SEP shall include site plans for each construction site and staging area, indicating the locations and arrangements of all storage areas and work sites subject to activities that may result in environmental impacts. At a minimum, the site plans must indicate the following:

- ***Hard Surface Areas***. Areas within the site where there is a regular movement of vehicles shall have an acceptable hard surface and be kept clear of loose surface material and shall be so indicated on the required site plan.
- ***Waste Disposal and Site Drainage Systems***. The following conditions shall apply:
  - *Waste Disposal*. All water and waste products arising on the site shall be collected, removed from the site via a suitable and properly designed temporary drainage system, and disposed of at a location and in a manner that will cause neither pollution nor nuisance, and is acceptable to the Engineer and the local authorities. The site plan shall indicate the system proposed and the locations of related facilities at the site, including latrines, holding areas, etc. There shall be no direct discharge of sanitary or wash water to surface water. Disposal of materials such as, but not limited to, lubricating oil onto the ground or water bodies shall be prohibited. Liquid material storage containment areas

shall not drain directly to surface water. Liquid material storage containment areas equipped with drains shall be valved, and the valve shall be maintained locked in the closed position with supervisory control of the key. Lubricating and fuel oil spills shall be cleaned up immediately and spill clean-up materials shall be stocked and maintained at the storage area.

- *Drainage*. The site plan shall be devised to ensure that run-off from excavations in the different parts of the works is not deposited directly into any watercourse, stream, or canal and shall indicate the system proposed, including the locations of retention ponds and other facilities. There shall be no direct discharge of sanitary wastewater, wash water, chemicals, spoil, waste oil or solid waste generated in connection with the Works to surface water bodies.

- ***Temporary Construction Facilities Relative to Watercourses***. The site plans shall be devised to ensure that, insofar as possible, all temporary construction facilities are located at least 50 meters away from an existing water course, stream, or canal.
- ***Other Water-Related Facilities***. Site Plans must indicate adequate precautions to ensure that no spoil or debris of any kind is allowed to be pushed, washed down, fallen or be deposited on land or water bodies adjacent to the site.
- ***Location of Batching Plant(s)***. Dry mix batching shall be carried out in a totally enclosed area with exhaust to suitable fabric filters. The locations of these facilities should be clearly illustrated by the site plans.
- ***Location of Wheel Washing Facilities***. The Contractor shall provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from the excavation sites. The Contractor shall ensure that all vehicle are properly cleaned (bodies and tires are free of sand and mud) prior to leaving the construction site and entering public areas and ensure that water or debris from such cleaning operations is contained and not deposited into nearby drains and watercourses. The locations of these facilities shall be clearly illustrated by the site plans.
- ***Location of Sand and Aggregate Storage Provisions***. The Contractor shall implement dust suppression measures that shall include, but not be limited to the following:

- Stockpiles of sand and aggregate greater than 20 cubic meters for use in concrete manufacture shall be enclosed on three sides, with walls extending above the pile and two (2) meters beyond the front of the piles.
- Cement and other such fine-grained materials delivered in bulk shall be stored in closed silos fitted with a high-level alarm indicator. The high-level alarm indicators shall be interlocked with the filling line such that in the event of the hopper approaching an overfull condition, an audible alarm will operate, and the pneumatic line to the filling tanker will close.

- ***Locations of Liquid and Toxic Material Storage Areas***. The site plans shall specify the locations for the storage of liquid materials and toxic materials including the following such conditions to avoid adverse impacts due to improper fuel and chemical storage:
  - All fuel and chemical storage (if any) shall be sited on an impervious base within a bund and secured by fencing. The storage area shall be located away from any watercourse or wetlands. The base and bund walls shall be impermeable and of sufficient capacity to contain 110 percent of the volume of tanks.
  - Filling and refueling shall be strictly controlled and subject to formal procedures, and will take place within areas surrounded by bunds to contain spills/leaks of potentially contaminating liquids.

- The contents of any tank or drum shall be clearly marked. Measures shall be taken to ensure that no contaminated discharges enter any drain or watercourses.
- Disposal of lubricating oil and other potentially hazardous liquids onto the ground or water bodies will be prohibited.
- Should any accidental spills occur, immediate cleanup will be undertaken and all cleanup materials stored in a secure area for disposal to a site authorized for the disposal of hazardous waste.

(ii) Health and Safety Plan (H&S Plan)

The Construction Contractor(s) are obliged to implement all reasonable precautions to protect the health and safety of workers. Construction Contractors(s) will be required to have a standalone Health and Safety Plan and associated procedures that will, as a minimum, adhere to the World Bank's H&S policies and ensure the health and safety of all workers employed during the construction phase of the project.

The Construction Contractor(s) shall establish an H&S Plan in accordance with the content and requirements specified in the OHS Plans (the H&S Plan can also be integrated to the CESMP).

(iii) Emergency Preparedness Plan (EPP)

In case of any accidents, the procedures contained within the EPP will be undertaken immediately. A copy of the EPP and the list of emergency contact numbers are to be posted in a highly visible place within the construction site area.

(iv) Chance Finds Procedure (CFP)

The effective protection of cultural heritage is based on an understanding of the key issues, appropriate assessment and the correct action to minimize possible damage or loss as per ESS 8, World Bank's ESF. As unknown features/objects could be encountered during works, in particular earthworks, a “chance finds procedure” shall be in place to stop works and require investigation by an archaeologist in case of such findings and involvement of relevant state entities.

(v) Stakeholder Engagement Plan (SEP)

The stakeholders and communities are to be informed on the construction activities; including implementation timeline and grievance redress procedure. It is the responsibility of the Construction Contractor(s) to ensure proper awareness and disclosure of information in affected communities during project implementation. (SEP depending on nature and the scale of risk and impacts of the project the element of SEP may be included as a part of Environmental and Social Commitment Plan and preparation of standalone SEP may not be necessary)

(vi) Gender and Social Inclusion Plan (GESI)

Under the GESI, the Contractor shall perform the work in accordance with relevant sections of the ESMP. The Contractor(s) shall ensure the exchange of information between Contractor(s) and the local population on planned and continuing works. The Contractor(s) will encourage the employment of qualified individuals among the local population(s) in project activities, with

particular focus on women, youth, and disadvantaged groups. This may include small-scale supply contracts or services, with announcement of jobs published on project information boards or other means approved by the Engineer. The dissemination of information on potential employment and service provision opportunities must consider ways in which to maximize outreach, using all forms of media that may be appropriate. Where appropriate, the Contractor will provide training to enhance the skills of employees.

9.5.5. Training and Orientation

All employees of Construction Contractor(s) and involved subcontractor(s) should obtain training and orientation on environmental protection, social and health and safety issues. The Supervising Engineer will be responsible for developing a training program on the, ESMP, WMP, OHS Plans, and related documents, and will give this training to the Contractor's Environmental Manager, Social Manager and H&S Manager during the mobilization period. Organization(s) specialized in training delivery can also be engaged by the Supervising Engineer for training purposes. DOR may request to review the training materials prior to their dissemination among the Contractor's staff.

Training materials shall include, but not be limited with the following topics:

- Introduction to environmental, social, health and safety documents and procedures developed for the construction activities
- Presentation of potential impacts and mitigation measures
- Environmental and H&S awareness
- General safety measures for various construction works
- Handling of hazardous materials and waste
- Spill prevention and spill management
- HIV/AIDS
- Trafficking in persons
- Inspections and monitoring
- Handling of incidents and incident reporting
- Emergency preparedness
- Stakeholder engagement and consultation
- Communication and reporting, etc.

Training attendance registers shall be maintained by the Construction Contractor's Environmental Manager, Social Manager and H&S Manager (as appropriate), and shall be made available to the Supervising Engineer and DOR upon request. The Supervising Engineer shall keep DOR informed on upcoming training and orientation sessions and invite them to attend.

The Consultant will be responsible for developing training materials for the Environmental Manager, Social Manager and H&S Manager of Construction Contractor(s) and site supervisors (as needed) and will accompany them in giving training to workers involved in construction works (including subcontractor workers), as well as providing additional on-the-job training relevant to the types of activities the workers are involved in.

All new workers shall be informed and aware of requirements of site-specific CESMP, including relevant parallel plans and procedures, OHS Plans, WMP, and other relevant environmental and social documents and guidelines. On-site guidance shall be provided by site supervisors on a daily basis, targeting environmental and H&S issues specific to each day's work.

9.5.6. Implementation of Site-specific CESMPs

Construction Contractor(s) will be responsible for implementing the site-specific CESMPs including parallel plans and procedures and for internal monitoring and assessment of how environmental and social management at each site is undertaken. This internal monitoring will include the activities undertaken by their subcontractors.

The Construction Contractor(s) will employ environmental, social, health and safety staff to ensure the proper and timely implementation of mitigation measures, coordinate environmental and social activities, undertake internal monitoring, contribute to grievance resolution (as needed), and to prepare environmental and social reports. The Construction Contractor(s) will prepare and maintain reports of their inspections and ensure that corrective actions are taken when necessary and to track environmental and social performance.

Similarly, Supervising Engineer will employ environmental, social, health and safety staff to undertake the supervision of construction works and assess compliance with environmental and social documents of the project, and most importantly CESMPs. Minor incompliance observed at the construction site by the Supervising Engineer shall be documented and Construction Contractor(s) shall be requested to undertake corrective actions within an agreed timeline and report on results. Follow-up inspection will be carried out by the Supervising Engineer to ensure that the issue is resolved.

If an important lack of compliance is observed at the construction site, the following procedure is recommended:

- Works are stopped in the event of a serious incompliance situation
- Follow-up visits are required to verify that the situation has been appropriately resolved by the Construction Contractor(s) through appropriate corrective measures
- Review and investigation of incompliance causes, and evaluate if changes need to be made to documented procedures or if new procedures are required to prevent similar lack of compliance from occurring in the future.

DOR, through the Project Management Team and Environmental and Social Performance Specialists, will undertake the monitoring of project implementation, including review of reports and plans, visits to construction sites, review of corrective measures and their implementation documents to assess compliance with environmental and social guidelines and policies. DOR will monitor the implementation of works against schedules and monitoring indicators, and regularly report to DOR on outcomes.

9.5.7. CESMP Monitoring and Reporting Requirements

The Construction Contractor(s) Environmental Manager, Social Manager and H&S Manager shall develop and submit to the Supervising Engineer reports identified in the Sections 4.2 and 4.3 of this ESMP, including site-specific CESMPs with parallel plans and procedures, training materials, training and orientation reports, regular environmental and H&S reports, as well as monthly progress reports (including environmental and social activities carried out, permits and agreements obtained, and information on incidents and their investigation).

Monitoring of compliance with environmental and social requirements of the site-specific CESMPs, ESMP, OHS Plans, WMP and other relevant legislation and policies includes both internal and external monitoring and inspections.

Internal monitoring is carried out by the Construction Contractor(s) Environmental Manager, Social Manager and H&S Manager and site supervisors to ensure adherence to environmental and social requirements and timely implementation of mitigation measures.

External day-to-day monitoring and site inspection is carried out by site inspectors of the Supervising Engineer. The Supervising Engineer shall review the all the reports and documents developed by Construction Contractor(s) and endorse them prior to implementing their respective activities. Environmental and social documents and reports endorsed by the Supervising Engineer then will be shared with DOR for review and approval (based on the provisions specified in the contract).

The Supervising Engineer shall develop and implement an Environmental and H&S Monitoring Program to verify the effectiveness of prevention and control strategies as outlined in the environmental and social documents developed by Construction Contractor(s). The Environmental and H&S Monitoring Program shall cover:

- Review/approval of environmental and social (including H&S) documents developed by Construction Contractor(s)
- Training and orientation sessions provided by Construction Contractor(s)
- Implementation of regular inspections and testing
- Completion of Inspection Checklists (a format for the Environmental and Social Inspection Checklist is provided in Appendix A, and the OHS Inspection Checklist will be provided as an annex to the OHS Plans to be developed by the Supervising Engineer)
- Communication of observed deficiencies or non-compliance with environmental and social requirements to Construction Contractor(s)
- Review and verification of Construction Contractor(s) progress reports, invoices, and other reports, as needed
- Reporting to DOR.

The Supervising Engineer shall regularly communicate to Construction Contractor(s) its observations on environmental and social issues, including:

- Informing Construction Contractor(s) in case any deficiency or non-compliance with environmental and social requirements is observed at any construction site, and agreeing on corrective actions and implementation timeline.
- Reviewing incident-related documents (including Incident Report Forms, preliminary reports on incident investigation and final reports on incident investigation), ensuring that information is presented correctly and provided in a timely manner; and providing recommendations for corrective actions, as needed.
- Reviewing Construction Contractor(s) progress reports with respect to environmental and social issues to ensure adequate representation of information and verify compliance with its own observations.

The Supervising Engineer shall develop and submit to DOR progress reports (including environmental and social activities and progress), including:

- Information on site inspection activities.
- Summary of findings of inspections and completed Environmental and Social Inspection Checklists and OHS Inspection Checklists.
- Details on any deficiencies or non-compliance with environmental and social requirements observed at any construction site, and corrective actions undertaken by Construction Contractor(s).
- Details on any incidents and/or emergencies observed at any construction site, including information on the investigation process and its outcomes.
- Conclusions of reviewing progress and other reports submitted by Construction Contractor(s) with respect to compliance to environmental and social requirements.

The Supervising Engineer will carry out periodic site inspections, monitoring and review of documents/reports. The Supervising Engineer will communicate the observations made during the inspection as well as outcomes of documents and reports review to Construction Contractor(s) and monitor overall implementation of works to ensure compliance with environmental and social provisions of the contracts.

- DOR can also carry out periodic site inspections, monitoring and review of documents / reports. The Supervising Engineer and DOR may involve a third party independent monitor (organization or individual) to carry out independent monitoring, as necessary.

9.5.8. Standards and Required Equipment

The Contractor shall comply with prevailing standards and regulations of the Government of Nepal. In instances in which the requirements of the Specifications and those of the Government of Nepal differ (if any), the more stringent shall apply. Instrumented monitoring, as called for herein, will require subcontractor services for which the following should be noted:

- ***Water Quality***. All sampling and analysis shall be in conformance with standard methods and standards of the Government of Nepal, and shall be acceptable to the Engineer.

- ***Noise***. Equipment as necessary to ensure monitoring meeting the requirements of the Government of Nepal is required. Baseline noise monitoring shall conform to standard methods and standards of the Government of Nepal, and shall be acceptable to the Engineer.

Soil Quality: All sampling and analysis shall be in conformance with standard methods and standards of the Government of Nepal, and shall be acceptable to the Engineer.

Table 16: Environmental and Social Management Plan (ESMP)

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
Design Phase					
Hydrological Impacts	▪ Design cost-effective drains to collect and appropriately treat runoff water prior to discharge to local water courses.	contractor	DCID/DOR	Design Cost	During Design
Wetlands	▪ In the design, avoid disturbing wetlands by routing the road alignment elsewhere or devising construction methods that preclude impacts to wetlands. ▪ Where construction near or in wetlands is required, specify construction procedures to avoid contamination to the wetlands through the use of silt screens and other appropriate measures. ▪ Given the sensitivity of wetlands, no works or activities that affect wetlands will be allowed.	contractor	DCID/DOR	Design Cost	During Design
Biodiversity and Wildlife	▪ Avoid environmentally-sensitive areas such as protected areas, wetlands, national parks, wildlife corridors, to the extent possible. ▪ Preparation and implementation of a Biodiversity Management Plan as ;part of the ESIA based on mitigation hierarchy. If offset is required, offset will be included in the BMP and will be discussed, assessed and agreed by the Bank. ▪ Provision of wildlife crossings/passes and fences in identified wildlife crossing points. Design will be done by a Wildlife Expert in consultation with Wildlife Authorities and World Wildlife Fund-Nepal, among others.	Contractor	DCID/DoR	EMP cost	Implementation Stage
Wildlife Movement	▪ Construct the Wildlife crossings at the Road Alignment	Contractor	DCID/DoR	EMP cost	Implementation stage

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
Soil Erosion	▪ As much as possible, utilize already used areas for earth borrowing, quarries, and disposal sites ▪ Design erosion protection with gabions, gravel, or vegetation cover according to Nepal standards on steep slopes and along river banks	contractor	DCID/DOR	Design Cost	During Design
Impact of Borrow Pits, Quarries and Waste Disposal	▪ Obtain a permit from local authorities for opening and/or use of borrow areas and quarries ▪ Obtain a permit from local authorities for construction and disposal operations ▪ Restricted to small areas, on sites without trees cover – and located away from cultivable lands and settlements, drinking water intakes, Areas where it will not result slope instability, erosion, disruption of natural drainages, changes in river regimes, river bank cutting, destruction of vegetation, damage of farmland and other physical resources ▪ Extraction of sand and gravel will be spread over the longest length possible from seasonal rivers so that no section of river bed is excessively disturbed ▪ No condition is created inducing spill over of impoverished materials by the discharge during wet season over the arable land on the valley side ▪ After the completion of extraction, the site will be properly fenced and closed, landscaping completed and plantation will be done on it.	contractor	DCID/DOR	Design Cost	After design, before construction
Public Safety	▪ Design the road alignment facilities using latest safety measures such as fences, signs, controlled entrances, etc.	contractor	DCID/DOR	Design Cost	During Design
ROW Environmen	▪ avoid critical habitat through use of existing utility and transport corridors for the	contractor	DSC/DOR	Design Cost	During Design

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
tal Impacts	establishment of associated facilities, whenever possible; ▪ Avoid construction activities during the breeding season and other sensitive seasons or times of day. ▪ Revegetate disturbed areas with native plant species. ▪ Remove invasive plant species during routine vegetation maintenance. ▪ Implement an integrated vegetation management approach.				
Aquatic Habitat	▪ Make extra environmental sensitive consideration while working in critical aquatic habitat (e.g., watercourses, wetlands, riparian areas), as well as fish spawning habitat, and critical fish over-wintering habitat; ▪ Maintain fish access when access road crossings of watercourses are unavoidable by utilizing clear span bridges, open-bottom culverts, or other approved methods; ▪ Minimize clearing and disruption to riparian vegetation.	contractor	DSC/DOR	Design Cost	During Design
Construction Phase					
Inadequate environmental awareness of workers	▪ Conduct special briefings and/or on-site training for the contractors and workers on the environmental requirements of the project ▪ Conduct briefing sessions as and when required	contractor	DSC/DOR	Construction Cost	Before start of construction
Water Quality	▪ Implement proper construction management, including training operators and other workers to avoid pollution of water bodies by the operation of construction machinery and equipment ▪ Store lubricants, fuels, and other hydrocarbons	contractor	DSC/DOR	Construction Cost	During Construction

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
	in self-contained enclosures ▪ Dispose of water and waste products arising from the site via a suitably designed temporary drainage system in a manner that will not cause pollution problems or other nuisance ▪ Properly dispose of solid waste from construction activities and labor camps ▪ Locate temporary construction facilities including structures and material stockpiles at least 50 m away from water bodies and wetland areas ▪ Avoid disposing of wash water, solid waste (such as discarded packing, waste from concrete agitator cleaning operations, and excavated material in water bodies and wetlands adjacent) to or in the vicinity of the sites ▪ Maintain vehicles and equipment in good operable condition and ensure no leakage of oil or fuel ▪ Perform regular checks on all equipment, plant, and machinery ▪ Service vehicles, machinery, and equipment at properly managed and equipped workshops where waste oil is collected and disposed of at approved locations ▪ Providing sanitation arrangements at work sites and temporary accommodation facilities to avoid releasing wastewater and sewage to drains or water bodies ▪ Avoid disposal of solid waste, sludge, and other wastes directly into water bodies and properly manage campsites ▪ Prohibit disposal of waste fuel, oil, grease into				

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
	water and cleaning of vehicles in rivers ▪ Prohibition of urination and defecation in open areas and near water bodies by construction workers with the installation of sanitation facilities. ▪ Prevent soil slippage at toe of the stocked areas by installing barriers at the perimeter ▪ Make a strict rule not to throw the excess material generated during construction ▪ Properly manage the stockpiled material so that the downstream erosion doesn't occur				
Air Quality/Dust	▪ Ensure all heavy equipment and machinery is in full compliance with national regulations ▪ Wet stockpiled soil and sand before loading, particularly in windy dry conditions ▪ Enclose stockpiles of sand and aggregate greater than 20 m3 in volume in walls extending above the pile and beyond its front face ▪ Ensure acceptable all-weather surfaces for areas within the site where there is a regular movement of vehicles ▪ Store cement and other such fine-grained materials delivered in bulk in closed silos fitted with a high-level alarm indicator; vent weigh hoppers to a suitable filter ▪ Employ fuel-efficient and well-maintained haulage trucks with proper exhaust baffles to minimize exhaust emissions ▪ Turn off the engines for all vehicles, while parked on the site ▪ Use efficient equipment, machinery and vehicles with regular checks to affect necessary	contractor	DSC/DOR	Construction Cost	During Construction

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
	corrections or repairs, and ensure compliance with safety and air pollution requirements ▪ Cover soil, sand, and other construction material in storage and in transit ▪ Use effective water sprays during the delivery and handling of all sand and aggregate and other similar material when dust is likely to be created ▪ Provide barriers in locations where strong winds are likely to blow away dust and debris ▪ Spray bare areas and roads used for haulage of material with water ▪ Wash tires and lower bodies of vehicles when moving out from the construction site ▪ Select sites for material extraction away from residential areas to reduce the impacts of dust ▪ Water spraying during construction two times a day if dust pollution becomes nuisance ▪ Prohibit open storage and spillage of loose soil in and around construction site ▪ Appropriately cover or wet the stock piled and spoil materials if it gives rise to dust pollution ▪ Cover loaded trucks with polythene sheets / tarpaulin during transportation ▪ Use of face masks to the construction workers in dust prone areas such as crushing plants, excavation sites etc. ▪ The diesel generator set will be established based on the Nepals Governments standard.				
Noise/ Vibration	▪ Fit all powered mechanical equipment and machinery with noise abating gear, such as mufflers for effective sound reduction, in full compliance with the applicable regulations	Contractor	DSC/DOR	Construction Cost	During Construction

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
	▪ As possible, operate heavy equipment during daylight hours ▪ Terminate works at the established time (e.g., work during daylight hours) and avoid increasing noise during peak hours ▪ Isolate construction equipment that generates excessive noise/vibration ▪ Use well-maintained haulage trucks with speed controls ▪ Take reasonable measures, such as installing acoustic screens to minimize noise near noise-sensitive areas such as schools and places of worship ▪ Ensure the contractor takes responsibility for rectifying damages caused by vibration generated from or by the use of any equipment, machinery, and haulage vehicles ▪ Establish crusher plant, batching plant etc. away from settlement and wildlife habitat areas to extent possible. ▪ Construction of noise barrier such as bund or vegetative barrier at construction site ▪ Prohibition of using pressure horns by vehicles near the settlements and wildlife habitat areas, if any ▪ Limit the volume of gelatin while blasting at quarry sites ▪ Provide ear plugs to each construction workers in the noise prone areas such as blasting for hard rock excavation at ridge site ▪ Large noise producing machineries such as air compressors, crushing plants to be fitted with noise reduction mechanism				

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
	▪ Use compaction equipment with caution and monitoring for any cracks near the settlement areas ▪ Use smaller equipment which generates less vibration near settlement areas. Avoid use of compaction equipment during night time				
Soil Erosion and soil contamination	▪ In the short-term, protect all areas susceptible to erosion, flood damage, and silt transport/sedimentation with either temporary or permanent drainage works ▪ Take measures to prevent pooling of surface water and scouring of slopes ▪ Use silt traps where earthworks are carried out adjacent to water bodies including wetlands ▪ Develop measures to strengthen the steep slopes with vegetation, grass and plants, or gabions. Work with local communities to implement these measures. ▪ Develop efficient methods for disposal or backfilling of extracted soils ▪ Avoid the use of arable land for earth borrowing. If unavoidable, the topsoil (ca 30 cm) shall be removed, stored, and refilled after the operation is completed. ▪ Restore to quasi-original conditions of landscape after completion of works and after use of quarries; restore vegetation cover in accordance with the design constraints of road alignment. ▪ Avoid stockpiling site near cultivable lands and settlements, drinking water intakes, public places, near school, health centres, forest area, sensitive ecosystem, fragile and landslide prone	Contractor	DSC/DOR	Construction Cost	During Construction

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
	slope or terraces etc. and where natural drainage will be disrupted ▪ Stockpiled material should be protected from erosion prior to rainy season, unless covered by a suitable material, including construction of drainage, trenches and ponds around the heap and where necessary, seal the area so surface water pollution does not occur ▪ Storage of material on private property will be allowed only if written permission is obtained from the owner of authorized lessee ▪ Compensation for land and crops damaged due to stockpiling of materials should be given by the Contractor to the affected landowners ▪ Site should be cleaned and brought to original condition after closure and removal of the stockpile				
Handling and Storage of Hazardous Materials	▪ Store hydrocarbons and hazardous materials on impervious ground under cover and construct the storage area as a spill tray to avoid spread of accidental spills ▪ Provide safe ventilation for storage of volatile chemicals ▪ Restrict and control access to areas containing hazardous substances ▪ Use refrigerants and fire extinguishing agents in accordance with the "Montreal Protocol" ▪ Adequate care in storing and handling bitumen. Avoid contamination with water sources in case of spillage. Storing compounds shall have fire extinguisher facilities ▪ Protective clothing, gloves, boots etc. should be provided to the laborers	Contractor	DSC/DOR	Construction Cost	During Construction

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
	▪ Bitumen heating and mixing plants should be away from settlement areas ▪ Excess bitumen should be managed properly ▪ Storing of fuel, lubricants etc. should be done in a safe manner ▪ Used lubricants shall not be discarded in a haphazard manner or disposed in streams/ rivers and water sources ▪ Direct cleaning of vehicles or equipments should prohibited in streams, rivers or canals. ▪ All storing compounds shall have fire extinguisher facilities and first aid kits				
Soil erosion and slope instability	▪ Design the road alignment using applicable soil erosion prevention design standards. ▪ Carry out construction activities so that vibrations from heavy equipment and soil disturbance from grading, excavation, or slope cutting does not cause the surrounding top soil layer to become unstable and begin a slide. In general take all necessary measures to avoid landslide/soil erosion risk during construction. ▪ On cut slopes, landscaping should be carried out with bio-engineering works, prior to rainy season, with the application of top soils ▪ Compensatory plantation if possible should be carried out in this area ▪ New embankments should be properly compacted and exposed surfaces should be covered with vegetation to avoid slope washout ▪ Contractor's BOQ should mention such measures	Contractor	DSC/DOR	Construction Cost	During Construction
Damage to Historic/Cul	▪ Cease work as soon as historical and cultural monuments are encountered during construction	Contractor	DSC/DOR	Construction Cost	During Construction

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
tural Monuments and Features	activities ▪ Provide relevant information to the Ministry of Culture. The Ministry will determine the value of the historic/archaeological monuments and provide guidance on if and how to proceed with the construction. This may include excavating or otherwise documenting the monuments before proceeding, or in cases of very valuable features, developing a design to avoid the features at that site.				
Work Camp/ Temporary Yard Operation and Location	▪ Identify the location of work camps in consultation with the local authorities, DOR, and NGOs; where possible, avoiding the location of camps near settlements or near water supply intakes ▪ Avoid the cutting of trees and minimizing the removal of vegetation for the camps ▪ Provide water and sanitary facilities for employees ▪ Manage solid waste and sewage according to the national and local regulations. As a rule, solid waste must not be dumped, buried, or burned at or near the project site, but shall be disposed of at the nearest sanitary landfill or site having and complying with the necessary permits. ▪ Ensure the Contractor organizes and maintains a waste separation, collection, and transportation system ▪ Ensure that all liquid and solid hazardous and non-hazardous wastes are separated, collected, and disposed of according to national requirements and regulations	Contractor	DSC/DOR	Construction Cost	Before starting construction and During Construction

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
	▪ At the conclusion of the project, remove all debris and waste, as well as all temporary structures, including office buildings, shelters, and toilets ▪ Plant exposed areas with suitable vegetation ▪ Ensure the Engineer inspects and reports that the camp has been vacated and restored to pre-project conditions ▪ Employ maximum number of labors from nearby villages as far as possible ▪ Establish labour camps away from water sources and specify appropriate sites for establishment of labour camps with appropriate arrangements for solid waste collection and its management through incineration or proper landfill for degradable wastes ▪ Strict prohibition of disposal of solid wastes near water sources ▪ Develop and implement "Code of Conduct" and enforce strict penalty to violator of "Code of Conduct" ▪ Educate about non-use of bio non-degradable materials such as plastic, metal, glass etc. and separation of such waster material and incineration safely ▪ Manage the solid waste generated in the construction activities and construction camp site as per the Solid Waste Management Act , 2068 ▪ Avoid open defecation of construction workers and construct pit latrine near the labor camps ▪ Sanitary wastes and excreta will be safely disposed into septic tanks				

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
	▪ Provide awareness program and training to the construction workers regarding health and sanitation.				
Disposal of spoils and construction debris	Avoid disposal on: ▪ natural water course posing a threat of or causing chowking in its flow and course change ▪ over the edge of the excavations and fresh embankments ▪ immediately above potential arable land and forest areas ▪ above public utilities and existing services – water supply lines, irrigation canal systems, valley side trails etc. ▪ above local settlements' physical structures, especially house ▪ on fresh unstable slopes Spoil disposal should be prioritized on: ▪ On undulated and low, flat plains ▪ Flood plains without stretching over to main course ▪ Site requiring landfills, especially local play ground, community ground, reclaimed land from rivers, etc. ▪ Site requiring value adding landfills, especially reclaiming land for building constructions ▪ Broad flat land on the ridge and depressions spread over large areas ▪ Solid Waste management ▪ Management of the waste based on its category of biodegradable and non biodegradable ▪ Biodegradable waste will be managed by the composting and non biodegradable will be	Contractor	DSC/DOR	Construction Cost	During Construction

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
	through the environment friendly disposal ▪ The Solid waste from the construction activities will be managed accordance with the Solid Waste Management Act of Nepal				
Blocking of natural drainage and cross drainages	▪ Avoid disposal of any excess material in natural drainage paths ▪ If temporarily disposed, clear drainage path prior to start of rainy season ▪ Periodically clean and maintain all cross drainage facilities ▪ Strictly prohibit disposal of solid wastes by local people ▪ Filling of excess material should be done such that it does not hinder natural drainage	Contractor	DSC/DOR	Construction Cost	During Construction
Impact on the local environment due to the operation of crusher and batching plants	▪ The crusher plant and concrete batching plants shall be established and operated at the selected places only ▪ Proper traffic signals and markings should be provided at the vicinity of such plants ▪ Extraction of sand and gravel from various river beds situated around the project area should be avoided	Contractor	DSC/DOR	Construction Cost	During Construction
Worker safety	Contractors to develop detailed Environmental, Safety and Health (ESH) plans to be approved by the Engineer. These plans should, at a minimum include sections on: ▪ Provide adequate warning signs ▪ Provide workers with skull guard or hardhat and other personal protective equipment	Contractor	DSC/DOR	Construction Cost	During Construction

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
	▪ Instruct contractor workers in health and safety matters, and require the workers to use the provided safety equipment ▪ Establish all relevant safety measures as required by law and good engineering practices ▪ Provide training and briefings for workers on safety precautions and their responsibility for their safety and the safety of others ▪ Ensure that vehicle and equipment operators are properly licensed and trained ▪ Arrange for the provision of first aid facilities, rapid availability of trained paramedical personnel, and emergency transport to nearest hospital with accident and emergency facilities ▪ Allocate responsibilities to ensure that these arrangements are in place ▪ Arrange for regular safety checks of vehicles and material, and allocate responsibility for checking ▪ Ensure that material extraction operations are supervised and carried out by trained and experienced staff ▪ Establish procedures and provide instructions about emergency evacuations, and provide a list of emergency contacts available for 24 hrs. ▪ Provide HIV/AIDS and STI awareness training and encourage voluntary and confidential HIV and STI testing				
Traffic Management and Construction Safety	▪ Formulating and implementing a construction-related traffic management plan. The plan should, at a minimum include sections on: ▪ Install traffic warning signs, and enforce traffic regulations during transportation of materials,	Contractor	DSC/DOR	Construction Cost	Before starting construction and During Construction

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
	equipment, and machinery ▪ Conduct awareness programs on safety and proper traffic behavior in densely populated areas near the construction sites ▪ Assign traffic control personnel/flaggers ▪ Provide alternative access to pedestrians ▪ Arrange necessary measures for passer-by safety and all means of transportation safety (e.g., establishing protection zones, bypassing these areas during transportation of materials) ▪ Select quarry and borrow sites that are served by roads of adequate capacity for heavy trucks; where minor roads cannot be avoided include provisions for repair and restoration ▪ Control the loading and operating speeds of haulage vehicles ▪ Repair damages to roads caused by haulage of construction materials, spoil and equipment, and machinery ▪ Obtain approval from local authorities if local road are used for transportation				
Operation Phase					
Obstruction to natural drainage and waterlogging	▪ Periodically clean and maintain all cross drainage facilities ▪ Strictly prohibit disposal of solid wastes by local people ▪ Avoid disposal of any excess material in natural drainage paths ▪ If temporarily disposed, clear drainage path prior to start of rainy season	DOR	DOR	repair and maintenance cost	during operation time
Fragmentation of individual	▪ Establishing easy access path rather than long time consuming into settlement area and farm land	DOR	DOR	repair and maintenance cost	

Environmental Concern	Mitigation Measures	Institutional Arrangements		Cost Estimate	Timing
		Implementing	Supervising		
land plots	▪ The RoW should be demarcated and fenced in order to avoid encroachment ▪ Improving agricultural extension services and applying additional protective measures on water logging issues				

Legend: DoR: Department of Roads
DSC: Design and Supervision Consultants

9.6 Environmental and Social Monitoring Plan

The mitigation measures proposed in this ESMP will be carried out by the responsible implementing agencies. However, to ascertain whether the mitigation measures are implemented properly and whether the implemented measures are capable of mitigating the adverse impacts as intended, conducting environmental monitoring is essential. The monitoring of the ESMP will: 1) track and report the effectiveness of the mitigation measures and responsibilities identified and conducted through the ESMP, 2) inform on the need to expand, increase or adjust mitigation measures, and 3) identify any potential new areas of impact exposure that were not identified in the ESMP.

ESMP monitoring begins along with the start of construction activities and continues throughout all subsequent project phases.

The following environmental monitoring parameters were prioritized for inclusion in the monitoring plan:

- Traffic and pedestrian safety
- Accessibility
- Borrow and disposal areas
- Water quality (surface water and ground water)
- Air quality
- Noise levels
- Soil, forest areas, trees and natural resources
- Hazardous material use
- Worker safety
- Social impacts
- Maintenance during operational phase.

Table 17 presents a summary of the environmental monitoring plan.

Table 17: Environmental and Social Monitoring Plan

Phase	Parameters to be monitored	Monitoring location	Monitoring method	Time of monitoring	Cost	Monitoring Agencies
Design	Traffic safety	Design office	Design and traffic parameters	During the design	Design cost	DOR
	Accessibility	Design office	Design and traffic parameters	During the design	Design cost	DOR
	Material borrow and disposal areas	Design office	Permits from responsible authorities	During the design	Design cost	DOR
Construction	Soil erosion Soil contamination	New cut and fill areas, slopes, and quarries Around areas of plant and machinery operation; Oil, chemical and hazardous materials storage areas	Inspections at site and soil mechanical information Inspection of sites and analysis of soil samples	When deemed necessary during and after construction work	Constructio n cost	DSC
	Water pollution (pH, color, electrical conductivity, turbidity, suspended solids, oil and grease, total dissolved solids)	In selected water bodies, mainly upstream and downstream of substations	Inspection and analysis of water samples in an approved laboratory	Before construction for establishing baseline; Semi-annually and when deemed necessary during construction	TBD	ME
	Noise - Leq (describes sound levels that vary over time as a single decibel value which takes into account the total sound	Work sites	Inspection and noise levels (dB); measurement	Before construction for baseline; When deemed necessary during earth, blasting, and	TBD	DSC, ME

Phase	Parameters to be monitored	Monitoring location	Monitoring method	Time of monitoring	Cost	Monitoring Agencies
	energy over the period of time of interest, usually one hour)			pile driving work; on public complaints		
	Use of hazardous materials should be monitored to prevent accidents and reduce remedial costs for clean up	Work sites	Accident reports	When accident occurs	Minimal additional construction cost	DSC
	Vehicle and pedestrian safety	At and around work sites in populated areas, and along roads used to move materials to project sites	Inspection on visibility and appropriateness	Once per month	Minimal additional construction cost	Contractor; DSC
	Worker safety (protective equipment)	At work site	Inspection	Unannounced inspections during work	Minimal additional construction cost	DSC
	Overall workers' camp site conditions	At the camp site during construction activities	Inspection	According to the existing regulations	Minimal additional construction cost	DSC
	Number of trainings on TIP by Contractor for their workforce Number of participants in the road safety trainings for women and children	At the camp site where training takes place	Training report and training attendance sheet signed by participants	After training completion	Minimal additional construction cost	DSC, DOR

Legend: DoR – Department of Roads

CHAPTER 10: STAKEHOLDER ENGAGEMENT

10.1 This is a process of engagement all the individuals and institution/organizations, business group civil society, medias and political leaders and concerned regarding social and environmental issues. Their involvement is assured throughout the project period during *preconstruction*, *construction* and *operation* phases of the project. A successful project will not just go all alone, but also take along with all those who have a stake on the project. A project cannot be successful without cooperation of interested community groups and individuals. This project identify the stakeholders as i) directly and/or indirectly project affected parties, ii) interested parties and those who have potential to influence project outcomes. Those identified groups are the affected communities, local loose networks, CBOs, NGO/INGOs, government agencies, academia, media and entrepreneurs.

Table 18: Potential Stakeholder of Local Level authorities for KDP road

SN	Name of Municipalities	District	Wards	Major Settlements
1.	Ganeshman Charnaath	Dhanusha	1,4,6,7 and 8	Godar, birendra Bazar
2.	Dhanusha Dham		6,9 and 8	Dharapani
3.	Mithila		10,9,8,7,6,5,3and 4	Dhalkebar
4.	Bardiwas	Mahottari	11,10,5,4,1,14,8	Bardiwas
5.	Gaushala		12,10,8,1	
6.	Ishworpur	Sarlahi	12,5,4	
7.	Lalbandi		1,10,9,7,6,17	Ranigaunja, Lalbandi, Nawalpur
8.	Hariwan		9,10,8,4	Hariwan
9.	Bagmati		12,4,1,2	Karmaiya
10	Brindawan	Rautahat	1	
11	Chandrapur		3,4,2,1	Paurahi, Chapur
12	Gujara		3,2	
13	Nijgadh	Bara	3,8,3,2	Dhansaar,Pasaha,Deuralipath,Nijagadh
14	Jeetpur Simara		1,2,4,14,15,16,17	Pathlaya

Stakeholder involvement in forest restoration activities

Most of the forest activities are carried by the Community Forest User Groups (CFUG), due to their presences locally. Collaborative Forest user groups are also found equally active. Some of the forest activities where the forest users are involved are:

1. Cutting, sectioning of affected trees including transporting and storing in nearest yard as defined by the DFO
2. Support DFO to identify, count and hammer all trees affected
3. Fencing of reclamation plantation area
4. Plantation of trees for compensation
5. Establishment of nursery and seedling production
6. Watchmen for the protection of planted trees

7. Nursery foremen
8. Silvicultural activities in the plantation for 3 years
9. Training on rearing and management of reclamation plantation
10. Training CFUG, LHF groups on felling, sectioning, hauling and piling techniques of cut trees and logs
11. Forest fire control and fire fighting
12. Sharing of knowledge on wild animal behaviour, habitat, range and co-existence.
13. Training labour on forest fire
14. Extension activities: sign boards and signs for forest fire sensitivity, educational / message oriented boards/signs on bird habitat, animal passing, educative sign boards on animal and bird behaviors, habitat and others
15. Orientation regarding the project to school children, local clubs, environmental management groups, management and enhancement of biodiversity (month-long co-working at school/clubs - environmental/forestry interns)
16. Environmental/Forestry interns (plantation/forest management, wildlife management, aquatic, terrestrial ecosystems and others) DFO to coordinate

Stakeholders and the level of their participation

Stakeholders are all those who will be affected/impacted positively or adversely while the project is implemented. They are also the participants of the sharing meetings. Sharing meeting is a group exercises of all concerned about the project and live within the ROW-50m, and/or ZOI or beyond. Some of identified stakeholders along Patlaiya – Kakarbhitta corridor are:

1. Community Forest User Groups (CFUG),
2. Leasehold User Groups (LFH User Groups),
3. Collaborative Forest User Group (Collaborative User Groups),
4. Protection Forest User Groups (Protection User Groups),
5. Department of National Parks and Wildlife Reserve staff (DWNP-staff)
6. Conservation areas (conservation area staff),
7. District Forest Office (DFO – Ilaka - Sector staff),
8. Local Government personnel and staff (Municipalities/Village staff)
9. Department of Soil Conservation (merged with the local bodies)
10. Forest based interest groups/enterprises representatives (NTFP, Bamboo groups, etc),
11. Forest based enterprises representatives
12. Mother's group
13. Other concerned groups and individuals.

Stakeholder engagement process

All stakeholders should be involved during the project process. During the initial field visit, pre-construction and construction phases, planning for their involvement is different. During field visits and sharing meetings at the pre-construction phase all involved stakeholders are informed about project objectives and its potential impacts. The DFO staffs from the project area are requested to inform all concerned stakeholders and forest managers spread over the project area for the meeting. During the recognizance survey of forest and biodiversity several meetings were held to inform all

concerned stakeholders spread over the project area that ensure their participation in the process and receive feedback. During data collection in Patlaiya-Kakarbhitta section, all stakeholders were informed about project activities and potential impacts on their forests and ecosystems surrounding them. Additional discussion was about the loss of forest area and their trees and how to avoid losses to the extent possible. Stakeholders were informed that the whole project team is working to minimize impact as far as possible. When the impact is unavoidable, the project will compensate for the loss.

During forest and biodiversity inventory, the concerned stakeholders were again met, specially the Community Forest User Groups (CFUG), the District Forest Office staff (DFO) and the Leasehold Forest User Groups (LHFUG), and they were informed about predicted impact on forest, trees, poles and other vegetation, which will be cut and removed. They were also informed that the project team enumerated and identified the extent of the impact. Forester in that case will identify and estimate the amount of damage and trees and pole being cut. Evaluation will also be made of other vegetation that will be removed.

Stakeholders are informed that the trees and pole loss during the construction phase will be compensated at a rate of 1:25 trees by planting sapling, replanting and replacing died trees with new saplings. The established plantations will be protected, silviculturally treated and handed over to the concerned stakeholder group after 5 years. During this 5-year period, plantations in Nepal are fenced and protected by a project paid watcher. The plantation will be annually weeded (3 years) and silvicultural treated for a better establishment. The area required for plantation and nursery establishment should be provided by the local communities. During the process of acquiring the land for plantation, the stakeholders participate in the selection of best place for nursery or plantation. If there is no enough sufficient area in one place, several small pieces can be selected. Engagement of concerned DFO and CFUG with regards to availing of land and collaboration with ongoing plantation programme of the government of Nepal could be of help in compensatory plantation, as it can accommodate the project need. Discussion with those stakeholders could be helpful for proper planning and implementation of forest/tree compensation programs, establishment of wildlife cross-road structures, finding of best solutions to ensure road safety in the places with high potential for wildlife – vehicle collisions, etc.

10.2 Roles of Involved Agencies

The institutional responsibility for planning, implementing and monitoring the proposed mitigation measures will be shared among the following agencies:

10.2.1. Executing Agencies

Executing agencies are responsible for designing and implementing the mitigation measures.

Before tendering for the design-construction works, DOR, the implementing entity, shall ensure that all the necessary permits and agreements are obtained from relevant state and local authorities before the construction works are tendered out. DOR shall also ensure that the appropriate

environmental and social clauses and documents are incorporated into biding documents and contracts for Construction Contractor(s) and the Supervision Consultant.

During the bidding process, the bidders for works shall commit to compliance with all applicable environmental and social documents developed as for the project, the requirements of national legislation and DOR guidelines. The potential Construction Contractor(s) shall assess mitigation measures required and include provisional sums in their bids to ensure that such measures will be carried out. The potential Construction Contractor(s) and Supervision Consultant shall also demonstrate in their bids the involvement of professional staff specializing in environmental, social, health and safety management, mitigation and supervision, as relevant.

During the design phase, from environmental and social perspective, the executing agency, design and supervision consultant will develop ESMP, OHS Plans, WMP (Waste Management Plan) and other documents required for project activities. The design and supervision consultant will also elaborate designs and other technical documents and follow up with obtaining appropriate permits and agreements.

During the construction phase, the executing agencies (Design consultant-Construction Contractors) will take responsibility for developing site-specific CESMPs (based on the ESMP) and other relevant plans and procedures, as well as for implementing the mitigation measures provided in the CESMPs, adherence to the provisions of the ESMP, WMP, OHS Guidelines, other documents and procedures developed in accordance with DOR's Environmental Guidelines, IFC Performance Standards, and applicable environmental and social legislation of Nepal, as well as for obtaining all permits and agreements related to construction activities (in agreement with the DSC and DOR). Construction Contractor(s) will also be responsible for regular reporting to the DSC and DOR (as provided in the contract) regarding the implementation of environmental and social activities.

10.2.2. Supervising Agencies

Supervising agencies are responsible for supervising the executing agencies to ensure that they implement the mitigation measures as planned and described in this ESMP.

The DSC is responsible for daily supervision of the implementation of civil works and will be responsible for supervising the timely, proper and reliable implementation of works and measures as provided by CESMPs (including parallel plans and procedures), WMP, OHS Guidelines and other relevant guidelines and documents.

This DSC will also oversee the environmental and social aspects of all activities implemented by Construction Contractor(s) during construction, in order to ensure that mitigation measures are designed and implemented properly to prevent and minimize likely adverse environmental and social impacts.

The DSC will also ensure that all construction-related agreements and permits are obtained by the Construction Contractor(s) from relevant authorities before the construction works commence on site. World Bank may request to check if such permits are issued and valid (e.g., not expired), as well as if the CESMPs (including parallel plans and procedures) mitigation and monitoring aspects are implemented on the ground during the project.

10.2.3. Monitoring and Evaluation Agencies

These agencies are in charge of monitoring the extent of implementation and the effectiveness of the mitigation and enhancement measures, and of adjusting the program if needed. DOR will monitor the implementation of works, including environmental and social measures and activities. DOR's monitoring function will include both reviews of documents and reports produced by executing and supervising agencies, and the verification of information on site.

The government entities (e.g., relevant Ministries responsible for environmental, social and cultural protection) may also be involved in the monitoring activities, as a part of their mandate.

10.3 Reporting and Follow-Up

The Environmental and Safety Officer (ESO) will prepare monthly and as-needed incident reports and submit them to the DSC, who will submit them in tern to DOR with their comments, observations, and recommendations. DSC will report to DOR and send feedback to the Contractor directly when urgent action is required. Monitoring and reporting on the implementation of follow-up action will also be part of the ESO's duties.

DSC will prepare and submit quarterly project environmental and social management reports to DOR, which will provide oversight. DOR will convene project environmental management meetings when necessary to discuss and instruct on the environmental and social management aspects of the project. DOR, the DSC, and the Contractor will participate in the meetings. Wherever possible, representatives of community organizations will also be invited to the meetings.

10.4 Public Complaints

Community members will be informed through consultation meetings where public complaints will be entertained, documented, and investigated by DOR. Complaints will be resolved in consultation with the Contractor and community representatives. Public complaints that cannot be resolved at the DSC level will be directed to DOR, which will record all complaints and the actions taken to resolve them. The DSC will inform the complainant of the action taken. If the complainant is not satisfied, he/she will be informed that there is further recourse through petitioning DOR.

Grievances regarding resettlement, compensation, and livelihood restoration, including Grivance related to labor group, GBV will be addressed in compliance with the Grievance Mechanism discussed as pre ESS 2 4 and10

10.5 Implementation Schedule

The implementation schedule for the ESMP has been prepared taking into consideration the provisional time schedules for preparing the ESIA, including preparation of the ESMP, project designs and bid documents, awarding of tenders, and start of construction.

As soon as the notification to proceed is received, the Contractor is expected to prepare and submit an Action Plan detailing the means by which the construction-related environmental and social mitigation measures recommended in the ESMP will be implemented. While the Contractor is expected to strictly follow the Action Plan, mitigation actions required at the pre-construction phase will already have been implemented by the DOR/Design and Supervision Consultant.

The key elements of the implementation schedule are:

- Preparation and submission of the contractor's ESMP (CESMP)
- Nominating an Environmental and Safety Officer and a Social and Gender Officer
- Finalizing site(s) and layout plan(s) for construction camps/temporary yards incorporating environmental requirements
- Preparation and submission of Mobility and Access Facilitation Plan (MAFP) and Construction Schedule
- Informing the public of MAFP and alternative access and alternative sites
- Implementation of mitigation and enhancement measures
- Monitoring and reporting on ESMP implementation (Contractor, DSC and DOR).

Table 4 present a representative duration-based Implementation Schedule.

10.6 Stakeholder Engagement for Conservation and Management of Biological Environment

Stakeholder engagement for conservation and management of biological environment starts from pre-construction phase and continues during construction and operation phases. For example, between pre- and construction phase, there is a need to obtaining clearance of cutting trees from the affected forests and involvement of stakeholders from CFUG/LHFUG/Coll/Prot-DFO-DWLNP and private owners of the forest in various activities. The number of methods and technics exists that to ensure stakeholder involvement through methods of communication and feedback received.

10.6.1. Stakeholder involvement in forest restoration activities

Most of the forest activities are carried by the Community Forest User Groups (CFUG), due to their presences locally. Collaborative Forest user groups are also found equally active. Some of the forest activities where the forest users are involved are:

17. Cutting, sectioning of affected trees including transporting and storing in nearest yard as defined by the DFO
18. Support DFO to identify, count and hammer all trees affected
19. Fencing of reclamation plantation area
20. Plantation of trees for compensation
21. Establishment of nursery and seedling production
22. Watchmen for the protection of planted trees
23. Nursery foremen
24. Silvicultural activities in the plantation for 3 years
25. Training on rearing and management of reclamation plantation
26. Training CFUG, LHF groups on felling, sectioning, hauling and piling techniques of cut trees and logs
27. Forest fire control and fire fighting
28. Sharing of knowledge on wild animal behaviour, habitat, range and co-existence.
29. Training labour on forest fire
30. Extension activities: sign boards and signs for forest fire sensitivity, educational / message oriented boards/signs on bird habitat, animal passing, educative sign boards on animal and bird behaviors, habitat and others
31. Orientation regarding the project to school children, local clubs, environmental management groups, management and enhancement of biodiversity (month-long co-working at school/clubs - environmental/forestry interns)
32. Environmental/Forestry interns (plantation/forest management, wildlife management, aquatic, terrestrial ecosystems and others) DFO to coordinate

10.6.2. Stakeholders and the level of their participation

Stakeholders are all those who will be affected/impacted positively or adversely while the project is implemented. They are also the participants of the sharing meetings. Sharing meeting is a group exercises of all concerned about the project and live within the ROW-50m, and/or ZOI or beyond. Some of identified stakeholders along Patlaiya – Kakarbhitta corridor are:

14. Community Forest User Groups (CFUG),
15. Leasehold User Groups (LFH User Groups),
16. Collaborative Forest User Group (Collaborative User Groups),
17. Protection Forest User Groups (Protection User Groups),

18. Department of National Parks and Wildlife Reserve staff (DWNP-staff)
19. Conservation areas (conservation area staff),
20. District Forest Office (DFO – Ilaka - Sector staff),
21. Local Government personnel and staff (Municipalities/Village staff)
22. Department of Soil Conservation (merged with the local bodies)
23. Forest based interest groups/enterprises representatives (NTFP, Bamboo groups, etc),
24. Forest based enterprises representatives
25. Mother's group
26. Other concerned groups and individuals.

Stakeholders have been designated during community meetings and other interactions with local communities. Nepali communities have special requirements and effects, which needs to be met and utilized in the form of partnership and bonding with these stakeholders. Bindings are temporary or medium term, at large. In the meetings, the project staff shares information regarding the project, as required and deliver answers to the questions about the project which the stakeholders have. Majority of the quarries are those which can impact or related to them. The project will also inform them of their involvement in various project activities. Some of these are as follows:

i) Share all information regarding the highway and its impact to the Nepalese communities,
ii) Share "know-how" of the forest resources, training and association with the forest based entrepreneurs.
iii) Sharing of information on prevailing project delivered facilities, government or I/NGOs delivered facilities and share other extension activities which the project have to share,
iv) Share information on impact that the project will have on the natural resources (stakeholders need to know the health hazard if the project is associated with) and property.
    a. Loss of trees from their forests during the process
    b. Loss of farm and agriculture land
    c. Loss of forest products, wildlife habitat, wetland and aquatic life, birds and other invertebrates.
    d. Process to overcome the impacts: The principle of Avoid, Minimize, Compensate.
v) Re-enumeration of trees of the affected forests upon the request of Cabinet of Ministers (COM) sends through the Ministry of Forests and Environment (MoFE).
vi) Supporting the Hammering and harvesting of affected trees. Compensation mechanism is important hence required sharing:
    a. It is essential to know what is there in the forests and surrounding. Trees are counted. Other biodiversity has a different nature of existence unlike trees and NTFP, which move around.

b. After approval from COM, the trees are hammered, in community forests, it is the CFUGs who hammer the trees, unlike whom it is Range Officers and Forest Guards in the Government forests.

vii) Role of stakeholders in various compensatory activities are

a. The project needs to know, if the stakeholders can grow tree saplings in the nurseries and if they are familiar with nursery establishment and operations. Exploring capacity of the existing nurseries or identification site location for new nurseries.

b. Learn also about the site for compensatory plantation locally from the stakeholders. Sharing will be also made regarding compensatory plantation, plantation management, and other supplementary activities and the role of stakeholder's in planting, plantation management and budget needed.

c. Consulting with stakeholders regarding estimation and spending the budget for all compensatory activities. It is important to share the five-year plan of managing compensatory plantation and other activities and budgeting mechanism.

10.6.3. Stakeholder engagement process

All stakeholders should be involved during the project process. During the initial field visit, pre-construction and construction phases, planning for their involvement is different. During field visits and sharing meetings at the pre-construction phase all involved stakeholders are informed about project objectives and its potential impacts. The DFO staffs from the project area are requested to inform all concerned stakeholders and forest managers spread over the project area for the meeting. During the recognizance survey of forest and biodiversity several meetings were held to inform all concerned stakeholders spread over the project area that ensure their participation in the process and receive feedback. During data collection in Patlaiya-Kakarbhitta section, all stakeholders were informed about project activities and potential impacts on their forests and ecosystems surrounding them. Additional discussion was about the loss of forest area and their trees and how to avoid losses to the extent possible. Stakeholders were informed that the whole project team is working to minimize impact as far as possible. When the impact is unavoidable, the project will compensate for the loss.

During forest and biodiversity inventory, the concerned stakeholders were again met, specially the Community Forest User Groups (CFUG), the District Forest Office staff (DFO) and the Leasehold Forest User Groups (LHFUG), and they were informed about predicted impact on forest, trees, poles and other vegetation, which will be cut and removed. They were also informed that the project team enumerated and identified the extent of the impact. Forester in that case will identify and estimate the amount of damage and trees and pole being cut. Evaluation will also be made of other vegetation that will be removed.

Stakeholders are informed that the trees and pole loss during the construction phase will be compensated at a rate of 1:25 trees by planting sapling, replanting and replacing died trees with new saplings. The established plantations will be protected, silviculturally treated and handed over to the concerned stakeholder group after 5 years. During this 5-year period, plantations in Nepal are fenced

and protected by a project paid watcher. The plantation will be annually weeded (3 years) and silvicultural treated for a better establishment. The area required for plantation and nursery establishment should be provided by the local communities. During the process of acquiring the land for plantation, the stakeholders participate in the selection of best place for nursery or plantation. If there is no enough sufficient area in one place, several small pieces can be selected. Engagement of concerned DFO and CFUG with regards to availing of land and collaboration with ongoing plantation programme of the government of Nepal could be of help in compensatory plantation, as it can accommodate the project need. Discussion with those stakeholders could be helpful for proper planning and implementation of forest/tree compensation programs, establishment of wildlife cross-road structures, finding of best solutions to ensure road safety in the places with high potential for wildlife – vehicle collisions, etc.

CONCLUSIONS AND RECOMMENDATIONS

1. Basing on the conducted environmental and social assessment of the Pathlaiya – Kakarbhitta Road, the proposed project has been classified as High risk project with potential significant environmental and social impacts broader than project area that are sensitive, diverse and unpredictable. It also has potential transboundary impacts on wildlife migration and movement.

2. The project area contains many valued environmental components, which can be impacted during road upgrades and expansion, including effects on following valued components:
    - Topography and geomorphology (erosion of bank slopes, landslides);
    - Natural drainage systems (flooding and siltation);
    - Soils (erosion, top-soil damage and contamination);
    - Ambient environmental conditions (air and noise pollution during construction and operations);
    - Environmentally sensitive areas such as critical habitats (Parsa National Park and Koshi-Tappu Wildlife Reserve), valuable ecosystems & critical wildlife habitats (Betana Wetland, Flying Fox Habitat in Ratuwamai Forest) and wildlife crossing areas or movement corridors (Elephant passing point at Parsa National Park, Belbari-Pathari Forests, Charali Forest, Buffer Zone of the Koshi-Tappu);
    - Terrestrial habitat (damaged forest areas and cut trees);
    - Aquatic habitat (Sapta-Koshi River, wetlands and other water-bodies, affected fish species and river dolphins);
    - Threatened and endangered species (Asian Elephant as umbrella indicator and 14 other indicator species that can be affected by road upgrades and expansion as well as by cumulative impacts);
    - Land and resource use (directly affected households and public structures);
    - Population infrastructure and services (health and safety issues);
    - Economy and wellbeing (impact on agricultural land and forestry);
    - Community life (impact on indigenous people and marginalised communities, impact on social, cultural and religious practices).

3. The most significant direct and indirect adverse impacts are expected during construction stage such as dust emission, noise effect, health and safety risks, hazards due to spoil disposal and construction wastes, blockage natural drainage, runoff water, siltation, pollution of water resources, contamination of soil, wildlife disturbance in the environmentally sensitive areas, habitat destruction and cutting of trees, barriers for wildlife movement, affected fish and herpeto-fauna, increased wildlife – road collisions, impacted threatened and endangered species, created conditions for spreading of invasive species. Direct socio-economic impacts will include change in land use, loss of productive land and houses, contamination of productive soil, increased road accidents, impact of dust and noise on health of laborers and local population,

increase in community transmitted diseases and others. The mitigation measures to avoid, minimize, rehabilitate and compensate predicted impacts have been proposed in the Initial Environmental and Social Management Plan.

4. Cumulative impacts have been predicted as evaluated as follows:
   - Cumulative impact of land use change in the general project area;
   - Natural drainage management issues in Sunsary District due to effects from several linear projects;
   - Fragmentation of wildlife habitats in Parsa National Park;
   - Population isolation and human-wildlife conflicts in Koshi-Tappu Wildlife Reserve due to several linear projects;
   - Barrier effect and loss of biological productivity in Betana Wetland due to road expansion;
   - Decreased permeability of linear structures (elephant movement corridors) within the project area;
   - Impact on Gangetic Dolphin and fish populations in the area of bridge over Koshi-Barrage.

1. There is a need in coordination of mitigation measures with other linear construction projects (railway, electric line, etc.) that to avoid or minimize adverse cumulative impacts after construction that can lead to the loss of many important environmental elements in the area and impact the quality of life for current and future generations in the Terai Region.

2. That to avoid adverse impacts on existing infrastructure and community life several by-pass areas are recommended, which are in Nijgadh section (16.16km), Inaruwa section (19.82km), Dhalkebar section (1.75km) and Paurahi section (15.73km).

3. Conducted studies and data analysis prove that road upgrading and expansion may cause significant environmental and social impacts. Additional studies and detailed Environmental and Social Impact Assessment are needed to identify the critical areas and apply mitigation hierarchy in accordance with national legislation and World Bank ESF.

Annex 1: Air and Water Quality

Table 19: Water Quality Data

Parameters	pH	BOD_5	Electrical Conductivity	Turbidity	COD	T hardness as CaCO3	Total Alkalinity as $CaCO_3$	Oil & Grease	Lead	Chloride	Cadmium	Chromium	Ammonia	Copper	Fluoride	Zinc	Nitrate	Total Kjeldahl Nitrogen	Calcium	Total Suspended Solid	Total Phosphate	Magnesium	Iron	Magnese	Fecal Coliform
Desired value	5.5-9	50	-	5	250	500		10	0.1	200	2	0.1	Nil	3	0.5-0.15	5	45.0	-	100	50	-	75	0.30	0.10	Nil
Sirsiya River-Parwanipur	6.0	108.0			130.0			19.0	0.017		<0.005	<0.05		0.014		0.04		10.36		114.0	0.17				
Simara tube well water	6.3		219	<1		124	12.44			1.98			0.6		0.01		<0.10		33.6			9.6	0.26	0.05	4

Source: Field sampling and lab test at Aastha Scientific Research Services Pvt. Ltd., Kathmandu, 2018

Table 3.4: Air Quality Data

Site	Date	Instrument		Parameters (µg/m3)								
				PM_{10}	$PM_{2.5}$	TSP	SO_2	NO_x	Benzene	Pb	Ozone	CO
Raxual-Amlekhgunj Petroleum Pipeline Area	27-28 /04/2018	High Volume Air Sampler (GTI-251), Combined Sampler (GTI 141) and UNIPHOS Precision air sampling (ASP-40)	Simara (Infront of Samyak hotel)	106.4	36.1	318.2	11.4	13.5	<5.0	<0.5	<100.0	<1000.0
			Amlekhgunj (Inside NOC staff quarter area)	68.3	22.8	196.7	8.6	6.1	<5.0	<0.5	<100.0	<1000.0
Tolerance				120	40	230	70	80	5	0.50	157	10000

Source: Field sampling and lab test at Aastha Scientific Research Services Pvt. Ltd., Kathmandu, 2018

Annex 2: Affected forests along the alignment

SN	Government Managed Forests	Area (Ha)	Community forests	Area (Ha)	Collaborative forest	Area (Ha)
District Bara						
1	West of Nijgadh (GF)	19.58	Pathlaiya	5.55	Gadimai	5.55
2	Parsa National park	27.07	Bakaiya Nagmani	5.31	Halkhoriya	12.81
3	East of Nijgadh (GF)	2.32	Janajyoti	4.93		
4	East of Nijgadh (GF)	3.88	Adarsha Sadabahar	2.60		
		52.85		**18.39**		**18.36**
					District total	**89.6**
District Rautahat						
	Government Forest	20.44	Janaekata	2.62	Ramlal	21.39
	Government Forest	19.72	Hatemalo	3.33		
			Sahid Part Bantole	4.93		
			Namuna	3.19		
			Deurali	7.02		
			Barambaba	3.55		
			Srijana	0.25		
			Bagmati	1.57		
			Janasewa	0.88		
		40.16		**27.34**		**21.39**
					District Total	**88.89**
District Sarlahi						
	Government forest (S)	0.71	Nandeshower	3.89	Fuljor	14.76
	Sagarnath plantation	14.76	Janajyoti	1.64		
	Government forest	0.36	Radha Krishna	1.67		
			Radha Krishna	2.02		
			Everest	1.82		
			Kalika	1.82		
		15.83		**12.86**		**14.76**
					District total	**43.45**
District Mahotari						
	Government forest(N)	2.13			Tuteshwor (Banke/Mahara -N)	4.48
	Sagarnath Plantation (S)	18.24			bardibas garanta (N)	11.09
		20.37				**15.57**
					District total	**35.94**
District Morang						
	Government Forest	0.22	Tamange Ghetung (N)	0.22	Belbari Chisang (N)	2.12
	Jadibuti Area	3.21	Amana sisauli (N)	0.80		
	National Forest (N)	6.04	Rai Yayokn	0.55		
			Khaptadi	0.30		
	Dhimal Conservation Salbari (B)	0.87	Betana WL (N)	2.02		
			Betana WL	0.69		

SN	Government Managed Forests	Area (Ha)	Community forests	Area (Ha)	Collaborative forest	Area (Ha)
			Devithan (N)	0.00		
			Laxmi (N)	0.58		
			Laxmi (S)	1.92		
			Srijana CF (B)	0.31		
			Srijana CF (B)	2.76		
			Singh devi	2.12		
			Janajagriti (N)	2.45		
			Janajagriti (S)	1.84		
			Kirat Yoyokha	0.37		
			Gramin sundar	6.34		
			Sita Chadhare (N)	0.55		
			Janagagriti mahila	0.61		
			Janagagriti mahila (N)	0.33		
			Dans Morang (N)	0.28		
			Pasupati (N)	1.72		
			Bhukle Pasupati	1.72		
			Manakamana (N)	0.78		
			Srijana	0.78		
			Shanti (N)	0.44		
			Hariyali (N)	2.94		
			Sundar	2.32		
			Chautari	2.73		
			Salbari (N)	1.68		
			Aailani (B)	0.43		
		10.34		**40.58**		**2.120**
					District total	**53.04**
	Ratuwamai Plantations (N)	18.79	Kankai (N)	4.26		
			Pragati (N)	4.23		
			Hariyali Cf	2.50		
			Hatemalo Cf	0.67		
		18.79		**11.66**		
					District total	**30.45**

Table 20: Replacement plantation, area and cost for replenishment plantation

Name of the districts	Name of Forest	trees being cut	Seedlings for replacement plantation	Area required for Plantation-Ha	Location for replacement plantation
Bara	Gadimai CFM	438	15330	6.85	Under the Forest decade program, Bara district is under taking a huge plantation programme in area bordering Nepal- India. Rivers originated from Chure have extend river beds and replacement plantation can be very effective. The objective will be to recover those area. • River bank of Bakaiya, Passha, Dhansar River. • Fallow land of Boarder area CFUGs were highly concerned about location of planation and who planted them. According to them plantation should carried with fast growing, local and high value timber species and planted in southern terai. Leasehold
	Pathlaiya CF	438	15330	6.85	
	Halkhoriya CFM	1012	35420	15.81	
	Government forest (West of Nijgadh)	1547	54145	24.16	
	Parsa National Park	2139	74865	33.42	
	Nagmani Bakaiya CF	419	14665	6.55	
	Janajyoti CF	389	13615	6.08	
	Adarsa sadabahar CF	206	7210	3.21	
	Government forest (East of Nijgadh-south)	184	6440	2.87	
	Government forest (East of Nijgadh-North)	306	10710	4.79	
	Total	7078	247730	110.59	

					approach would be helpful in protecting plantations.
Rautahat	Government Forest (Left)	2452	85820	38.31	Area for replacement plantation inside community forest or collaborative forest is very limited often zero area. Few barren patches of land in southern Terai of the district can be utilized. Similar to Bara district, river banks of Bagmati and Lamaha can be used for replacement plantation.
	Government Forest (Right)	2366	82810	36.97	
	Janaekata CF	314	10990	4.90	
	Hatemalo CF	400	14000	6.25	
	Sahid Part Bantole CF	592	20720	9.24	
	Namuna CF	383	13405	5.98	
	Deurali CF	842	29470	13.16	
	Barambaba CF	426	14910	6.65	
	Srijana CF	30	1050	0.46	
	Bagmati CF	189	6615	2.95	
	Janasewa CF	106	3710	1.66	
	Ramlal CBFM	2567	89845	40.11	
	Total	10666	373345	166.66	
Sarlahi	Nandeshower CF	467	11680	7.30	Sagarnath forest development project is a plantation project. Collaboration with the project could be helpful and the project have enough area as well. Few small patches of barren land inside CF were found where CFUGs can be negotiated with and following the similar principal, riverside plantation would be effective.
	Government Forest	86	2141	1.34	
	Janajyoti CF	197	4931	3.08	
	National forest	43	1071	0.67	
	Radha Krishna CF	200	4999	3.12	
	Radha Krishna CF	243	6069	3.79	
	Everest CF	219	5468	3.42	
	Kalika CF	219	5468	3.42	
	Fuljor CBFM	1771	44283	27.68	
	Sagarnath plantation	1771	44283	27.68	
	Total	5216	130393	81.50	
Mahotari					**Location for Replacement Plantation** Like earlier districts, area for plantation
	Tuteshwor CFM	688	24080	10.75	
	Bardibas Garanta CFM	1709	59815	26.70	
	Government Forest	328	11480	5.12	
	Sagarnath Plantation	2809	98315	43.90	

	Total	**5534**	193690	86.47	is not available in this district as well. Sagarnatha plantation project will be greatly hit. Replacement plantation for Sagarnath can be negotiated with the project itself and Sagarnath has the space required. Additional area beyond Saganath required is 42.57 ha., which is not available. Hence similar approach as other district may be helpful. Selection of area can be done in coordination with DFO, DSCO and others.
Morang	Tamange Ghetung RF	118	4130	1.84	Area for replacement plantation in Morang district is around 450 Ha. Selection of area for replacement plantation is huge challenge in this district, there is hardly area inside community forest for replacement plantation. There are few patches of rivers beds
	Government Forest	118	4130	1.84	
	Amana sisauli CF	427	14945	6.67	
	Rai Yayokn RF	295	10325	4.61	
	Khaptadi CF	162	5670	2.53	
	Betana WL CF (North)	1082	37870	16.91	
	Betana WL CF (South)	370	12950	5.77	
	Jadibuti Area	1717	60095	26.83	
	Devithan CF	3	105	0.04	
	Laxmi CF (North)	312	10920	4.87	
	Laxmi CF (South)	1025	35875	16.01	
	Srijana CF (North)	164	5740	2.56	
	Srijana CF (South)	1478	51730	23.09	
	Belbari Chisang CFM	1136	39760	17.76	
	Singh devi CF	1136	39760	17.76	
	Janajagriti CF(North)	1309	45815	20.45	

	Janajagriti CF (South)	983	34405	15.36	where plantation can be done. Location for plantation need to be identified with consultation with district forest office and local authorities. Rivers emerging from Siwalik like Tandi, Letang, Madhumalla, Kerabari, Yangsilla can cumulatively avail necessary area for plantation.
	Kirat Yoyokha CF	196	6860	3.06	
	Gramin sundar CF	3389	118615	52.96	
	National Forest	3232	113120	50.51	
	Sita Chadhare CF	296	10360	4.62	
	Janagagriti mahila CF (South)	326	11410	5.09	
	Janagagriti mahila CF (North)	178	6230	2.79	
	Dans Morang CF	147	5145	2.30	
	Pasupati CF	919	32165	14.36	
	Bhukle Pasupati CF	919	32165	14.36	
	Manakamana CF	415	14525	6.48	
	Srijana CF	415	14525	6.48	
	Shanti CF	236	8260	3.69	
	Hariyali CF	1572	55020	24.56	
	Sundar CF	1243	43505	19.43	
	Chautari CF	1458	51030	22.79	
	Salbari CF	901	31535	14.08	
	Aailani	229	8015	3.59	
	Dhimal Conservation Salbari	467	16345	7.29	
	Total	28373	993055	443.33	
Jhapa	Kankai CF	1449	50715	22.64	Around 238 ha of land is needed for plantation. Collaboration with Ratuwamai Forest Development Project, a plantation project can be helpful. Besides the replacement for Ratuwamai, additional 60 ha is required. Various rivers banks, small patches of barran and degraded forest in existing community forest can be utilize.
	Pragati CF	1437	50295	22.45	
	Hariyali CF	600	21000	9.38	
	Hatemalo CF	93	3255	1.45	
	Ratuwamai plantation	11647	407645	181.98	
	Total	15226	532910	237.91	

Annex 3: National Ambient Air Quality Standards for Nepal

National Ambient Air Quality Standards for Nepal, 2012

Parameters	Units	Averaging Time	Concentration in Ambient Air, maximum	Test Methods
TSP (Total Suspended Particulates)	µg/m3	Annual -	-	
		24-hours*	230	High Volume Sampling and Gravimetric Analysis
PM10	µg/m3	Annual	-	High Volume Sampler and Gravimetric Analysis, TOEM, Beta Attenuation
		24-hours*	120	
Sulphur Dioxide	µg/m3	Annual**	50	Ultraviolet Fluroscence, Waste and Geake method
		24-hours*	70	Same as annual
Nitrogen Dioxide	µg/m3	Annual	40	Chemiluminescence
		24-hours*	80	Same as annual
Carbon Monoxide	µg/m3	8 hours*	10,000	Non dispersive Infra Red spectrophotometer(NDIR)
Lead	µg/m3	Annual**	0.5	High volume sampling, followed by atomic absorption spectrometry.
Benzene	µg/m3	Annual **	5	Gas chromatographic Technique
PM 2.5	µg/m3	24-hours*	40	PM2.5 sampling gravimetric analysis
Ozone	µg/m3	8 hours*	157	UV spectrophotometer

*24 and 8 hourly values shall be met 95% of the time in a year. 18 days per calendar year, the standard may be exceeded but not on two consecutive days.

** The above indicators are prepared by the 104 data taken yearly average in a fixed location in one week by observing two times in 24 hours.

National Ambient Sound Quality Standard, 2012

S.N.	Land Use	Sound limit Leq (dBA)	
		Day	Night
1.	Industrial	75	70
2.	Commercial	65	55
3.	Rural Residential Area	45	40
4.	Urban Residential Area	55	50
5.	Mixed Residential Area	63	55
6.	Peace Area	50	40

Source:Ministry of Forest and Environment

Note: Leq (24) = Equivalent Sound Level in decibels.