

Initial Environmental Examination

June 2019

NEP: SASEC Mugling–Pokhara Highway Improvement Phase 1 Project

Prepared by the Department of Roads, Ministry of Physical Infrastructure and Transport,
Government of Nepal for the Asian Development Bank

CURRENCY EQUIVALENTS

(as of 1 June 2019)

Currency Unit	–	Nepalese Rupee (NRe/NRs)
NRe 1.00	=	\$ 0.00895
\$1.00	=	NRs 111.7567

ABBREVIATIONS

AADT	Average Annual Daily Traffic
ADB	Asian Development Bank
ADT	Average Daily Traffic
amsl	Above Mean Sea Level
AP	Affected People
BOD	Biological Oxygen Demand
CBOs	Community Based Organization
CBS	Central Bureau of Statistics
CDMA	Code Division Multiple Access
CFUG	Community Forest User Group
CITES	Convention on International Trade in Endangered Species
CO	Carbon Monoxide
COI	Corridor of Impact
DBST	Double Bituminous Surface Treatment
DDC	District Development Committee
DG	Diesel Generating
DHM	Department of Hydrology and Metrology
DHO	District Health Office
DNPWC	Department of National Parks and Wildlife Conservation
DOF	Department of Forest
DoR	Department of Roads
DSC	Design and Supervision Consultant
EA	Executing Agency
EAG	Environmental Assessment Guidelines
EIA	Environmental Impact Assessment
EMG	Environmental Management Guidelines
EMP	Environmental Management Plan
EPR	Environment Protection Rules
ES	Environmental Specialist
FIDIC	Federation Internationale des Ingenieurs Conseils
GESU	Geo-Environment and Social Unit
GHG	Green House Gas
GSM	Global System for Mobile Communication
IA	Implementing Agency
IEE	Initial Environmental Examination
IUCN	International Union for Conservation of Nature
LPG	Liquefied Petroleum Gas
MCT	Main Central Trust
MoPE	Ministry of Population and Environment
MoSTE	Ministry of Science, Technology and Environment
MoPIT	Ministry of Physical Infrastructure and Transport
NAAQS	Nepal Ambient Air Quality Standard
NEP	Nepal

NOx	Nitrogen Oxide
ODS	Ozone Depleting Substances
PD	Project Directorate
PIP	Priority Investment Plan
PIU	Project Implementation Unit
PPE	Personal Protective Equipment
PSA	Poverty and Social Assessment
REA	Rapid Environmental Assessment
RoW	Right of Way
RSSDU	Road Sector Skills Development Unit
SC	Supervision Consultant
SDC	Social Development Consultant
SRN	Strategic Road Network
TA	Technical Assistance
TMO	Transport Management Office
TPPF	Transport Project Preparation Facility – ADB
TRL	Transport Research Laboratory
VDC	Village Development Committee
V-SAT	Very Small Aperture Terminal
ZOI	Zone of Influence

WEIGHTS AND MEASURES

dBA	decibels A
KWH	Kilowatt-Hour
K VA	Kilo-Volt- Ampere
MLD	Millions of Litres Per Day
ppb	Parts Per Billion
pph	Persons Per Hectare
ppm	Parts Per Million

NOTES

The Nepalese calendar year (B.S) runs from mid-April to mid-April. Unless otherwise stated, year ranges written in the form 2015/016 denote a single calendar year. The fiscal year (FY) of the Government ends on 15 July. FY before a calendar Year denotes the year in which the fiscal year ends (For example, FY 2015 begins on 16 July 2014 and ends on 15 July 2015).

Acts and Regulations are cited under the name of the ministry from which they originate. The official version of Acts and Regulations is published in the Nepal Gazette (in Nepali). Some Acts and Regulations are published by other Government agencies in English (Unofficial translations).

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EXECUTIVE SUMMARY

1. This Initial Environmental Examination (IEE) covers the road upgrading works of the Mugling-Pokhara Road (Abhukhaireni-Pokhara Section), including the construction of two new major bridges – Madi bridge (km 41+725) and Seti bridge (km 88+583) in Tanahu and Kaski Districts, in Gandaki Province of Nepal. The Executing Agency (EA) for the project is the Ministry of Physical Infrastructure and Transport (MOPIT) and the Implementing Agency (IA) is the Department of Roads (DOR), Project Directorate of the Asian Development Bank (ADB).

2. The objective of the project is to widen and upgrade the Abhukherini Pokhara Road (81 km) from existing double lane to four lane bituminous paved standard along with the construction of two major bridges (Seti bridge and Madi bridge) to cater to increased traffic load and provide smooth, easy and quick access eliminating existing traffic congestion and reduction in roadway accidents. The whole section of the road is rapidly being developed as urban area and forms the only major gateways to Pokhara, famous tourist center in Western Development Region.

3. Abukhaireni – Pokhara Road (81 km) is a section of the Prithvi Highway (174-kilometre-long) connecting Naubise of Tribhuvan Highway, 26 km from Kathmandu, the capital of Nepal, and Pokhara, a tourist city in the western region of Nepal is designated as a National Highway; H04 as per SSRN/DoR. The road section starts from Abhukherini Bazaar Chowk (08+250) at an elevation of 257.289 m amsl, passes through various small towns and settlements and it ends at Prithivi Chowk (90+000) of Pokhara city at an elevation of 842.70 m amsl. Under the present project scope, the road section starts from the right bank of the Trishuli river near from Abhukhaireni settlement (towards Pokhara) in Abhukhaireni municipality (257.289 m amsl), Tanahu District and ends at Seti River Bridge of Pokhara at about km 88+583 (835.795 m amsl) in Kaski district. The road section runs along the hilly/mountainous terrain of mid-hills in Tanahu and Kaski Districts. This section of Prithivi Highway was constructed as a 7m wide road with Chinese Government Assistance in 1967 as bituminous road. The project road crosses 26 major and minor rivers. The road runs mostly in steep rocky hill section and river valley terraces with various land use pattern, mostly forest, urban and rural settlements, cultivated land. Considerable vehicular traffic exists as the road forms one of the major links to western region of Nepal. The alignment passes through former six (6) municipalities and four (4) Village Development Committees (VDCs) namely; Abukhaireni Municipality, Ghansikuwa VDC, Bandipur Municipality, Vyas Municipality, Jamune Bhanjyang, Manpang, and Chhang VDCs, Shukla Gandaki Municipality of Tanahu district and Lekhnath municipality and Pokhara Sub-metropolitan city in Kaski district respectively. As per recent federal structure it encompasses through Abhukhaireni and Bandipur rural municipality as well as Vyas and Suklagandaki municipality of Tanahu district and Pokhara-lekhnath metropolitan city of Kaski district.

4. Existing width of the road is 6.5 m on an average and condition of road, structures and drainage facilities are in fairly good condition throughout the road section. After the road is upgraded, it is expected that the volume of traffic in the proposed road section will increase from the current level of 5,501 to 17,278 vehicles per day (vpd) in 2016 AD to the traffic level of 49,175 to 187,600 vpd by 2039 AD (Source: Traffic Survey, 2016).

Physiographically, the proposed road section lies in mountainous/hilly region. The road starts from Abhukherini Bazar at an elevation of 257.289 m amsl of Abhukhairini municipality of Tanahu district and ends at Shahid Chok in Pokhara Sub Metropolitan City at an elevation of 842.70 m amsl. Climatologically, the project area lies in subtropical region. The average maximum and minimum temperature of Tanahu district is 38°C and 5°C respectively and average annual rainfall in the district is 1761 mm. Similarly, the average annual rainfall in

Kaski district is 1701.70 mm and the average maximum and minimum temperatures of this district is 32°C and 2.2°C respectively (District Profile of Kaski, 2014).

Project districts have complex physiographic features like the warm and dry tropical belt to the alpine region where harsh and cold weather prevails. The road section passes through numerous terraces consisting of recent alluvial materials and along the moderate to gentle hill slope with a few exceptions where the road passes through rocky terrain consisting vertical rocky cliff. The hill slope is either covered with medium thick to thick residual to colluvial deposits or slope scree material, from Khairanitar onwards up to the Seti river bridge the alignment passes through Pokhara valley floor characterized by recent quaternary Pokhara Valley sediments consisting of slightly to moderately cemented silty/sandy gravel.

5. Approximately 45% of the road alignment passes through baazars and built up area, consisting alluvial-colluvial, colluvial-residual and debris flow deposits, 9% through forest area consisting thin to medium thick slope scree material along with colluvial to residual deposits, 39% through rural and cultivated area consisting thick to medium thick silty/clay about 2% of the alignment through barren land including river, kholsi etc and 5% alignment passes through rocky area consisting rocks of Nuwakot Group and Kunchha Group.

6. There are twenty-six (26) major streams across the road alignment as major water bodies. There are nine (9) irrigation crossings along the road alignment (Chainages: 27+060, 37+130, 37+725, 48+120, 48+160, 49+150, 52+400, 52+890, and 67+580). In addition, there are 197 RCC slab and 114 box culverts along the road alignment. No wetlands are found within the vicinity of the road.

7. The road section traverses seventeen (17) community managed forests. A total of 7.8 km of the proposed road upgrading section passes through these community forests and National Forest. The dominant forest types existing along the road corridor include Riverine forests, *schima forests*, *Alnus nepalensis* forests, and *Shorea robusta* forests. Three species namely, *Shorea robusta*, *Bombax ceiba* and *Acacia catechu* are protected plant species. The first one is high value timber and second one offers industrial value. *Shorea robusta* is banned for commercial felling, transportation and export including their fruit/seed, leaf and twigs. Similarly, commercial felling, transportation and export include pod/seed, leaf, bark and wood for *Acacia catechu* are also banned. Further, *Acacia catechu* falls under the threatened category of IUCN status.

8. Total population of 6 municipalities and 4 VDCs touched and traversed by the proposed road section is estimated at 5,22,837 with 1,35,932 households which accounts for 64.12 % of the project districts population. Gender-wise population distribution is estimated at 48.84% male and 51.16% female (CBS, 2011). Diverse ethnic groups such as Brahmin, Gurung, Chhetri, Newar, Magar, Tamang, Thakuri and occupational caste (Damai, Sarki, Kami) lives along the Zol of road alignment. However, the numbers of occupational caste households are very less and distributed in almost all the settlements.

9. Major occupation of the households is trade & business. Similarly, people are carrying out other economic activities like agriculture, working in government and non-government organizations as well as abroad. The project area contains a renowned historical site, Ghasikuwa, along the road corridor at around km. 36+870.

10. Implementation of the proposal will have both beneficial and adverse impacts. Some of the beneficial impacts will be on human life, income generation from employment during the construction stage and increased income from improved access for market to agricultural products during operational stage. Most importantly, the upgraded road will provide smooth, easy and quick access to traffic eliminating existing traffic congestion and reduction in roadway accidents. The upgrading of the road will reduce running costs of vehicles such as

fuel economy, reduction in wear and tear of vehicle parts etc. Gaseous emission will be reduced due to better riding quality.

11. The ADB SPS, 2009 aims to avoid, minimise or mitigate harmful environmental and social impacts and help the borrower strengthen their safeguard system. It also provides a platform for participation by affected community in project design and implementation.

12. The project road was screened and categorized using Rapid Environmental Assessment (REA). The REA consist of questions relating to: (i) the sensitivity and vulnerability of environmental resources in the sub-project area, and (ii) the potential for the sub-project to cause significant adverse environmental impacts. This project road has been classified as Category "B".

13. In order to accomplish the IEE, public consultations were organized at two levels namely, (i) district headquarters, and (ii) project level. During consultation, local beneficiaries, affected people and stakeholders expressed various ideas and opinions.

14. Following issues and concerns were raised commonly by local stakeholders:

- Land acquisition and compensation issues,
- Possibility of displacement of persons and resettlement of the displaced persons,
- Community involvement in the project activities, and
- Support programs/ training needs to the community.

15. After the incorporation of their idea, opinions and suggestions in the IEE report, Information will be disclosed through public consultation and more formally by making documents and other materials available in a form and at a location they can be easily accessed by stakeholders.

16. Potential adverse impacts due to the proposed project implementation are temporary disruption of public utilities and existing services as electrical poles/line, telephone poles/line, water supply pipelines, existing bus bays, existing cross-drainage structures including canal crossings. A total of 350 trees will be required to be cleared from seventeen (17) community forests along the road alignment and 6,294 trees from the RoW in front of private land/road side. A total 6,644 trees will need to be cut down (Road: bordering with community forest 350 & 6000 within the ROW, Seti Bridge 81 and Madi Bridge 213). Water pollution could result from waste disposal and spoil deposits if not properly managed. The road construction will provoke accident risks if the road safety and safe diversion is not managed for smooth flow of traffic. Air pollution due to dust particles and vehicle emissions, pollution of water, poor sanitation, road and work site accidents, social conflicts and other pressures on the local communities are the possible impacts during construction. During the operation stage, soil erosion and scouring of embanked slopes/siltation on farm land due to monsoon rain could occur. Cross-drains may cause erosion of adjacent agricultural fields if not maintained properly.

17. Rehabilitation, extension and construction of adequate drainage and cross-drainage structures are provisioned in the design to avoid alteration of surface water hydrology by maintaining flow and course of stream and irrigation crossings. The mitigation measures such as bio-engineering (seed sowing) for stabilization of embanked slopes and restoration of visual environment, road safety and occupational safety and hazards mitigation will be included in the technical detailed design. Mitigation measures for health and sanitation, pollution control and social and economic impacts are recommended and will be implemented during the project implementation. Strict rules and regulation in the labor and work camp is being provisioned so that any engagement in alcoholic and other bad habits are restricted.

18. Adequate traffic signs and markings, delineators, proper passing bays at bus stops/bus bays, proper junction layout, appropriate entry and exit at access roads and approach to petrol pumps to minimize traffic conflict have been cautiously provisioned in the design for safety of vehicular traffic during operation stage.

19. Most of the cost for mitigation measures is included in the in-built design and estimate. However, some of the mitigation costs not included in the project design and construction contract are estimated separately for inclusion in the Civil Works contract. Such costs include the costs for vegetation and plantation of trees, and reinstatement of public utilities/services etc. and cost for monitoring of air, water and noise during construction and operation stage etc.

20. Environmental management plan (EMP) in the IEE report has identified key issues likely to arise from project implementation, and has proposed mitigation measures, including responsibility. A separate Poverty and Social Assessment and Resettlement Studies Report have also been prepared by the Social Development Specialist and the Resettlement Specialist, respectively under the TPPF. However, the correlated issues such as safety of community and construction crews, safe passages for public, protection of common physical, cultural, religious, historical, archaeological and public utilities/facilities reinstatement are covered under the mitigation plan. Environmental monitoring is an essential component in the implementation of IEE recommendation. The Environmental Monitoring Plan (EMoP) has been prepared to monitor the implementation performance of the EMP.

21. Grievance Re-dress mechanism will be established to resolve grievances from public or stakeholders concerning the project. This mechanism will be made effective by establishing mandatory grievance register book at the office of PIC. The grievances in the register book will be assessed in the case of genuine grievance or acceptable suggestion. Accordingly, the response will be given by the concerned PIC in consultation with supervision consultant or by DoR/Geo-environment and Social Unit (GESU) if the supervision consultants and contractor are unable to resolve the issue. The outcome will also be included in the quarterly report of ADB.

22. Most of the adverse impacts identified and predicted are of minimal scale, temporary, short term and reversible in nature associated with construction stage. The project will be implemented with strict adherence to the mitigation measures as prescribed in the Environmental Management Plan which will be a part of the Bidding Document.

23. The proposed road upgrading works do not exceed any of the prescribed thresholds by EPA, EPR and other relevant Acts and Regulations. Thus, IEE study of the project will be sufficient, and an EIA level study is not required.

I. INTRODUCTION

A. Project Background

24. The Abukhaireni - Pokhara Road has a total length of 81 km providing link between Mugling a market center and Pokhara-the tourist center of western region of Nepal. The project road has connectivity with other district roads connecting to rural areas of Gorkha, Tanahun, Manang, Lamjung and Kaski districts of Nepal. Thousands of tourists from all over the world visit Pokhara and its surroundings to enjoy trekking around Annapurna mountain peak and to see panoramic view of Snowy Mountains range of Annapurna peak, Machhapuchhre, Manaslu seen from Pokhara, Gorkha, Lamjung and Manang district region.

25. This road is of great importance to provide connectivity to the people of western districts and tourists from Kathmandu Valley and the rest of country. This road is of strategic importance to boost tourism industry in the western districts of the country and is therefore proposed for extension to four lane standards. In the existing situation the road generally meets highway standard.

26. The Department of Roads (DoR) intends to upgrade the Abukhaireni-Pokhara Section of Mugling – Pokhara road (km 8+250 to 88+583) to meet the Four Lane Standard with DBST Surfacing. Project road has been selected based on environment, resettlement, social and economic impacts; and project readiness. The Project is relevant to achieving results of the Country Strategy and Program (2013-2017), enhancing global-local connectivity to facilitate regionally balanced economic growth.

The project also includes the construction of two new major bridges i.e. Madi bridge at Ch. Km (41 + 725) and Seti bridge at Ch. Km (88+583). The proposed Madi bridge (4 lanes, 315 m length) will be constructed in the upstream of the existing Madi bridge. The proposed Seti bridge (2 lanes, 190 m length) will be constructed in the downstream of the existing Seti bridge.

B. Project Objectives

27. Project aims to improve transport efficiency of the strategic road network, which will contribute to expansion of economic opportunities and poverty reduction. This will be realized by (i) improving the national highway network, (ii) facilitating safe and appropriate road usage, (iii) increasing efficiency of transport services and (iv) enhancing DoR capacity for road asset development and management. Project immediate outcome will be improved accessibility to social services and markets, increased fuel efficiency, reduced travel time, accidents, vehicle emissions and better employment opportunities outside agriculture, both through improved access to economic centers and increased industrial activities in the project area.

28. To achieve the above objectives, the project road and bridges will be improved to 4-lane with largely in consistent to NRS 2070 and other relevant and DoR guidelines. Widening and improvement components will include (i) improvement in pavement conditions and road geometry (ii) re-construction /widening and provision of additional cross drainage structures, (iii) provision of service roads, lined drains in built-up sections, junction improvement, protection works, bus bays/lay byes and installation of adequate road safety measures etc.

C. Purpose of the IEE Study

29. The project is categorized as category 'B' in accordance with ADB's Safeguard Policy Statement (SPS), 2009 warranting an initial environmental examination (IEE). IEE identifies the environmental issues to be considered at project planning and design stage. The IEE report covers the general environmental profile of the study area and includes an overview of

the potential environmental impacts and their magnitude on physical, ecological, economic, and social and cultural resources within the project's influence area during design construction, and operation stages. An Environmental Management Plan (EMP) is also proposed as part of this report which includes mitigation measures for significant environmental impacts during implementation of the project, environmental monitoring program, and the responsible entities for mitigation and monitoring. IEE has four basic objectives; (i) identify the environmental issues that should be taken into account due to project interventions (ii) determine the magnitude of potential environmental concerns and to ensure that environmental considerations are given adequate weight at planning/design stage (iii) identify need for further environmental studies or Environmental Impact Assessment (EIA) and (iv) suggest enhancement measures, if any.

D. Extent of IEE Study

30. IEE extent has been decided considering all likely Impacts and risks analyzed in the context of the project's area of influence. It encompasses (i) the primary project site(s) and related facilities (ii) associated facilities whose viability and existence depend exclusively on the project (iii) areas and communities potentially affected by cumulative impacts from further planned development of any existing project or condition, and other project-related developments that are realistically defined at the time of assessment; and (iv) areas and communities potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The core zone of impact is taken as proposed right of way and its immediate vicinity. The assessment also considers the areas and activities related to associated facilities viz. quarry operation, borrow areas, construction camp, transportation/haulage routes etc. The study area is considered up to 5 km on either side of road alignment for larger analysis of land use and other environmental features. Assessment is carried out for all components of environment covering terrestrial and aquatic ecology, soil, water, noise and socio-economic aspects.

E. Methods Adopted to Prepare the IEE Study Report

31. Since the project scope is limited to reconstruction/rehabilitation and widening of existing road stretch and construction of two bridges without any new bypasses with more or less similar environmental setting viz. climate, terrain, land use and temporal extent, one consolidated IEE has been prepared highlighting the road specific environmental issues. This IEE report has been prepared on the basis of detailed engineering design prepared by Project Preparatory Consultant (PPC) team, field investigations and stakeholder consultations to meet the requirements for environmental assessment process and documentation as per ADB's Safeguard Policy Statement (SPS), 2009.

32. IEE commenced with the review of legal requirements for the project. In next step, technical details were collected compiled by the design team. Further steps followed for IEE has been concisely described in following paragraphs.

1. Reconnaissance Survey and Initial Consultations

33. Reconnaissance survey and initial consultations facilitated in designing the nature of the environmental survey and extent of consultations to be carried out along the road alignment. It helped to identify data gaps, decide valued environment components, key stakeholders and key informants who can further substantiate the collected information.

2. Primary Data Collection

34. Environmental resource inventory was prepared of all environmental features viz. terrain, land use, waterways/water bodies, road side vegetation, sensitive receptors, common

property resources, utilities, drainage, flooding/water logging, industries, accident prone areas etc. within the area of interest/core zone. Similarly, floral survey was also carried out. Baseline monitoring was conducted at the locations for which data was not available in environmental assessment report conducted by detailed design team.

3. Secondary Data Collection

35. Secondary sources included detail design report, published government reports, environmental impact assessments conducted in the similar region, government websites, recognized institutions and relevant government departments (forest, irrigation, statistics, Department of Hydrology and Meteorology (DoHM) etc.

4. Public Consultations

36. Meaningful consultations were organized with the government agencies, local people/beneficiary population to know the level of project acceptability, understand their concerns, apprehensions, and overall opinion. Information were gathered about existing baseline environmental condition viz. ambient levels and its effects on health, water resources, flora and fauna, socio-economic standing of local people, impact due to loss of land other assets and common property resources, accident risk during construction and operation stage, perceived benefits and losses, etc. Information thus gathered was used to integrate it in project design and formulate mitigation measures and environmental management plan.

5. Other Tools, Additional Surveys and Studies

37. Climate risk screening identified flood as major risk which may adversely impact the road components like, pavement, embankment and cross drainage structures during design life. To avoid flood induced impact on road components it is essential to incorporate various measures in design. Details of structures, history of floods, water logging/low lying areas, road stretches and bridge liable to submergence along the project road were collected during field visit and the same was corroborated with information available with design team.

6. Assessment of Potential Impacts

38. The assessment of the type, nature, direct, indirect, cumulative or induced impacts and their significance to the physical, biological, and socio-economic components of the environment has been done to ascertain whether the project is environmentally sustainable or not. Nature of impacts has been classified as significant, insignificant, short-term, long-term, reversible, irreversible etc. After identification of nature and extent of impacts, mitigation measures have been suggested.

7. Preparation of the Environment Management Plan

39. The project specific Environment Management plan has been formulated with an aim to avoid, reduce, mitigate, or compensate for adverse environmental impacts/risks and propose enhancement measures. This includes (i) mitigation of potentially adverse impacts (ii) monitoring of impacts and mitigation measures during project implementation and operation (iii) institutional capacity building and training (iii) compliance to statutory requirements (iv) integration of EMP with Project planning, design, construction and operation.

F. IEE Report Content

40. The IEE has been prepared based on the requirements of the Environment Protection Act (EPA), 1996 and Environment Protection Rules (EPR), 1997 of the Government of Nepal

(GoN), and the ADB Safeguard Policy Statement (SPS), 2009. The content covers following eight chapters, including this introduction chapter:

- Chapter – 1: Introduction
- Chapter – 2: Policy, Legal and Administrative Framework
- Chapter – 3: Description of Project
- Chapter – 4: Description of Environment
- Chapter – 5: Anticipated Impacts and Mitigation Measures
- Chapter – 6: Public Consultation and Information Disclosure
- Chapter – 7: Environmental Management Plan
- Chapter – 8: Grievance Redress Mechanism
- Chapter – 9: Conclusion and Recommendation

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

41. This chapter presents a review of the international agreements and commitments, existing institutions and legislations relevant to the project at the National and State level. The environmental assessment process needs to adopt environmental regulations and guidelines of Government of Nepal (GoN) and ADB's safeguard requirements.

A. International Agreements and Commitments

42. Nepal is party to various international agreements/conventions/treaties for conservation of environment at global level. Important agreements and commitments have been briefly described and analyzed vis-a-vis the project development.

43. **Ramsar Convention on Wetlands, 1971:** The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an inter-governmental treaty, which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The convention entered into force in Nepal on 17 April 1988. Nepal currently has 10 sites designated as Wetlands of International Importance (Ramsar Sites). Out of 10 designated wetlands of International Importance in Nepal, none of them is located in project influence area.

44. **Convention on Protection of the World Cultural and Natural Heritage, 1972:** The United Nations Educational, Scientific and Cultural Organization (UNESCO), which seeks to encourage the identification, protection and preservation of cultural and natural heritage around the world considered to be of outstanding value to humanity has embodied these objectives in an international treaty called the Convention concerning the Protection of the World Cultural and Natural Heritage in 1972. In Nepal, there are 2 cultural and 2 natural mixed sites. None of them is located in project influence area.

45. **Vienna Convention for Protection of the Ozone layer, 1985 and Montreal Protocol on Substances Depleting the Ozone layer, 1987:** The Vienna Convention outlines states responsibilities for protecting human health and the environment against the adverse effects of ozone depletion, and established the framework under which the Montreal Protocol was negotiated. The Montreal Protocol stipulates that the production and consumption of compounds that deplete ozone in the stratosphere chlorofluorocarbons (CFCs), halons, carbon tetrachloride, and methyl chloroform) are to be phased out by 2010. The project does not envisage production and consumption of ODS.

46. **United Nations Framework Convention on Climate Change (UNFCCC), 1994:** As per the convention the reduction/limitation requirements of Green House Gases (GHG) apply only to developed countries. The only reporting obligation for developing countries relates to the construction of a GHG inventory (GHG sources and sinks, potential vulnerability to climate change, adaptation measures and other steps being taken to address climate change). Nepal ratified the protocol on September 16, 2005 and became the signatory of the protocol on 14 December 2005. Nepal is categorized as non annex countries. Hence the country is not obliged to set a reduction target like the Annex I countries and it can only participate in the Clean Development Mechanism (CDM) of the protocol. However Nepal can raise its voice to receive resources for adaptation and mitigation through the Conference of Parties, as individual country or via group of countries.

47. **Convention on Biological Diversity (CBD) 1992:** The Convention on Biological Diversity (CBD) is dedicated to promoting sustainable development and came into force in 1992 Rio Earth Summit. India signed the CBD in 1994. Member Parties have committed themselves to achieve by 2010, a significant reduction of the current rate of biodiversity loss

at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on earth.

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

B. Country's Legal Framework and Regulatory Requirements

49. In Nepal, various legal instruments are in place to ease the integration of environmental aspects in development proposals. The study team has reviewed, but not limited to the following legislative provisions and guidelines of Nepal.

1. Plan and Policies

50. **Constitution of Nepal.** Article 25 (2) of the constitution has mentioned that the state shall acquire legal private property only for public interest, and Article 25 (3) has mentioned that compensation shall be provided for such acquired property on the basis of compensation as prescribed by law. Article 30 (1) has mentioned that every citizen has the right to live in a clean and healthy environment. Under state policy, Article 51 (f) clause (2) has mentioned that state is to develop balanced, environment friendly, quality and sustainable physical infrastructures, while according priority to the regions lagging behind from development perspective, and clause (3) mentions that state is to enhance local public participation in the process of development works. Article 51 (g) explains about applying appropriate minimization or mitigation measures for negative impact on nature, environment or biodiversity.

51. **The Fourteenth Three Year Plan (2016/17-2018/19).** The government has recently endorsed the Fourteenth Three Year Plan. This plan will cover the period of 2016/17 - 2018/2019. Its long-term vision is to promote Nepal from its current status of a least developed country to a developing country by 2022. Its aim is to reduce human and economic poverty, bring change in the living standard of citizen by promoting green economy focusing on poverty reduction and reducing the percentage of population living below the poverty line from 23.8% to 18.0% during the plan period. The plan also aims to achieve 6.0% of annual economic growth rate. The priority areas of the plan are hydropower, energy, agriculture, basic education, health, drinking water, good governance, tourism, and environment. The GoN will increase the participation and contribution of private sector, public sector, and cooperatives for the promotion and development of the priority areas during the plan period.

52. **Forest Policy, 2071 BS (2014 AD).** The forest policy is attracted when a development project directly or indirectly impacts on the forest resources. The forest policy is directed, inter alias, to contribute food production through effective interaction between forestry and farming system, to protect land against degradation by soil erosion, landslide, and other effects of ecological disturbances, and to conserve ecosystem and genetic resources. However, the forest policy re-emphasizes to avoid forest destruction or tree cutting while constructing infrastructures during implementation of project other than forest sector. The policy has

prioritized the protection of Siwalik, the geologically vulnerable area, with a view to ensure watershed conservation, and maintenance of water recharge. The policy also stresses conservation of endangered species. It has reiterated that forest area will not be used for any activities other than prescribed in Operational Forest Management Plan. The forest policy emphasizes the implementation of community and private forestry development programs, national parks and conservation areas management programs, soil and watershed conservation program, management and development of medicinal plants, and conservation of biological diversity.

2. Acts and Rules

53. **Environment Protection Act, 1996.** The Environment Protection Act, 1996 and Environment Protection Rules, 1997 (with amendment) contain several provisions to institutionalize the integration of environmental aspects in development projects including road sector, and empowers Ministry of Population and Environment approve EIA report. Similarly, in case of IEE level study, line Ministry, which is Ministry of Physical Infrastructure and Transport is authorized to approve the Final IEE Report.

54. The Act recognizes the interdependence between development and the environment and shows the concerns for minimizing the impacts of environmental degradation on people, animal, and plant species and their physical surroundings. The Act obliges the proponent to undertake IEE and EIA of proposal, plans or projects which may cause changes in existing environmental condition and authorizes Ministry of Population and Environment to clear all EIA and line Ministry for IEE study.

55. The Act empowers Ministry of Population and Environment to prohibit the use of any matter, fuel, equipment or plant, which has adverse effects on the environment. The Act has provisions for polluters to compensate affected persons from polluting activities and empowers government to provide additional incentives to any industry, occupation, technology or process, which has positive impacts on environmental conservation. It provisions to establish an Environmental Protection Fund to be used for environmental protection, pollution control and heritage conservation, and it gives the government authority to declare specific area as environmentally protected areas.

56. **Environment Protection Rules, 1997 (with amendments).** In the process of implementing EPA (1996) effectively the Environment Protection Rule (EPR) came into force in 1997 and was amended in 1999. The EPR contains elaborate provisions for the process to be followed during the preparation and approval of projects requiring EIAs and IEEs including scoping documents, terms of reference, public consultations and hearings, and environmental monitoring and auditing. The environmental legislation empowers the concerned Ministry to monitor the environmental activities including mitigation measures and Ministry of Population and Environment for environmental auditing. For IEE, the concerned Ministry, which is the Ministry of Physical Infrastructure and Transport in case of the road projects, is authorized to approve the Final IEE Report. The EPR also lists the types of development activities requiring IEE or EIA level Study. It also gives an outline of content of the terms of reference document, IEE and EIA report.

57. **Solid Waste Management Act 2068, 2011.** Various laws have been consolidated to manage solid wastes in systematic and effective way through the principle of reduction at source, reuse, processing and discharge. The law also assigns responsibility to the local body for the management of solid waste by construction and operation of infrastructure like transfer station, landfill site, processing plant, compost plant, biogas-plant and also collection of waste, final disposal and processing. On the other hand, the responsibility for the processing and management within the set standard of harmful waste, health institution related waste,

chemical waste or industrial waste shall be of the individual or body producing such solid waste.

58. **Public Roads Act, 1974.** The Department of Roads may temporarily acquire the land and other property adopting compensatory measures during the construction, rehabilitation and maintenance of the public roads according to the Act (Article 14 &15). The Act also empowers the DoR to operate quarries, borrow pits and other facilities during the road construction (Article 17). In sum, the Act facilitates the acquisition of land and property for the extraction of construction materials and development of other facilities as well as to maintain greenery along the roadside with adoption of compensatory measures.

59. **Forest Act, 1993 (with amendments).** The Forest Act, 1993 recognizes the importance of forests in maintaining a healthy environment. The Act requires decision makers to take account of all forest values, including environment services and biodiversity, not just production of timber and other commodities. The basis of Act is resource oriented rather than use oriented.

60. The Forest Act, 1993, (with amendment) contains several provisions to ensure the development, conservation, management and sustainable use of forest resources, based on approved work plan. The work plan should contain a list of activities that should be implemented in the different forest categories - national forests, community forests, leasehold forests, private forests, and religious forests. Section 23 of the Act empowers the government to delineate any part of the national forest, which has 'special environmental, scientific or cultural importance', as a protected forest. Section 49 of the Act prohibits reclaiming lands, setting fires, grazing cattle, removing and damaging forest products, felling trees of plants, wildlife hunting and extracting boulders sand and soil from the National forest without the prior approval. However, the government may enforce Section 68 of the Forest Act to provide parts of any type of forest for the implementation of a national priority plan with the assurance that it does not adversely affect the environment significantly. As provisioned under the Act, while clearing the forest on the RoW of road, the implementing authority will co-ordinate with the District Forest Office. If necessary, the compensatory re-plantation will also be carried out at the rate of 1:25 under the provision of the Act.

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

62. **Forest Products Collection and Sales Distribution Guidelines, 2016 AD.** The section 2 (3 – 10) of the guidelines have specified process and formats for getting approvals from the division forest office (DFO) for vegetation clearance such as tree marking, cutting, transportation and storage. The section 2(3) describes the marking of trees to be felled down, location of marked trees and storage space after cutting with GPS coordinates in the Forest map. The section 2(5) describes procedure for marking the trees to be felled down. The section 2(6) describes procedure for evaluation of marked trees. The section 2(7-10) describes further procedure for work responsibility after tree marking and tree evaluation. The section 2{10-(2)} describes time frame (Month Kartik to Falgun for cutting of marked trees and by the end of month Jestha storage of cut down trees) for approval of vegetation clearance from DFO except for the National Priority Projects.

63. The section 3(11-16) of the guidelines have specified procedure and formats for management of cutting, transportation and storage of approved marked trees. The section

3(11) describes management procedure from trees marking to tree cutting. The section 3(12) describes management from transportation to storage of cut down trees. The section 3(13) describes responsibilities and safety of cut down stored trees. The section 3(14) describes time extension for continuing the unfinished works. The section 3(15) describes checking the cut down trees as per records, inquiry for the marked trees remaining to be cut down, punishment for cutting unmarked trees or cutting more number of trees beyond approved quantity. The section 3(16) describes responsibility of cleaning and reinstatement of the area where trees were cut down.

64. **Government Tree Removing Standards (2017 AD).** It describes about the procedures to be followed for removing the trees under the government land. Permission will be given by District Forest Office (DFO) with approval of Department of Forest on the basis of recommendation from the verification committee as per clause 10 along with the DoR decision. The proponent on his own cost shall cut, stack and transport the felled trees and hand over to concerned DFO. There will be checking panel committee for this process who will check the no. of tree felling down and its area and give the guideline for the compensation tree plantation.

65. **Local Governance Operation Act, 2017.** The Local Self-Governance Act, 1999 empowers the local bodies for the conservation of soil, forest, and other natural resources and implementation of environmental conservation activities. The Village Development Committees (VDCs), Municipalities and District Development Committees (DDCs) are mandated to take up the responsibilities for the formulation and implementation of a programme relating to the protection of the environment and biodiversity, and to give adequate priority for the protection of the environment during the formulation of local level plans and programme.

66. **Land Acquisition Act, 1977.** The Land Acquisition Act (1977, as amended 1993) guides the compulsory acquisition of land. GoN can acquire land at any place and in any quantity by giving compensation pursuant to the Act for the land acquired for any public purpose(s) or for operation of any development project initiated by GoN institutions.

67. **Child Labour Prohibition and Regulation Act 2001.** Section 3 of the act prohibits a child from engaging in work, sub clause 1 of the clause 3 states "Nobody shall engage in work a child who has not completed fourteen years of age as a labour and sub clause 2 states "Nobody shall engage a child in a risk full occupation or work set forth in the Schedule". The section 4 states "Child not to be engaged in work against his will by temptation or fear or pressure or by any other means". Child labor will be strictly prohibited in the project work.

68. **Soil and Watershed Conservation Act, 1982.** Soil and Watershed Conservation Act makes provision to control floods landslides (watershed conservation rules, 1985). The watershed conservation office is authority and district watershed conservation committee must implement watershed conservation practices and public participation for soil and land protection

69. **Water Resources Act, 1992.** Water Resources Act (1992) makes provision for the rational use of surface and underground water. The act seeks to prevent environment and hazardous effects from the use of water and prohibit water pollution by chemicals, industries waste. Water may only be used in manner that does not permit soil erosion, landslide or flood. Pollution of drinking water is prohibited under the Nepal drinking water corporation act (1989).

70. **The Aquatic Animal Protection Act, 1961 (with amendment).** This Act indicates an early recognition of the value of wetlands and aquatic animals. Section 3 renders punishment to any party introducing poisonous, noxious or explosive materials into a water source, or destroying any dam, bridge or water system with the intent of catching or killing aquatic life.

Under Section 4 of the Act, Government is empowered to prohibit catching, killing and harming of certain kinds of aquatic animals by notification in Nepal Gazette.

71. **Motor Vehicle and Transportation Management Act, 1993.** This act sets standard for vehicles emission and mechanical condition for vehicle registration by the Transport Management Office (TMO) and the TMO can deny a permit based on environmental factor. Standards are set for petrol and diesel engines under the Nepal vehicle mass emission standard 1999.

3. Guidelines for the Road Sector

72. **Guidelines**, including the draft EIA Guidelines for Road Sector, 1996, facilitate the proponents to prepare environmental assessment reports. These guidelines have been thoroughly reviewed and all pertinent issues have been incorporated during the preparation of this Report. The DoR Environmental Management Guidelines (EMG), 1997 provides guidance to the Proponent to integrate environmental mitigation measures, particularly on the management of quarries, borrow pits, stockpiling of materials and spoil disposal, earthworks and slope stabilization, location of stone crushing plants, etc. The Environmental Guidelines for Local Development also encourages the Proponent to incorporate environmental issues during project design and implementation.

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

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

75. **The Environmental and Social Management Framework (ESMF), DoR/GESU, 2013 AD.** The Environmental and Social Management Framework (ESMF) is prepared to compile in an overview and guidance manner, various safeguard and compliance aspects of environmental and social issues related with the road construction and development.

76. The ESMF intends to provide technical and managerial inputs and guidance into the design of the strategic roads (both designated for rehabilitation and, to lesser extent, to new construction), through identification of key environmental and social issues related to the foreseen projects, mitigate potential impacts and concerns and, devise opportunities to enhance the benefits. The framework integrates in a step-wise approach the most important

environmental and social considerations into all stages of project preparation, implementation, monitoring and operation.

4. Other Guidelines and Manuals

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

- Reference Manual for Environmental and Social Aspects of Integrated Road Development; MPPWD/DoR. HMGN, 2003
- Environmental Management Guidelines for Roads and Bridges, GEU/DoR, 1997
- Public Work Directives, HMGN, 2002
- Guide to Road Slope Protection Works, DoR,

C. ADB Safeguard Policy Statement, 2009

78. The ADB SPS, 2009 aims to avoid, minimise or mitigate harmful environmental and social impacts and help the borrower strengthen their safeguard system. It also provides a platform for participation by affected community in project design and implementation.

79. All roads proposed to be upgraded under the Strategic Road Improvement Project (SRIP) were screened and categorized using Rapid Environmental Assessment (REA). The REA consist of questions relating to: (i) the sensitivity and vulnerability of environmental resources in the sub-project area, and (ii) the potential for the sub-project to cause significant adverse environmental impacts. These roads are then classified into one of the following categories:

80. **Category A.** Projects with potential for significant adverse environmental impacts. An Environmental Impact Assessment (EIA) is required to address significant impacts.

81. **Category B.** Projects judged to have some adverse environmental impacts, but of lesser degree and/or significance than those for category A projects. An IEE is required to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.

82. **Category C.** Projects unlikely to have adverse environmental impacts. No EIA or IEE is needed although environmental implications are still reviewed.

83. The project road has been classified as Category "B".

84. All ADB investments are subject to an environmental assessment to address environmental impacts and risks. The environmental assessment starts with screening and categorization; followed by baseline data collection, impact analysis, environmental management planning, information disclosure, consultation and participation, grievance Redressal mechanism development, EMP implementation, and reporting.

D. Permissions and Clearance Required for the Project

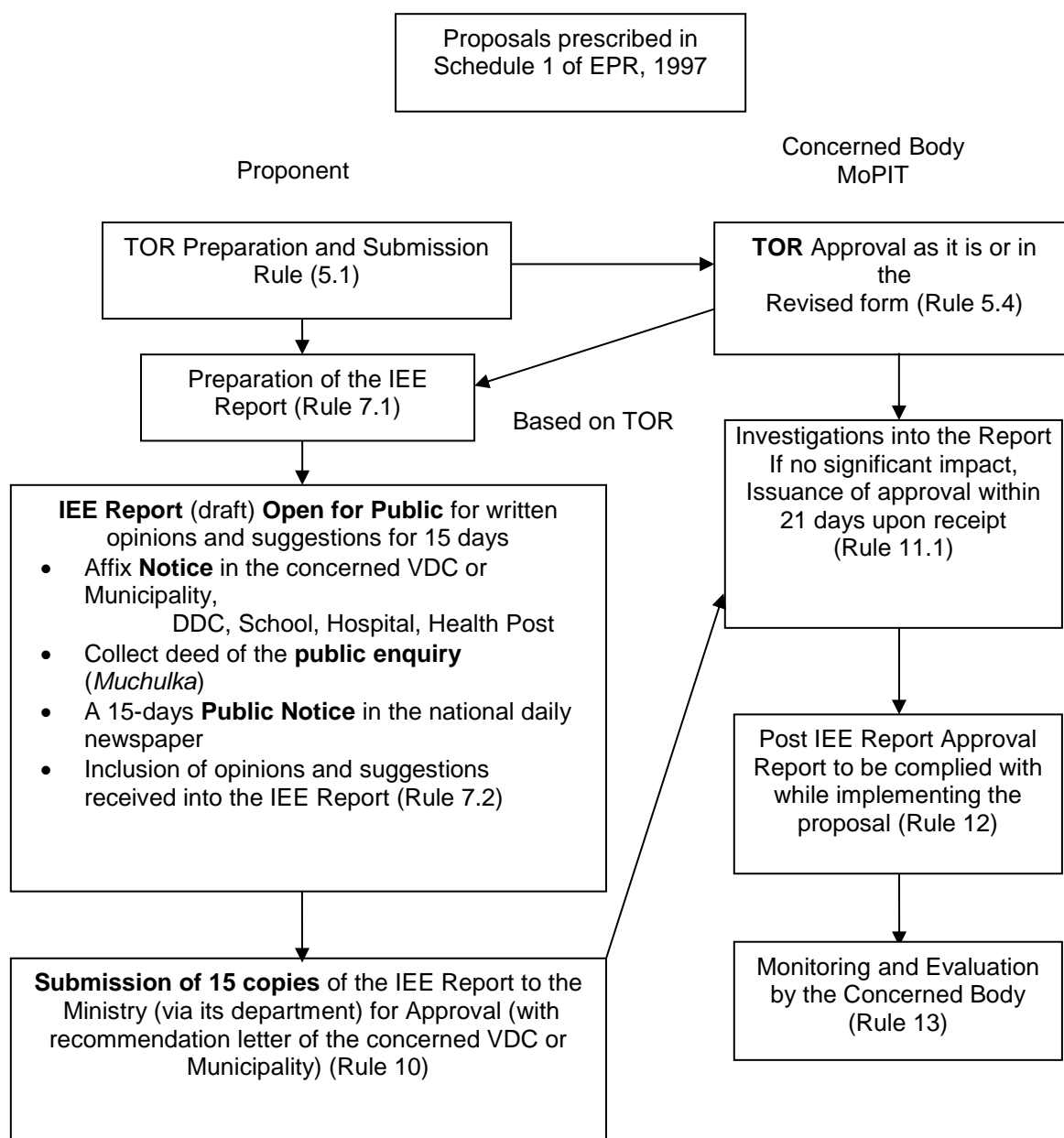
85. The legal framework of the country consists of several acts, notifications, rules, and regulations to protect environment and wildlife. List of required clearances / permissions related to environment has been summarized in **Table 1** below.

Table 1: Permissions and Clearance Required

S.N	Clearance	Act/Rule/Notification /Guideline	Concerned Agency	Responsibility
A. Pre-construction Stage				
1	Environmental Clearance (categorized as “B” with IEE requirement)	Environment Protection Act 1996 and Environment Protection Rules, 1997 (with amendments).	Ministry of Physical Infrastructure and Transport	Department of Roads / PD, DOR (ADB)
2	Land Acquisition and Compensation	Land Acquisition Act, 1977(with amendments)	Ministry of Physical Infrastructure and Transport	Department of Roads / PD, DOR (ADB)
3	Forestry clearance for felling of Trees	Forest Act, 1993 (with amendment), Forest Rule, 1995, Forest Products Collection and Sales Distribution Guidelines, 2001 and Local Self-Governance Act, 1999	Ministry of Forest and Soil Conservation, Department of Forest	Department of Roads / PD, DOR (ADB)
B. Implementation Stage				
4	Permission for construction material quarrying (stone, cobble, sand, gravel, soil etc)	Local Self-Governance Act, 1999 and Soil and Watershed Conservation Act, 1982 and Watershed Conservation Rule, 1985. PA,1996 and EPR, 1997 (with amendments)	Concerned Project and Concerned VDC, DDC and Municipality	Contractor
5	Consent to operate Hot mix plant, Crushers, Batching Plant	Local Self-Governance Act, 1999	Concerned Project and Concerned VDC, DDC and Municipality	Contractor
6	Consent for disposal of sewage from labour camps	Water Resource Act, 1992	Concerned Project	Contractor
7	Pollution Under Control Certificate	Motor Vehicle and Transportation Management Act, 1993	Department of Transport Management	Contractor

E. Environmental Clearance Process

Figure 1: Environmental Clearance Procedure in Nepal



III. DESCRIPTION OF THE PROJECT

A. The Project

86. Abhukhaireni – Pokhara Road (08+250 to 88+583) is a section of the Prithvi Highway (174-kilometre-long) connecting Naubise of Tribhuvan Highway, 34.25 km from Kathmandu, the capital of Nepal, and Pokhara, a tourist city in the western part of Nepal. The proposed road section starts from Abhukherini Bazaar Chok (08+250) at an elevation of 257.289 m amsl, passes through various small towns and settlements and it ends at Prithvi Chowk (90+000) of Pokhara city at an elevation of 842.70 m from amsl. The road runs along the hilly/mountainous terrain of mid-hills in Tanahu and Kaski Districts. Considerable vehicular traffic exists as the road forms one of the major links to western region of Nepal.

87. This section of Prithvi Highway was constructed as a 7m wide road with Chinese Government Assistance in 1967 as bituminous road. The project road crosses 26 rivers/streams. The road runs mostly in steep rocky hill section and river valley terraces with various land use pattern, mostly forest, urban and rural settlements, cultivated land.

88. The road alignment passes through former six (6) municipalities and four (4) VDCs namely; Abukhaireni Municipality, Ghansikuwa VDC, Bandipur Municipality, Vyas Municipality, Jamune Bhanjyang, Manpang, and Chhang VDCs, Shukla Gandaki Municipality of Tanahu district and Lekhnath municipality and Pokhara Sub-metropolitan city in Kaski district respectively. As per recent federal structure, it encompasses through Abhukhaireni and Bandipur rural municipality as well as Vyas and Suklagandaki municipality of Tanau district and Pokhara-lekhnath metropolitan city of Kaski district. The alignment passes through settlement areas of Abukhaireni, Bimalnagar, Dumre, Damauli, Tharpu, Jamunne, Khairenitar, Gagangaunda, Taal chowk, Bijaypur and Pokhara while rests of the alignment passes through intermixture of scattered settlements, open land bearing commercial value, cultivated and open grazing lands.

89. The Department of Roads (DoR) intends to upgrade the Abukhaireni-Pokhara Section of Mugling – Pokhara road (km 8+250 to 88+583) to meet the Four Lane Standard with DBST Surfacing. Due to geotechnical cause it is not possible to extend the road to four lane at Mugling Abukhaireni section hence a separate two-lane road has proposed at left bank of Marsyangdi river which connects to Prithvi highway east of Mugling settlement. For the purpose phase 2 program will be held to construct new two-lane road making bridge over Marsyangdi near Abukhaireni and Trishuli river escaping Mugling settlement. Under the present project scope, upgrading works will be carried out from Ch. 8+250 (west of Abukhaireni settlement) from the right bank of Trishuli River at Mugling.

90. The project includes the construction of two new major bridges i.e. Madi bridge at Ch. Km (41 + 725) and Seti bridge at Ch. Km (88+583). The proposed Madi bridge (4 lanes, 315 m length) will be constructed in the upstream of the existing Madi bridge. The design of the Madi bridge is Extra Dose PSC Box Girder type. The construction of bridge is also supplemented by constructing of 2.96 km long approach road (including both side) which includes construction of new access road of 0.16 km at left approach and 2.80 km at right approach passing through DoR of Damauli. The proposed Seti bridge (2 lanes, 190 m length) will be constructed in the downstream of the existing Seti bridge. The design of the Seti bridge is PSC Box Girder type.

B. Project Location

91. The existing Mugling–Pokhara double lane road is located in Tanahun and Kaski districts in the Gandaki Province of Nepal. The road starts from Abhukherini Bazar at an elevation of 257.289 m asml of Abhukherini Municipality of Tanahu district and ends at Prithvi

Chok in Pokhara of Pokhara Sub-metropolitan city in Kaski district at an elevation of 842.70 m amsl. The location and the alignment map of the road are shown in Figures 2 and 3.

92. The salient features of the project improvement are presented in Table 2. The salient features for major bridges Madi bridge and Seti bridge is presented in Table 3 and Table 4 respectively.

Table 2: Salient Features of the project

Particulars	Existing	Proposed
Name of the Road	Mugling– Pokhara Road (Abukhaireni-Pokhara Section)	
Terrain	Mountainous. Land use is predominantly agriculture, settlements	
RoW	50 m	50 m
Carriageway Configuration	6.5 m with 1.0 m – 1.5 m of gravel shoulder	14 m with 1.0 and 2.5 m paved shoulder
Geometry	Generally straight except at some bridge locations	
Pavement Condition	Fairly good and bituminous surface, Crust: Avg. 100 to 150mm	DBST
Traffic (AADT) in vpd	5,501 to 17,278 vehicle per day for 2016 AD	49,175 to 187,600 vpd by 2039 AD
Bridge/Culverts	Major/Minor Bridge = 27, Slab Culvert = 20, Pipe culvert = 37, Irrigation crossing = 9	New Construction – Major Bridge = 9 (Including Madi and Seti bridges), Minor Bridge = 26, Improvement/extension (Slab Culvert = 185, Box culvert 110, Pipe culvert = 411, Irrigation crossing = 9)
Side Drains	Exists in some built-up stretches. Mostly choked	111020 m (65210 m on left side and 45810 m on right side)
Intersections/Junctions	Major road intersection – 4 Minor road intersection – 6	3-way Intersection = 5, 4-way Intersection = 3
Road Facility/ Safety Features	<ul style="list-style-type: none"> There is no bus bays/Truck lay bye, service road, underpass or any other road side furniture Safety installations are limited to speed breakers and signage at very few locations	<ul style="list-style-type: none"> Passenger Sheds = 46 Traffic Sign Post – Single = 1658, Double = 100 Delineators = 12250 Metal Crash Barrier = 74,413 m
Total Cost		
Project Cost	NRs 19,106,257,725	
Environmental Cost	NRs. 614,595,360	

Source: Detail Design Report, Mugling-Pokhara Road, 2017

C. Proposed Madi Bridge Design Features

93. **Bridge Deck Configuration.** The cross section of 4-lane Bridge is 25 m having 7.0 m for each carriageway with 0.38 m crash barrier at outer ends and 1.5 m footpaths on each side. The 4 lane major bridge consists of Composite deck with precast, pre-tensioned Box Girders and cast in situ RCC deck slab. Other features are as mentioned below:

- Bridge Class: Class 70R, Class A

- Pre stress method: Post-Tensioned Concrete
- Construction Method: FCM (Free Cantilever method)
- Type of bearings: EQS type bearing
- Type of abutments: RCC inverted T type cantilever wall
- Type of pier(s): Y type Rectangular RCC column

94. **Substructure and Foundation.** Rectangular RCC piers are proposed considering the possible direction of flow of water and from aesthetics point of view resting on pile foundation. Considering the site condition and the type of soil, pile foundations are proposed. Salient feature of the proposed bridge is presented in a summarized form in following table 3.1a below:

Table 3: Salient Features of Madi Project Bridge

Detail of Particulars	Description
Name of the Bridge	Madi Bridge
Location of the Bridge	
Left Bank	Byas Municipality ward 4
Right Bank	Byas Municipality ward 5
Name of the River	Madi river
Name of the Bridge	Madi Bridge
Easting	84°15'39.87"
Northing	27°58'47.35"
Information on structure :	
Approach Road	Prithvi highway
Type of Bridge	Extra Dose PSC Box Girder type bridge
Total length	315 m
Span arrangement	Total no. of span 3 85+145+85 m
Total Width	25 m
Carriageway	145 m
Footpath	1.5 m
Existing/Predicted traffic load (AADT)	4,968 to 20,469 vpd in 2018 AD to the traffic level of 13,489 to 65,613 vpd by 2037 AD
Type of Superstructure:	
Type of Abutments	bank seat (spill-through)
Type and Depth of Foundation	Pile foundation with 22 m depth from bed level
Design data :	
Live load	IRC 70R
Design Discharge (100 years)	3268 m ³ /Sec
Linear Waterway, m	320 m
Scour depth, m	6 m
Highest flood level, m	309.53
Bridge Deck Configuration	
Bridge Class	Class 70R, Class A
Prestress Method	Post-Tensioned Concrete
Construction method	FCM (Free Cantilever Method)
Type of bearings	EQS type bearing
Type of Abutments	RCC inverted T type cantilever wall
Type of piers	Y type Rectangular RCC column
Pylons	Two nos. of 21 m height RC pylons
Cable arrangement	Fan Type

Detail of Particulars	Description
Sub structure and Foundation	Cast-in-situ Pile of 1.0 m diameter for abutments and 1.5 m diameter for piers
Bridge approach (storm water drainage)	<ul style="list-style-type: none"> Footpath cum drain having a width of 1.0 m and depth of 1.0 m Drainage spouts on every 5 m on bridge deck on LHS and RHS Bridge approach has 0.3% slope and all storm water will flow through liner side drains on either side of the divided carriageway.
Total Construction Period	3 years (Construction period) 5 years (Defect Liability Period)
Total Cost	
Project Cost	NRs 3,759,525,852
Environmental Cost	NRs. 168,696,094

Source: Detail Design Report, Madi Bridge, 2018

D. Proposed *Seti Bridge* Design Features

95. **Bridge Deck Configuration.** The cross section of 2-lane Bridge is 190 m length and 11 m width having 8.0 m for carriageway with 0.38 m crash barrier at outer ends and 2 m footpaths on each side. The 2 lane major bridge consists of Composite deck with precast, pre-tensioned Box Girders and cast in situ RCC deck slab. Other features are as mentioned below:

- Bridge Class: Class 70R, Class A
- Pre stress method: Post-Tensioned Concrete
- Construction Method: FCM (Free Cantilever method)
- Type of bearings: EQS type bearing
- Type of abutments: RCC inverted T type cantilever with spread footing
- Type of pier(s): Rectangle RCC wall

96. **Substructure and Foundation.** Circular RCC piers are proposed considering the possible direction of flow of water and from aesthetics point of view resting on pile foundation. Considering the site condition and the type of soil, pile foundations are proposed. Salient feature of the proposed bridge is presented in a summarized form in following Table 4 below:

Table 4: Salient Features of Seti Project Bridge

Detail of Particulars	Description
Name of the Bridge	Seti Bridge
Location of the Bridge	
Left Bank	Pokhara Lekhnath Metropolitan City, ward 9
Right Bank	Pokhara Lekhnath Metropolitan City, ward 10
Name of the River	Seti River
Name of the Bridge	Seti Bridge
Easting	86°54'1.5"
Northing	26°36'23.1"
Information on structure :	
Approach Road	Prithvi Highway
Type of Bridge	PSC Box Girder type bridge
Total length	190 m
Span arrangement	Total no. of span 3

Detail of Particulars	Description
	50,90,50 m
Total Width	11 m
Carriageway	8.0 m
Footpath	2.0 m
Existing/Predicted traffic load (AADT)	4,968 to 20,469 vpd in 2018 AD to the traffic level of 13,489 to 65,613 vpd by 2037 AD
Design data	
Live load	IRC 70R
Design Discharge (100 years)	1977m ³ /Sec
Linear Waterway, m	200 m
Scour depth, m	Not relevant
Highest flood level, m	Not relevant
Bridge Deck Configuration	
Bridge Class	Class 70R, Class A
Prestress Method	Post-Tensioned Concrete
Construction method	FCM (Free Cantilever Method)
Type of bearings	EQS type bearing
Type of Abutments	RCC inverted T type cantilever with spread footing
Type of piers	Rectangle RCC wall
Sub structure and Foundation	Rectangular RCC intermediate piers resting on RCC pile foundation
Bridge approach (Storm water drainage prevention)	<ul style="list-style-type: none"> • Footpath cum drain having a width of 1.0 m and depth of 1.0 m • Drainage spouts on every 5 m on bridge deck on LHS and RHS • Bridge approach has 0.3% slope and all storm water will flow through liner side drains on either side of the divided carriageway.
Total Construction Period	3 years (Construction period) 5 years (Defect Liability Period)
Total Cost	
Project Cost	NRs 1,396,067,021
Environmental Cost	NRs. 61,283,171

Source: Detail Design Report, Seti Bridge, 2018

E. Characteristics of the Existing Road

97. Existing road is mostly of two-lane with deficient horizontal and vertical alignment, degraded earthen or no shoulder in most stretches, inadequate and damaged cross drainage structures, absence of adequate side drains, safety installations, protection works and road furniture. Salient features of existing road have been summarized in Table 4 above.

Figure 2: Project Location Map

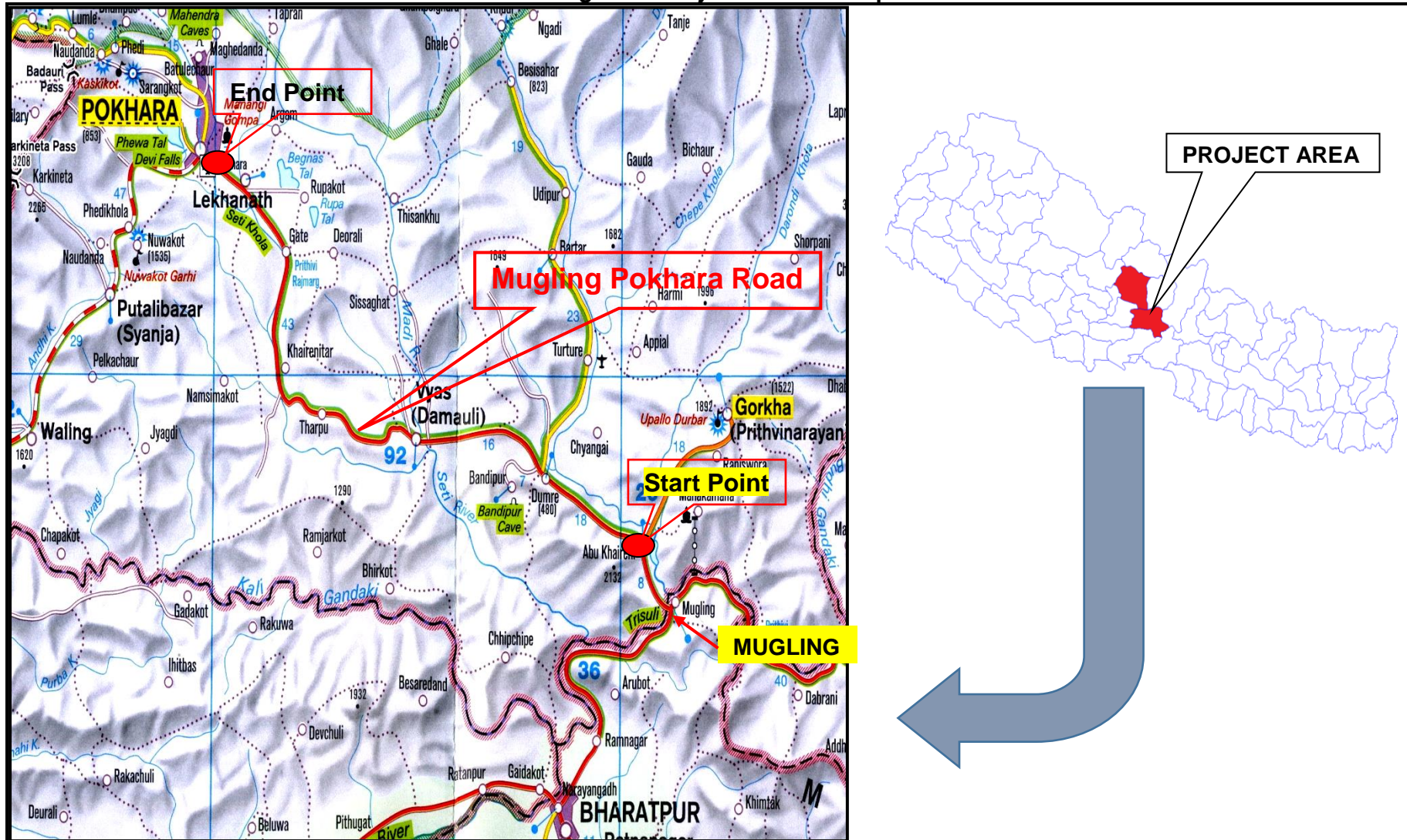
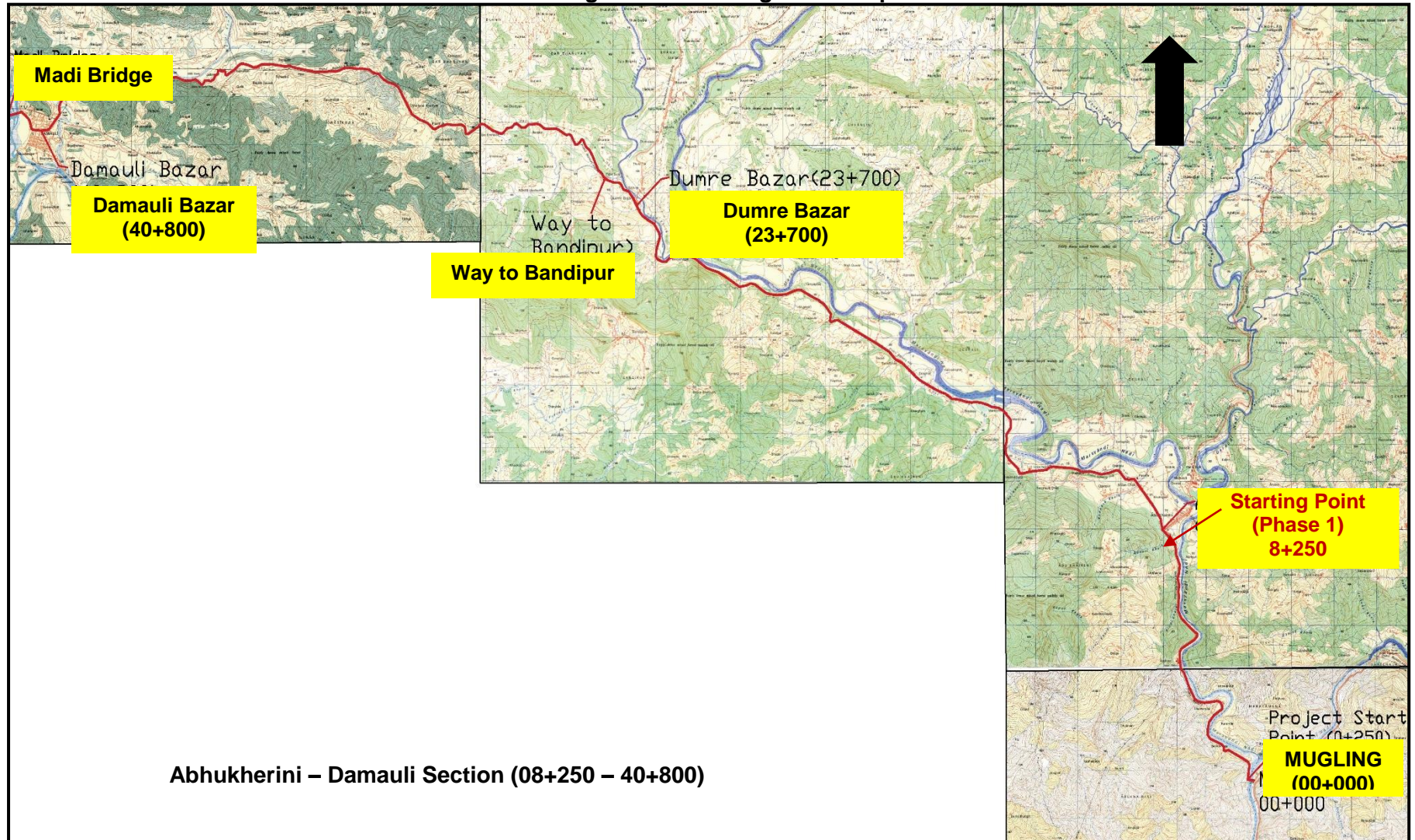
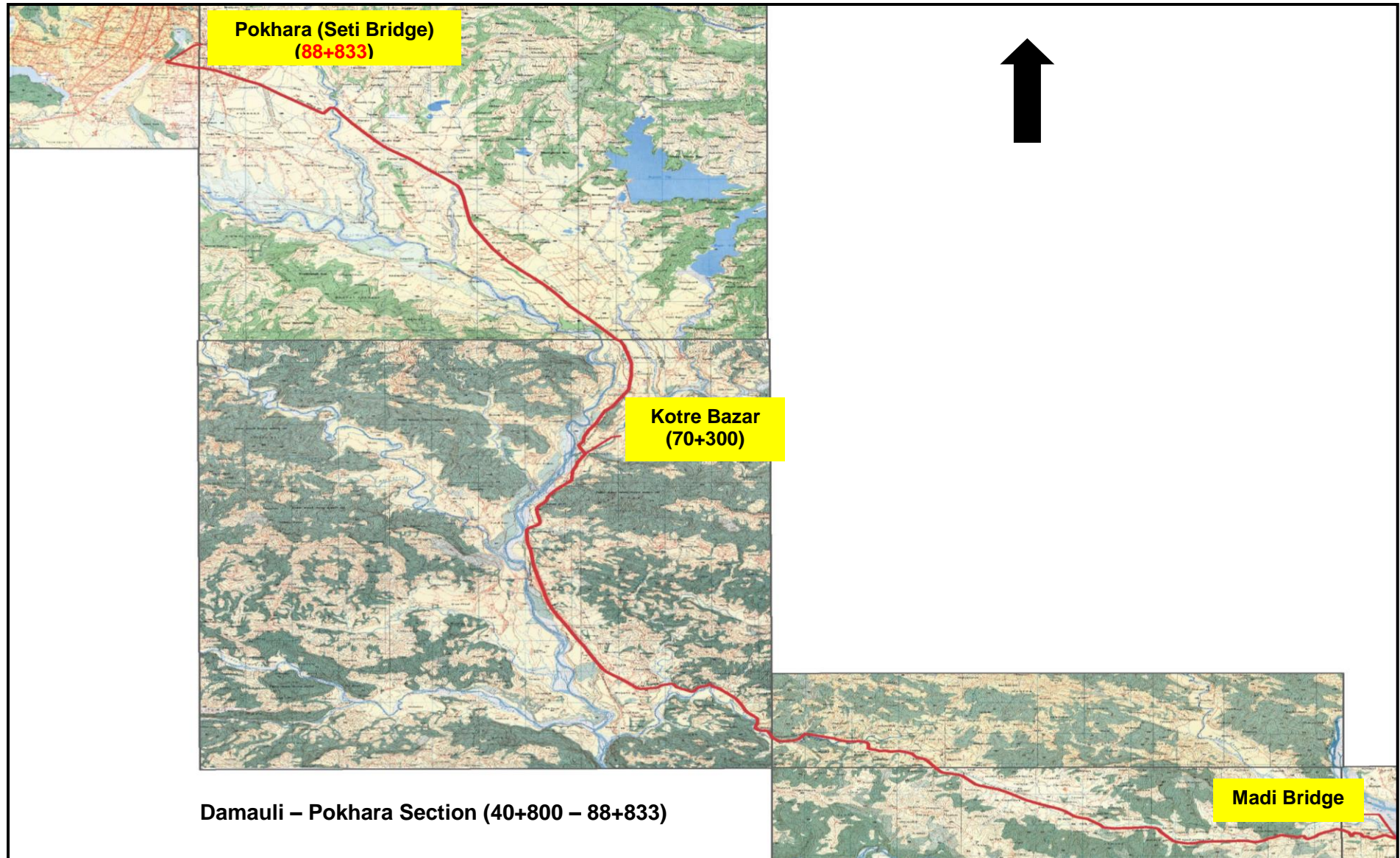


Figure 3: Road Alignment Map





F. Environmental Classification of the Proposed Road Widening Work

98. The Asian Development Bank's-Roads and Highways-Rapid Environmental Assessment (REA) Checklist (**Appendix A**) along with the Project/Site Description were prepared. This is a road upgrading project from 2 lanes to 4 lanes. This upgrading is to meet four lane Nepalese design standard within the existing right-of-way (RoW) and categorized by ADB as Environment Category B since some adverse issues of lesser degree are involved with it for environmental assessment and therefore, an IEE is prepared.

G. Need for the project road

99. Road transport is the dominant mode of transport for passengers and freight within Nepal. The project Road, Abhukherini- Pokhara will promote road connectivity and it has strategic importance to boost tourism sector and economic activities in western districts - Gorkha, Tanahun, Manang, Lamjung and Kaski of the country as well as connectivity to western hills. Thousands of tourists from all over the world visit Pokhara and its surroundings to enjoy trekking around Annapurna mountain peak and to see panoramic view of Snowy Mountains range of Annapurna peak, Machhapuchhre, Manaslu seen from Pokhara, Gorkha, Lamjung and Manang district region. Similarly, many Hindu pilgrims visit Pokhara, Gorkha and Jomsom to visit the Manakamana and Muktinath temples.

100. This road is of great importance to provide connectivity to the people of western districts and tourists from Kathmandu Valley and the rest of country. This road is of strategic importance to boost tourism industry in the western districts of the country and is therefore proposed for four lane. In the existing condition, the road is double lane highway with adequate drainage, cross drainage structures and other road structures. Existing pavement is mostly resealed by Surface Dressing.

H. Existing and Projected Traffic

101. After the road is upgraded, it is expected that the volume of traffic in the proposed road section will increase from the current level of 5,501 to 17,278 vpd in 2016 AD to the traffic level of 49,175 to 187,600 vpd by 2039 AD (Source: Traffic Survey, 2016).

I. Improvement/Strengthening Components

102. The proposed project involves key upgrading activities including geometry improvement, pavement upgrading, drainage improvement, retaining structures; slope protection/stabilization, other off-road works, and works on traffic management and road safety. Proposed cross-section of the road is given in the Figure 4.

103. **Geometry Improvement:** This involves widening of road to varying width (7m, 9m, 12.5m, 18m, 18.5m, 23.00m, 42.50m, 46.20m) to meet the design standards including sections along rock falls, landslides, religious and cultural sites, markets, and built-up areas. Along selected major built-up areas and market fronts consideration has been made in preliminary design to widen the road to full width. This road is difficult to ply for heavy vehicles because of geometry constraints. Currently, the road has narrow road formation, high grade sections, and narrow bends at places. The geometry improvement will enhance serviceability of road, provide hard stand to parking/stopping vehicles and better drainage management.

Table 5: Road Improvement Detail

Chainage		Length (m)	Types of Improvement	Main Carriageway Width (m)	Total Width (m)	Description of Section
From	To					
8+250	23+400	15,150.00	Four Lane with Normal Shoulder + Centre Space	14.00	18.00	Abukhaireni - Dumre Bazar
23+400	23+950	550.00	Four Lane without Service Road + Centre Median+ Footpath	14.00	42.50	Dumre Bazar
23+950	40+430	16,480.00	Four Lane with Normal Shoulder + Centre Space	14.00	18.00	Dumre - Damauli Bazar
40+430	41+400.00	970.00	Four Lane without Service Road + Centre Median+ Footpath	14.00	42.50	Damauli Bazar
41+400	61+700	20,300.00	Four Lane with Normal Shoulder + Centre Space	14.00	18.00	Damauli - Dulegaunda
61+700	66+740	5,040.00	Four Lane with Service Road + Centre Median+ Footpath	14.00	46.20	Dulegaunda, Belchautara and Thati Bazar
66+740	70+210	3,470.00	Four Lane with Normal Shoulder + Centre Median	14.00	23.00	Thati - Kotre Bazar
70+210	70+510	300.00	Four Lane with Service Road + Centre Median+ Footpath	14.00	46.20	Kotre Bazar
70+510	74+600	4,090.00	Four Lane with Normal Shoulder + Centre Median	14.00	23.00	Kotre - Gagangauda
74+600	76+940	2,340.00	Four Lane with Service Road + Centre Median+ Footpath	14.00	46.20	Gagangauda - Sainik Basti
76+940	77+010	70.00	Four Lane with Normal Shoulder + Centre Median	14.00	23.00	Sainik Basti - Bhandardhik
77+010	83+920	6,910.00	Four Lane with Service Road + Centre Median+ Footpath	14.00	46.20	Bhandardhik, Okhale, Talchok, Lakhanchok, Sundar Bazar, Budhi Bazaar, Kalika Chok, Bijayapur
83+920	84+570	650.00	Four Lane with Normal Shoulder +Centre Median	14.00	23.00	Bijayapur
84+570	88+583	4,013.00	Four Lane with Service Road +Centre Median+Footpath	14.00	46.20	Baijayapur - end of Seti Bridge
Total		88,583.00	Source: Detail Design Report, 2017			

104. **Pavement upgrading:** The road pavement activities involve strengthening, resurfacing and reconstruction on existing section. It also covers shoulder improvement and sealing of shoulder on hill side for the road. The existing road surface is bituminous. As part of its upgrading, full pavement with Double Bituminous Surface Treatment (DBST) is designed for this road. Based on terrain evaluation, suitable subgrade strength has been assumed for various sections of the road. Generally, the road section is assumed to fall under two subgrade strength categories as per TRL: S2 (5-7%) and S3 (8-14%).

105. **Bypass and realignment:** No new construction of bypass is proposed for the project road. However, minor realignment has been proposed between Ch. 36+700 and Ch. 37+050 for avoidance of environmentally sensitive sites such as historical sites “Ghansi Kuwa” at chainage 36+870.

106. **Drainage Improvement:** This involves lining of side drains, improvement of existing natural drainage systems, culverts and causeways and construction of new culverts and causeways, and side drains along main market fronts. The road has earth ditches/lined drains at places for side drainage and cross-drainage works comprising major/minor bridges, slab and pipe culverts and causeways.

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

108. **Slope protection/stabilization:** This involves landslide stabilization and slope protection activities. Both civil engineering and bioengineering activities will be under consideration.

109. **Road Safety Measures:** This includes provision of signs, delineators, barriers and pavement markings, minor realignment at identified black spots including pedestrian foot paths in market areas. No existing posts, traffic signs and delineators exist in this road. The project has proposed for installation of 1758 traffic signs (single post – 1658, Double or more post – 100) and 12250 delineators.

110. **Bridges:** Under the present project scope, 8 major bridges and 31 minor bridges are proposed to be constructed. The proposed type of substructure of bridges is RCC, solid and two lane with sidewalks.

Table 6: Details of Bridges, Culverts and Side Drains under Project Scope

Type of Cross Drainage Structure			Length (in Km both sides together) of Roadside Drains		
Major Bridge	Minor Bridge	Culvert	Rectangular Covered Drain	Open Lined Trapezoidal Drain	Open Lined Tick Drain
9	26	411 number of Pipe culverts and 138 number of slab culverts proposed	6.080	46.330	58.610

Source: Source: Detail Design Report, 2017

J. Materials Required and Sourcing

111. As per construction material study, environmentally acceptable and technically viable sources of boulders are identified to be Marsyangdi River basin (Ch. 09+000), Madi River Basin (Ch.42+000) and Seti River Basin (Ch.71+000, Kotre area Borrow pit). There is existing local crusher plant at Ch. 10+000 and Ch. 71+000 at Kotre area in the vicinity of road alignment.

Table 7: Probable Construction Materials Quarry Sites

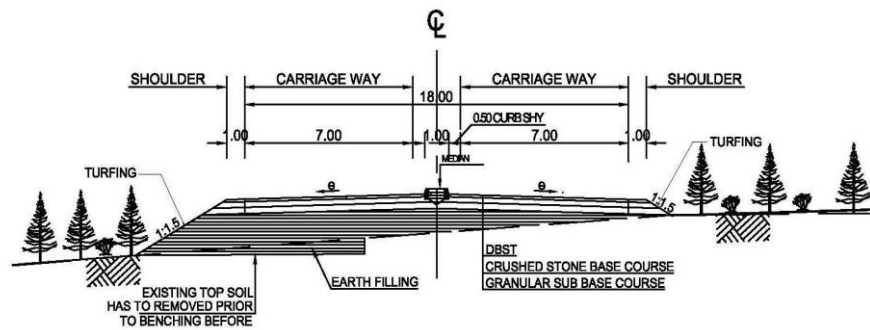
S. N	Location/ Chainage	Approximate Extractable Quantity (m ³)	Required Quantity			Equipment used for materials extraction
			Crushed stone Aggregate (Base Course)	Natural Aggregate Material (Sub – Base)	Sand	
			Qty, m ³	Qty, m ³	Qty, m ³	
1	Marsyangdi River Basin Ch. 9+000	35,450.00	11344.00	12,408.00	8,863.00	Excavator, Bulldozer, Loader, Tipper, Trucks, Tractors, Shovel and Crusher Plant and Screen plant etc.
2	Maadi River Basin Ch. 42+000	373,750.00	93,438.00	186,875.00	48,587.00	Excavator, Bulldozer, Loader, Tipper, Trucks, Tractors, Shovel and Crusher Plant and Screen plant etc.
3	Seti River Basin Ch. 71+000, Kotre area Borrow pit	460,000 .00	230,000.00	92,000.00	115,000.00	Excavator, Bulldozer, Loader, Tipper, Trucks, Tractors, Shovel and Crusher Plant and Screen plant etc.

Source: Detail Design Report, Mugling-Pokhara Road, 2017

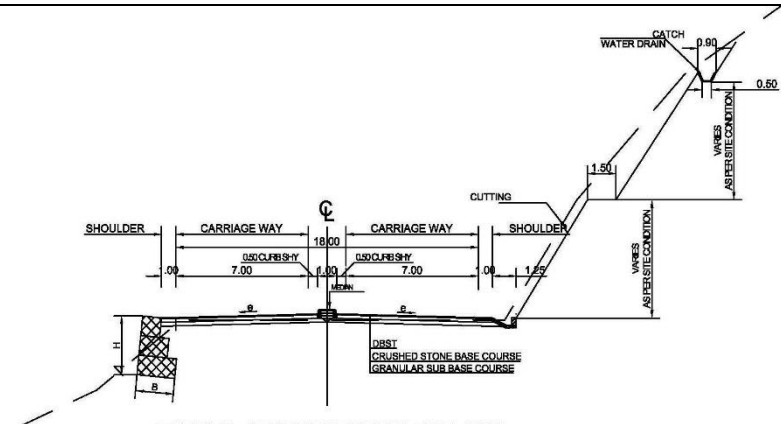
K. Project Implementation Schedule and Cost

112. There are three construction packages viz. Abukhaireni-Pokhara section of the road, Madi & Seti bridges and Mugling-Abukhaireni road. Two packages will be operated under phase 1 whereas one will be in phase 2. First phase will include construction of Abukhaireni-Pokhara road (81 km) as well as Madi & Seti bridges. Project construction period will be approximately 36 months followed by performance based five-year defect liability period for the road whereas construction period for the bridges will be 3 years followed by its DLP. Similarly, Muglin-Abukhaireni section will be implemented in phase 2 of the project. Different contractors will be recruited for the construction and maintenance related works. The total construction cost needed for this project is approximately NRs 18,707.00 million (Abukhaireni-Pokhara Road: 14,162.00, Seti bridge: 1,087. and Madi bridge:3,458.00 million) including VAT (as per Detail Design Report road & bridge, 2017).

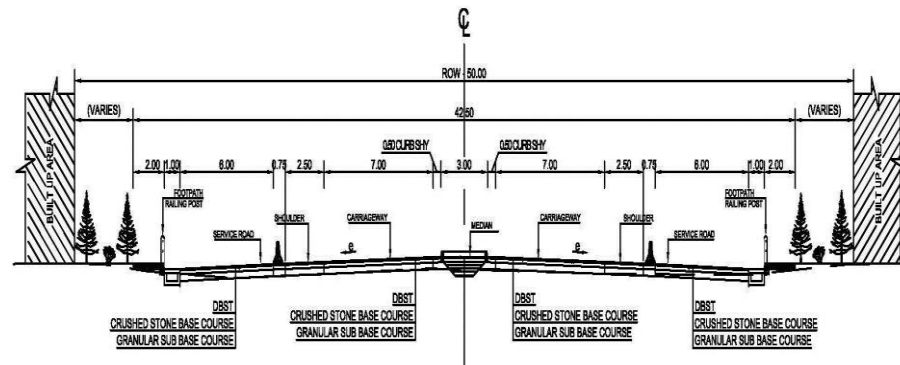
Figure 4: Proposed Cross-sections of the Road



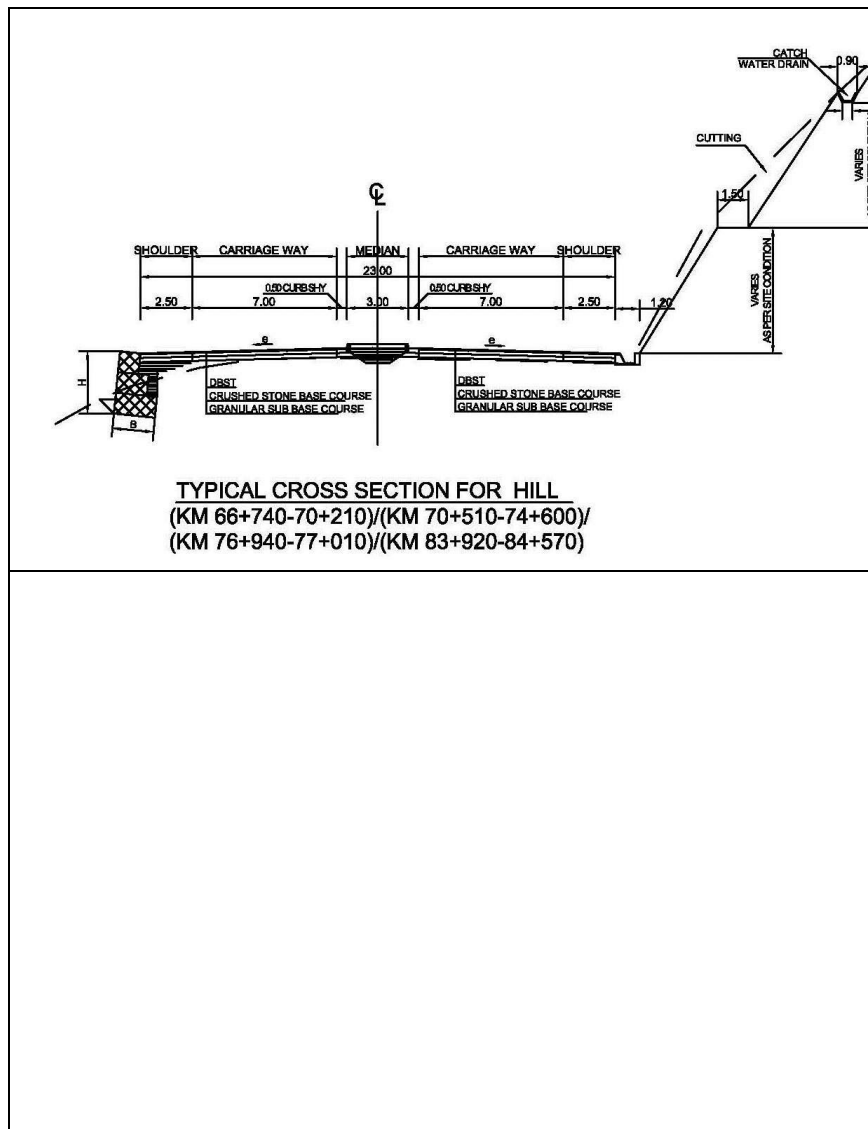
TYPICAL CROSS SECTION FOR (PLAIN/ROLLING)
 ABUKHAIRENI - DUMRE (KM 8+250 - KM 23+400)
 DUMRE - DAMAULI (KM 23+950- KM 40+430)
 DAMAULI - KHAIRENITAR (KM 41+400- KM 61+700)



TYPICAL CROSS SECTION FOR HILL
 ABUKHAIRENI - DUMRE (KM 8+250 - KM 23+400)
 DUMRE - DAMAULI (KM 23+950- KM 40+430)
 DAMAULI - KHAIRENITAR (KM 41+400- KM 61+700)



TYPICAL CROSS SECTION FOR
 BUILT UP AREA WITH SERVICE ROAD/CENTER MEDIAN
 [KM 23+400 - KM 23+950/KM 40+430-KM 41+400:DUMRE/DAMAULI BAZAR]



IV. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Meteorology and Climate

113. Physiographically, the proposed road project lies in mountainous/hilly region. Climatologically, the project area lies in subtropical region. The average maximum and minimum temperature of Tanahun district is 38°C and 5°C respectively and average annual rainfall in the district is 1761 mm. Similarly, the average annual rainfall in Kaski district is 1701.70 mm and the average maximum and minimum temperatures of this district is 32°C and 2.2°C respectively (District Profile of Kaski, 2014). Project districts have complex physiographic features like the warm and dry tropical belt to the alpine region where harsh and cold weather prevails.

114. The twenty-four hours maximum rainfall at different time period at Pokhara stations, DHM 0804 at Pokhara Airport, near project area is shown in tabular form.

Table 8: Maximum Monthly Temperature and Average Monthly Rainfall

Month	Min. Temp (°C)	Max. Temp (°C)	Precipitation Rainfall (mm)
Jan	19.9	8.3	2.3
Feb	24.6	11.2	0.1
Mar	28.1	14.3	93.5
Apr	31.8	15.4	24.6
May	30.6	19.3	241.9
June	30.8	22.1	589.0
July	30.0	22.5	877.5
Aug	32.1	22.7	381.6
Sept	30.1	21.5	972.0
Oct	28.9	18.4	335.4
Nov	25.5	11.9	0
Dec	23.1	9.7	0

Source: DHM, 2016

115. The twenty four hours maximum rainfall at different time period in at Damauli station, DHM 0817, near project area is shown in tabular form.

Table 9: Maximum Monthly Temperature and Average Monthly Rainfall

Month	Min. Temp (oC)	Max. Temp (oC)	Precipitation Rainfall (mm)
Jan	21.3	10.5	0
Feb	24.5	9.6	0
Mar	31.1	12.6	70.7
Apr	35.2	19.5	93.0
May	37.8	19.2	57.0
June	36.0	23.1	245.9
July	34.9	24.1	498.9
Aug	35.6	23.8	94.8
Sept	34.4	22.5	111.8
Oct	30.1	19.0	0
Nov	26.7	16.4	0
Dec	19.6	11.1	0

Source: DHM, 2016

2. Topography and Soils

116. The Abhukherini - Pokhara road section passes through numerous terraces consisting of recent alluvial materials and along the moderate to gentle hill slope with a few exceptions where the road passes through rocky terrain consisting vertical rocky cliff. The hill slope is either covered with medium thick to thick residual to colluvial deposits or slope scree material, from Khairenitar onwards up to the Seti river bridge the alignment passes through Pokhara valley floor characterized by recent quaternary Pokhara Valley sediments consisting of slightly to moderately cemented silty/sandy gravel.

3. Land Use Pattern

117. Land use pattern of the area through which the road alignment passes have been classified into four types: market area, settlement area, agriculture land, and forest area. Approximately 45% of the road alignment passes through bazaar and built up area, consisting alluvial-colluvial, colluvial-residual and debris flow deposits, 9% through forest area consisting thin to medium thick slope scree material along with colluvial to residual deposits, 39% through rural and cultivated area consisting thick to medium thick silty/clay about 2% of the alignment through barren land including river, kholsi etc and 5% of alignment passes through rocky area consisting rocks of Nuwakot Group and Kunchha Group.

4. Hydrology and Drainage

118. There are twenty (26) major rivers & streams across the road alignment as major water bodies. There are nine (9) irrigation crossings along the road alignment (Chainage: 27+060, 37+130, 37+725, 48+120, 48+160, 49+150, 52+400, 52+890, and 67+580). In addition, there are 197 RCC slab and 114 box culverts along the road alignment. No wetlands are found within the vicinity of the road. Table 10 below shows the list of rivers/streams crossed by the Abhukhaireni - Pokhara Road.

119. **Madi River** flows beneath the project area. The linear water way of Madi River is 320 m. The river length from its headwaters to the proposed bridge site is 84.8 km. The scour depth is estimated to be 6 m. The design Flood for the bridges have been taken as the floods of return period 100 years with the flood discharge of 3268 cu.m/s. High flood level corresponding to the 100 years flood of Madi River is computes out as 309.53 m. The characteristic sediments size considered at Bridge location are 3mm of D_{50} and 40 mm of D_{90} .

120. The catchment area of the bridge measures out to be 1117.62 sq. km. The catchment area along the relevant rainfall station from Khudi Bazaar, Pokhara airport, Kunchha, Khairenitar, Chame, Damauli and Siklesh area as shown in Figure 5. The elevation range in the catchment is between 7937m and 320 m

121. **Seti River** has carved a deep gorge and flows much below the surface of the bridge. The depth of the river course is approximately 50.0 m deep. The catchment area of the Seti River is measured to be 577.55 sq. km. The river length from its headwaters to the proposed bridge site is 53.8 km. The elevation range in the catchment is between 7555 m and 808 m. The linear waterway of the Seti River is 200 m. The design Flood for the bridges have been taken as the floods of return period 100 years with the flood discharge of 1977 cu.m/s. The maximum rainfall observed at Airport of Pokhara (near the project area) was 274.2 mm in year 2016 (Source: Detail Design Report of Seti bridge, 2018).

Table 10: Rivers/Streams crossed by the Road Section

S. No.	River/Streams	Chainage(km)	S. No.	River/Streams	Chainage(km)
1	Unnamed stream	00+850	11	Buldi Khola	40+110

S. No.	River/Streams	Chainage(km)	S. No.	River/Streams	Chainage(km)
2	Unnamed stream	01+743	12	Madi Khola	41+725
3	Ruwa Khola	03+652	13	New Proposed Bridge	43+060
4	Khola near BM 86	08+153	14	Moto Bridge-1	51+062
5	Khani Khola	11+060	15	Myagde Khola	55+051
6	Rodi Khola	13+060	16	Kumle Khola	60+570
7	Hudi Khola	15+503	17	Haledi Khola	66+550
8	Nala Khola	24+679	18	Kotre Khola	70+185
9	New Proposed Bridge	25+560	19	Bijayapur Khola	84+152
10	Buldi Khola	37+425	20	Seti River	88+290

Source: TPPF/PPC-2 Field Survey, 2016

5. Air, Noise and Water Quality

122. The source of air pollution in the project area includes vehicular emission and dust pollution due to vehicular movement on unpaved shoulders / agricultural farming activities. Dust pollution, which varies from one to the other season, is the major contributor in deteriorating air quality in the project area. During unsaturated soil condition situation along with farming activities, dust particles rises and the air quality deteriorates. This is a seasonal effect and it neutralizes naturally during the monsoon period. The air, noise quality parameters of the Proposal area are observed to be of good quality despite the vehicles plying.

Table 11: Ambient Air Quality ($\mu\text{g}/\text{m}^3$)

City	PM _{2.5}	PM ₁₀	CO	SO ₂	NO ₂
Abukhaireni	35.60	130.00	<0.5	<5	0.68
Damauli	37.90	150.00	<0.5	<5	0.19
Tharpu	26.20	65.60	<0.5	<5	0.12
Pokhara	38.20	115.00	<0.5	<5	0.65
NAAQS	40 (24 hr ave)	120 (24 hr ave)	8.11	70 (24 hr ave)	80 (24 hr ave)

Note: The baseline values are for 8-hour average concentrations.

Source: Field Survey, 2017

123. The PM₁₀ concentration was found above the NAAQS limit of 120 $\mu\text{g}/\text{m}^3$ at Anbu Khaireni and Damauli however the observed concentration of PM₁₀ at Pokhara and Tharpu was found below the NAAQS specified limit. Similarly, PM_{2.5} Concentration in all four locations was detected marginally below the NAAQS limit. Other pollutants however were detected fairly below the National Standard Limit.

124. Noise level measured along the project road along with the standards for noise under the World Bank Environmental Health and Safety (WB-EHS) Guidelines and national standards are also provided.

Table 12: Analysis of water samples from four points of Seti River at Pokhara

Parameters	Desired Value	Unit	Seti-Setidoban	Seti-Mardi	Seti-PN college	Seti-Dobila
pH	6.5-8.5*		7.5	7.4	7.5	7.6
DO	>5	mg/l	8.1	8.1	14.5	8.7
BOD	<30	mg/l	1.2	1.2	1.2	1.3
COD	<250	mg/l	2.4	2.4	2.5	2.6
TDS	<1000	mg/l	110	110	160	150
EC	<1500	μS/cm	130	130	1870	170
NH3-N	<1.5	mg/l	1.5	1.5	3.2	2.8
NO3-N	<50	mg/l	0.13	0.13	0.11	0.1
NO2-N	-	mg/l	0.05	0.05	0.02	0.01
TOC	-	mg/l	2	2	2	2
TH	<500	mg/l	120	120	110	170
Mg	<100	mg/l	9.8	9.8	5.6	6.9
Fe	<0.3(3.0)	mg/l	0.3	0.3	3.4	3.8
TC	0	MPN/100ml	500	500	1600	500
E.coli	0	MPN/100ml	50	50	120	40

Source: Water Quality Measurement, GoN, 2016

*Represent the range value

125. Water quality around the project area and of Madi River is observed to be good and people use springs, pipe/tap water and small streams for drinking purpose. The water quality test of Madi River will be done before and after the construction phase of the project.

Table 13: Noise level recorded at different locations along the road alignment

126. Location	Noise Level dB (A)			GON Noise zones/standard	WB Noise Zones/standard
	Minimum	Maximum	Average		
Abukhaireni Bazaar	59.29	76.44	74.94	New residential area (62 dBA)	Residential (50 dbA)
Damauli	59.85	89.38	77.86	New residential area (62 dBA)	Residential (50 dBA)
Tharpu	49.70	66.00	63.85	Rural Area (None)	-
Pokhara Bazaar (End Point)	58.28	85.00	75.36	Commercial cum residential Area (72.75 dBA)	Commercial (70)

Source: Field Survey, 2017

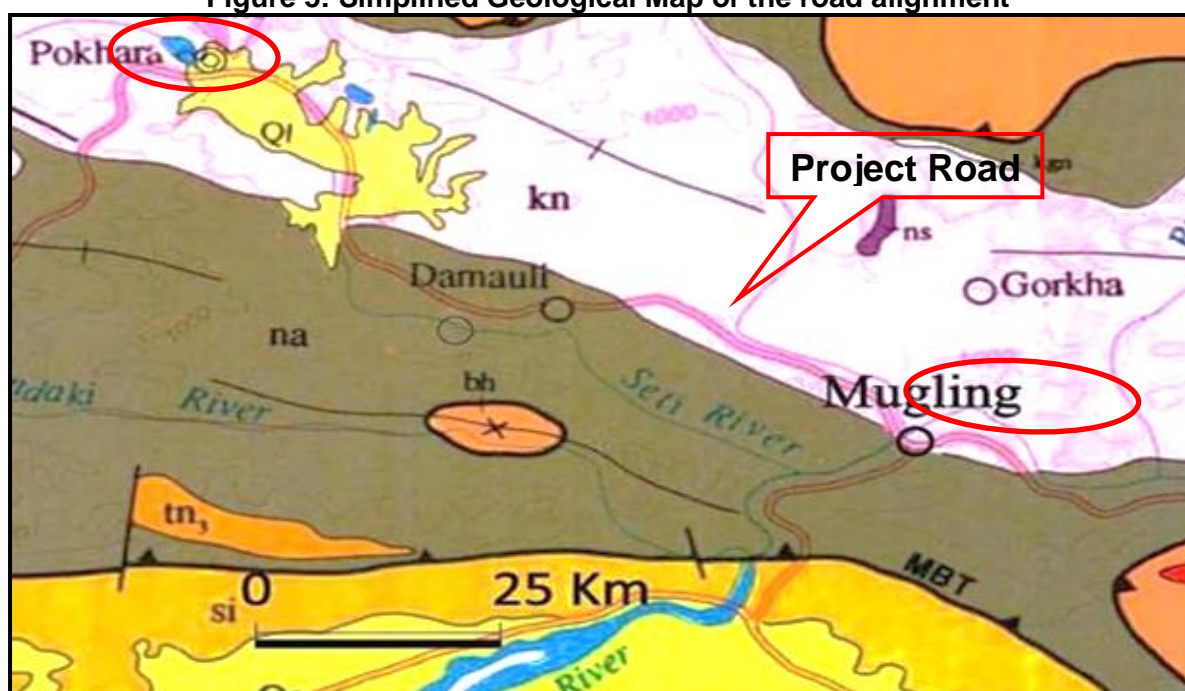
127. Noise quality data presented in Table 13 shows that the day-night average noise pressure levels of these locations were found to vary from 63.85 dBA to 77.86 dBA. The lowest noise pressure level was detected from the Tharpu area whereas the highest level of noise pressure was detected from Damauli area. Comparison of the observed noise quality data against the National Standard for Noise reveals that observed day-night average sound pressure levels in all locations but Tharpu was found above the day time sound pressure level of 65 dBA specified by the national standard for commercial areas. The detected pressure level at Tharpu was found marginally below than this standard limit. The day-night sound pressure levels observed from Pokhara and Damauli areas were found exceeding the standard limit set by national standard for day time industrial noise (75 dBA).

128. Water quality is observed to be good and people use springs, pipe/tap water and small streams for drinking purpose.

6. Geology/Seismology

129. Geologically, the road alignment passes on the rocks of Nuwakot Group and Kunchha Group consisting Phyllite, Metasandstone, Slate, Dolomite, Quartzite rocks. The exposed rock is slightly to moderately weathered and completely weathered at places. The rocks are jointed and fractured at places. Joints are non-persistent to persistent and are open with infilling of sandy silty/clay material at places. Mostly the rocks are covered by thin to thick slope scree to colluvial-residual materials.

Figure 5: Simplified Geological Map of the road alignment

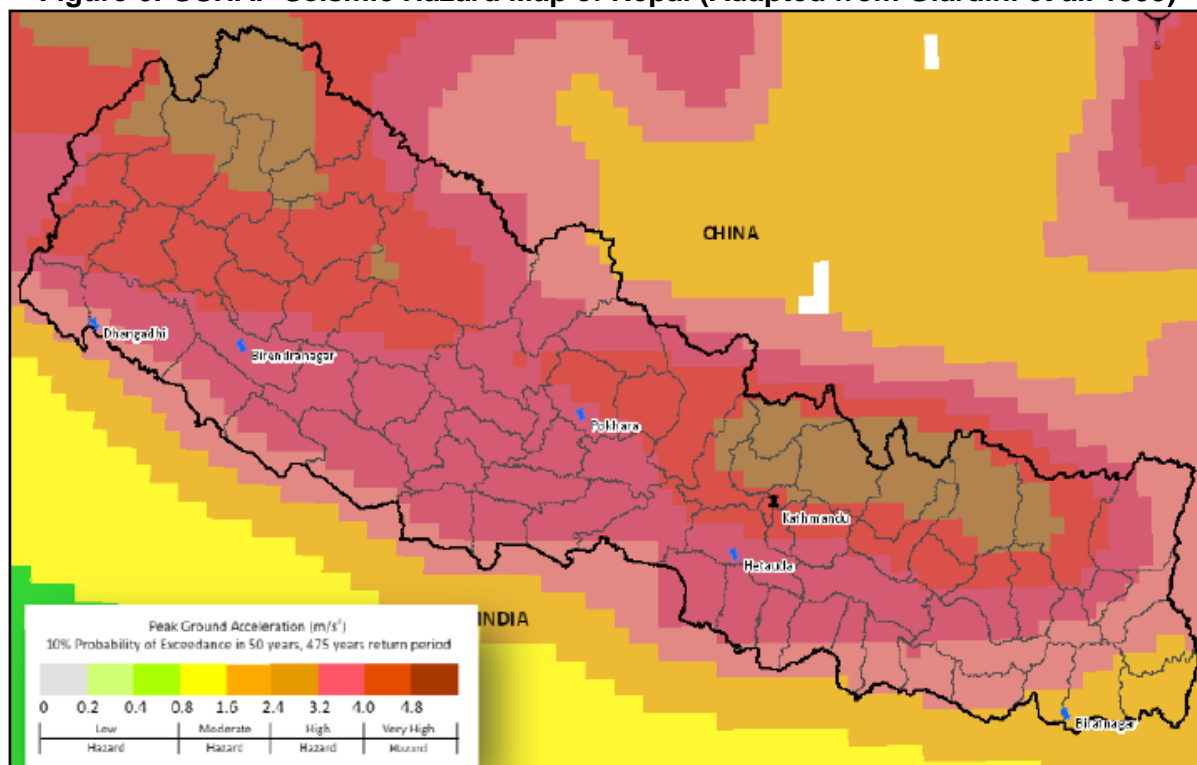


(Source: Geological Map of Nepal, 1994), Note: Si – Siwalik, Qi – Lesser Himalaya, Na – Nuwakot Group, Kn – Kunchha Group, bh – Bhimphedi Group

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

131. The proposed project road section falls under the Seismic Zone IV, which is susceptible to major earthquakes as per the seismic zone map of Nepal, shown below in Figure 3.5. The project road has negligible impact from the recent 2015 earthquake.

Figure 6: GSHAP Seismic Hazard Map of Nepal (Adapted from Giardini et al. 1999)



B. Ecological Resources

1. Flora

132. The project road traverses seventeen (17) community managed forests as listed in Table 14. A total of 7.8 km of the proposed road section passes through these community forests and National Forest. The dominant forest types existing along the road corridor include Riverine forests, *schima* forests, *Alnus nepalensis* forests, and *Shorea robusta* forests. Three species namely, *Shorea robusta*, *Bombax ceiba* and *Acacia catechu* are protected plant species. The first one is high value timber and second one offers industrial value. *Shorea robusta* is banned for commercial felling, transportation and export including their fruit/seed, leaf and twigs. Similarly, commercial felling, transportation and export include pod/seed, leaf, bark and wood for *Acacia catechu* are also banned. Further, *Acacia catechu* falls under the *threatened category of IUCN status*.

Table 14: Community Forests (CF) Along Road Alignment

S. No.	Name of Community Forest	Chainage	Location	Dominant Species	Protected Species
1.	Sri Bhanghe CFUG	06+900 – 07+525	Bhanghe, Anbukhairani – 7, Tanahun	Bakaino, Khirro, Simal, Sal, Rittha, Chanp	Sal
2.	Yampa CFUG	19+075 – 19+450	Bandipur-8	Bakaino, Sissoo, Padke, kyamuno	
3.	Lohi Pakha CFUG	20+075 – 21+275	Bandipur-6, 8, Tanahun	Bakaino, Sissoo, Padke, Ipilipil, Amaro, Ashok, Dhumri	
4.	Kowacha CFUG	21+275 – 22+225	Bimalnagar, Bandipur-6, Tanahun	Sissoo, Padke, Ipil ipil	

S. No.	Name of Community Forest	Chainage	Location	Dominant Species	Protected Species
5.	Sri Shiva Parvati CFUG	35+600 – 35+675	Ghansikuwa-5, Tanahun	Simal, Sal, Khayer, Peepal, Bar, Ramritho	Sal, Khayar
6.	Sri Shwagdi CFUG	36+350 – 37+700	Golla, Ghansikuwa-5, Tanahun	Chanp, Ramritho, Sissoo, Padke, Chilaune, Paiyau	
7.	Sri Sundari CFUG	37+800 – 38+425	Musekhola, Vyas municipality – 1, Tanahun	Chanp,	
8.	Sri Barahi CFUG	44+675 – 45+100	Gunadi, Jamunne – 1, Tanahun	Simal, Sal, Khayar, Chilaune, Bael, Katus	Sal, Khayar
9.	Mahila Makhawa CFUG	56+100 – 56+250	Chhabise, Manpang – 1, Tanahun	Khayar	Khayar
10.	Lamidanda CFUG	56+650 – 58+250	Manpang – 2, Tanahun	Sal, Khayar	Sal, Khayar
11.	Sri Simalchaur CFUG	59+700 – 59+950	Khairenitar, Shuklagandaki Municipality – 9, 10, 11, Tanahun	Sal, Chilaune, Katus	Sal
12.	Bagedanda CFUG	68+325 – 69+250	Dulegaunda, Shuklagandaki Municipality – 3, Tanahun	Sal, Chilaune, Katus	Sal
13.	Kayachaur Chhaharepakha CFUG	69+250 – 70+045	Dulegaunda, Shuklagandaki Municipality – 7, Tanahun	Sal, Khayar, Sissoo, Chilaune, Katus	Sal, Khayar
14.	Raipurkotre CFUG	70+045 – 70+500	Kotre, Shuklagandaki Municipality – 1, Tanahun	Sal, Sissoo, Chilaune, Katus	Sal
15.	Pragatishil CFUG	71+375 – 71+725	Lekhnath Municipality – 3, Kaski	Sal, Khayar, Sissoo, Chilaune	Sal, Khayar

Source: Field survey, 2017

Table 15: Major Tree Species available surrounding to the project area

Local Name	Botanical Name	Family	Forest Act	IUCN	CITES
Chilaune	<i>Schima wallichii</i>	Theaceae			
Jamun	<i>Syzygium cumini</i>	Myrtaceae			
Kadam	<i>Anthocephalus chinensis</i> (Lam.) A. Rich. Ex Walp	Rubiaceae			
Karam	<i>Adina cordifolia</i> (Wild. Ex Roxb.) Benth. & Hook. F. ex Brandis	Rubiaceae			
Khayar	<i>Acacia catechu</i> (L.f.) Wild	Leguminosae	Protected	T	III
Khirro	<i>Sapium insigne</i> (Royle) Benth. Ex Hook.f.	Euphorbiaceae			
Sal	<i>Shorea robusta</i> Gaertn.	Dipterocarpaceae	Protected Against commercial use		
Tanki	<i>Bauhinia purpurea</i> L.	Leguminosae			

Local Name	Botanical Name	Family	Forest Act	IUCN	CITES
Amala	<i>Phyllanthus emblica</i>	Euphorbiaceae			
Chiyuri	<i>Aesandra butyracea</i>	Sapotaceae			
Dale Kutus	<i>Castanopsis indica</i>	Fagaceae			
Kafal	<i>Myrica esculenta</i>	Myricaceae			
Kyamun	<i>Syzygium cerasoides</i>	Myrtaceae			
Mahuwa	<i>Engelhardia spicata</i>	Juglandaceae			
Uttis	<i>Alnus nepalensis</i>	Betulaceae			
Rato siris	<i>Albizia chinensis</i>	Leguminosae			
Saj	<i>Terminalia tomentosa</i>	Combretaceae			
Salla	<i>Pinus roxburgii</i>	Pinaceae			
Tateri	<i>Dillenia pentagana</i>	Dilleniaceae			
Mayal	<i>Pyrus pashia</i>	Rosaceae			

133. Roadside plantations (avenue trees) were also noted almost throughout the road alignment in urban areas. The major tree species recorded in from the COI are: Kadam (*Anthocephalus chinensis*), Bar (*Ficus bengalensis*), Pipal (*Ficus religiosa*), Sissau (*Dalbergia sisso*), Neem (*Azadirachta indica*), Siris (*Albizia sp*), Jamun (*Syzygium cumini*), etc. 279 Bar and Pipal Chautari's with cemented platform (natural shaded resting place) were observed at various locations. The road side trees within the COI will be affected. The details of roadside trees with girth ranging from 0.5 m to 3 m and height from 3 m to maximum 12m were recorded within the COI as mentioned below in table 16.

Table 16: Detail of Roadside Trees

Tree Type	Quantity in Nos.
Lapsi (<i>Choerospondias axillaris</i>), Pipal (<i>Ficus religiosa</i>), Bar (<i>Ficus bengalensis</i>), Neem (<i>Azadirachta indica</i>), Kavro (<i>Ficus lacor</i>), Kadam (<i>Anthocephalus chinensis</i>), Siris (<i>Albizia sp</i>), Sissau (<i>Dalbergia sisso</i>), Masala, Shami (<i>Ficus benjamina</i>), Ashok (<i>Saraca asoca</i>), Simal, Bakaino, Sal, Rubber, and Mango (<i>magnifera indica</i>), Palm trees, Tuni, Dhupi, , Rittha, Chilaune, Khayar, Katus(<i>Castanopsis indica</i>) Kaulo (<i>Persea odoratissima</i>), Khaniyu (<i>Ficus semicordata</i>), Khirro (<i>Sapium insigne</i>), Lakuri (<i>Fraxinus floribunda</i>), Naspati (<i>Pyrus communis</i>), Newaro (<i>Ficus auriculata</i>), Paiyun (<i>Prunus cerasoides</i>), Sallo (<i>Pinus roxburghii</i>), Suntala (<i>Citrus sp.</i>), Uttis (<i>Alnus nepalensis</i>) etc.	6000
Bamboo clumps	186 clumps
Chautari's with cemented platform (natural shaded resting place) with pipal (<i>Ficus religiosa</i>), bar (<i>Ficus bengalensis</i>) as major tree species.	279

Source: Field survey, 2017

Table 17: Total no. of Tree Species around the Seti Bridge project area

SN	Location	Tree Species	Circumference (m)	Height (m)	Remark
1	Along the access road (left side)	Ashok	2.95	15	
2		Ashok	0.3	8	7
3		Tadi	0.9	6	
4		Peepal	0.5	10	
5		Sisau	0.3	4	
6		Ashok	0.2	3	5
7		Rudrakchya	0.6	3	
8		Sisau	0.2	3	
9		Sisau	3	20	
10	Buddha Nursery	Halaude	0.3	4	
11		Aaru	0.2	4	2
12		Sisau	0.9	15	

SN	Location	Tree Species	Circumference (m)	Height (m)	Remark
13		Sisau	0.8	15	
14		Sisau	1.2	15	
15		Sisau	0.8	15	
16		Sisau	0.8	15	
17		Sisau	0.8	10	
18		Sisau	0.8	10	2
19		Sisau	0.9	8	
20	Shree Bhadrakali Nursery	Dumstick	1.0	6	
21		Ipil Ipil	0.2	2	
22		Kabro	0.2	2	
23		Fistel Pan	0.6	3	
24		Kutmero	0.2	4	
25		Bedalo	0.2	4	
26		Chritmas Tree	0.2	4	
27		Fistel Pan	0.4	4	
28		Christman Tree	0.2	10	
29		Sisau	1.2	15	
30		Painyu	0.4	5	
31		Aap	0.2	4	
32		Bottlebrush	0.3	4	
33		Sisau	0.6	4	
34		Sisau	1.1	4	
35		Bottlebrush	3	10	
36		Bottlebrush	0.3	20	
37		Dumri	0.6	5	
38		Siris	3.1	10	
39		Paulaniya	0.4	5	
40		Siris	1.2	15	
41		Lapsi	1.0	15	
42		Parijat	0.3	5	2
43		siris	0.9	5	
44		Swami	0.3	25	
45		Champa ful	0.8	6	
46		Polenia	0.2	4	
47	Along the access road (right side)	Emli	0.9	5	
48		Peepal	1.5	5	
49		Peepal	2	10	
50		Peepal	1.2	8	
51		Peepal	0.6	10	
52		Peepal	2.1	10	
53		Ashok	2.2	15	
54		Kadam	0.6	5	
55		Peepal	3.3	15	
56		Peepal	0.2	3	
57		Siris	1.7	10	
58		Siris	1.1	10	2
59		Siris	1.1	10	2
				Total	81

Source: IEE Seti Field Visit, 2018

Table 18: List of trees to be removed within Formation Width of Madi Bridge

S. N.	Location	Species	Number	Remark
1	0+000-0+160	Khair	2	2 Khayar as protected species
3		Falate	10	
4		Dabdade	1	

S. N.	Location	Species	Number	Remark
5		Sisau	20	Along the approach road
7		Sajiwun	12	
8		Bel	1	
9		Pakait	12	
10		Amala	1	
11		Peepal	1	
12		Kapoor	16	
13		Bar	1	
14		Lakuri	7	
15		Ahok	2	
16	0+480-0+635	Aap	8	Department of road of Damauli
17		Katahar	1	
18		Kimbhu	1	
19		Ashok	26	
20		Kapoor	7	
21		Sajiwon	13	
22		Kalki	13	
23		Neem	3	
24		Kabro	2	
25		Gulmohar	1	
26		Sisau	33	
27		Bakainya	1	
28		Bar	1	
29		Swami	5	
30		Lichi	3	
31		Peepla	1	
32		Chilaune	1	
33		Unknown	1	
34		Ipil Ipil	6	
	Total		213	

Source: IEE Madi Field Survey, 2018

2. Fauna

134. Diverse forest species along the road corridor offers home and migratory routes to different species of mammals. The project area covers wide range of commonly found faunal diversity also. The information on wildlife and avian fauna gathered from the local residents indicated that Leopard cat (*Felis bengalensis*), Jungle cat (*Felis Chaus*), Jackal (*Canis aureus*), monkey (*Macaca Assamensis*), langur monkey (*Presbytis entellus*), Squirrel (*Funambulus pennati*), squirrel (*Funalbalus sp.*), Fox (*Vulpes bengalensis*), hare (*Lupus migricollis*) and porcupine (*Hystrix hodgsoni*) etc.

Table 19: Species of Mammals around the project area

Name			Family	CITES	IUCN	Forest Act
Local	English	Scientific				
Ban Biralo	Jungle cat	<i>Felis chaus</i>	Felidae	2	LR/lc	
Bandar	Monkey	<i>Macaca assamensis</i>	Cercopithecidae	2	VU	Protected
Dhedu	Langur Monkey	<i>Semnopithecus entellus</i> Syn. <i>Presbytis entellus</i>	Cercopithecidae	1	LR/nt	
Dumsi	Porcupine	<i>Hystrix hodgsoni</i>	Hystriidae			
Fayuro	Fox	<i>Vulpes bengalensis</i>	Canidae	3	DD	
Syal	Jackal	<i>Canis aureus</i>	Canidae	3		

Name			Family	CITES	IUCN	Forest Act
Local	English	Scientific				
Chari Bagh	Leopard cat	<i>Felis bengalensis</i>	Felidae	1	LR/nt	
Lokharke	Squirrel	<i>Funambulus pennati</i>	Sciuridae			
Kharayo	Indian hare	<i>Lepus nigricollis</i>	Leporidae			

Source: Field Survey, 2016, LR/LC= Lower Risk/Least Concern; VU= Vulnerable; nt= Near Threatened; DD=Data Deficient; and EN=Endangered

135. Similarly, major birds reported in the project area include Sparrow (*Passer domesticus*), Owl Bam (*Tyto alba*), Crow (*Corous macrorhynches*), Nepali Kaliz pheasant (*Lophura leucomelanos*), Cuckoo (*Eudynamus scolopacea*), Jungle Fowl (*Gallus gallus*), Myna (*Gracula religiosa*), Red Turtle Dove (*Streptopelia tranquebarica*), and Hill Partridge (*Arborophila hyperythra*) etc.

Table 20: Bird Species along the Road Corridor

Name			Family	CITES
Local	English	Scientific		
Bhangera	Sparrow	<i>Passer domesticus</i>	Passeridae	
Huchil	Owl Bam	<i>Tyto alba</i>	Tytonidae	2
Kag	Crow	<i>Corous macrorhynches</i>	Corvidae	
Kalij	Pheasant	<i>Lophura leucomelana</i>	Phasianidae	
Koili	Cuckoo	<i>Eudynamus scolopacea</i>	Cuculidae	
Luiche	Jungle Fowl	<i>Gallus gallus</i>	Phasianidae	
Sarung	Myna	<i>Gracula religiosa</i>	Sturnidae	3
Dhukur	Red Turtle Dove	<i>Streptopelia tranquebarica</i>	Columbidae	
Piura	Hill Partridge	<i>Arborophila hyperythra</i>	Phasianidae	

Source: IUCN, Nepal, (2005). Nepal's Illustrated Biodiversity Primer

3. Freshwater Aquatic System

136. The sub-project area contains few perennial rivers and streams viz. Seti, Madi, Marsyangdi Rivers. Most of other streams are perennial. Marsyangdi, Madi and Seti Rivers are the major sources of habitat for different type of fish species. The commonly found species of fishes are Asala/ Chuche Asala (*Schizothorax progastus*), Bam/Raj Bam (*Anguilla bengalensis*), Buduna (*Gerraaun andalei*), Buhari (*Wallago attao*), Katle, Copper Mahseer (*Neolissochilus hexagonolepsis*), Kabre (*Glyptothorax trilineatus*), (*Acrossocheilus hexagonolepis*), River stone carp (*Psilorhynchidae sucatio*), Sahar (*Tor tor*) and Stone carp (*Psilorhynchus pseudecheneis*).

Table 21: Commonly found Species of Fishes along Road Corridor

River /Stream	Local Name	Scientific Name
Seti, Marsyangdi and Madi Rivers	Asala/ Chuche Asala	<i>Schizothorax progastus</i>
	Bam/Raj Bam	<i>Anguilla bengalensis</i>
	Buduna	<i>Gerraaun andalei</i>
	Buhari	<i>Wallago attao</i>
	Copper Mahseer	<i>Acrossocheilus hexagonolepsis</i>
	Kabre	<i>Glyptothorax trilineatus</i>
	Katle	<i>Acrossocheilus hexagonolepis</i>
	River stone carp	<i>Psilorhynchus sucatio</i>
	Sahar (Kalo, Pahelo) Ratar	<i>Tor tor, putitora</i>
	Tite (Stone Carp)	<i>Psilorhynchus pseudecheneis</i>

Source: Field Survey, 2016

4. Flora and Fauna of Conservation Significance

137. One protected wildlife species (mammals) is reported in the project corridor and rest of the existing species of mammals are commonly found species. Among the reported species, Monkey (*Macaca assamensis*) is protected and vulnerable species according to Forest Act, and IUCN respectively. Some of the species found in the project area are also listed in IUCN RED LIST, among them jungle cat and ghoral are categorised as having lower risk and of least concern; Langur monkey (*Semnopithecus entellus* Syn. *Presbytis entellus*), and Leopard cat (*Felis bengalensis*) are categorised as having lower risk and nearly threatened. Fox (*Vulpes bengalensis*) is categorised as data deficient.

5. Biodiversity Conservation

138. The project area lies outside the biodiversity conservation sites (National Parks, Protected Nature Reserve, Wildlife Reserve, Hunting Reserve, Conservation Area, and Buffer Zone) officially declared by the Government of Nepal. The forest areas within the project area are the parts of Government Managed National Forests, some part of which are handed over to the Communities as Community Forests for the management purpose. The road section does not fall under any protected or buffer zone area.

B. Social and Cultural Resources

1. Population and Communities

139. According to the Census 2011 (CBS), total population of Tanahun and Kaski districts are 323,288 and 492,098 respectively. The average family size of project districts is 4.13 and 3.92 respectively. The population density per square kilometer is 209.11 persons per square kilometer in Tanahu and 243.98 persons per sq. km in Kaski respectively.

Table 22: Population Distribution by Project affected Districts

District	Total HHs	Total Population	Male (%)	Female (%)	Average HH Size	Population density
Tanahu	78,309	323,288	143,410	179,878	4.13	209.11
Kaski	125,673	492,098	236,385	255,713	3.92	243.98
Total	203982	815386	379795	435591	4.00	228.85

Source: District Development Profile of Nepal, CBS, 2011

140. According to 2011 census, total population of 6 municipalities and 4 VDCs touched and traversed by the proposed upgrading road section is estimated at 5228,37 with 135,932 households which accounts for 64.12 % of the project districts population. Gender-wise population distribution is estimated at 48.84% male and 51.16% female.

Table 23: Population Distribution of Project affected Municipality/VDCs

Municipality/VDC	Total HHs	Population			Average HH Size
		Total	Male	Female	
Aanbukhaireni Municipality	4,034	16,382	7,573	8,809	4.06
Ghansikuwa VDC	1,942	7,834	3,484	4,350	4.03
Bandipur Municipality	3,056	12,450	5,710	6,740	4.07
Vyas Municipality	11,321	42,899	19,376	23,523	3.79
Jamunne Bhanjyang VDC	2,408	9,838	4,416	5,422	4.09
Manpang VDC	1,721	6,698	2,863	3,835	3.89
Chhang VDC	1,499	5,966	2,607	3,359	3.98
Shuklagandaki Municipality	9,676	38,307	16,911	21,396	3.96
Lekhnath Municipality	17,405	68,622	31,218	37,404	3.94
Pokhara Sub-metropolitan City	82,870	313,841	161,190	152,651	3.78
TOTAL	135,932	522,837	255,348	267,489	3.85

Source: District Development Profile of Nepal, CBS, 2011

2. Religion and Ethnicity

141. The predominant ethnic groups residing along the road section is Brahmin, Chhetri, Gurung, Magar, Newar, and Dalits. The other major castes are Tamang, Thakuri, Kumal, Damai/Dholi, Gharti/Bhujel and Musalman. In the project affected municipality/VDCs, Brahmin – Hill is the largest ethnic population with 23.40% followed by Gurung (14.95%), Chhetri (14.92%), Magar (12.85%), Kami (7.15%), Newar (6.80%), Damai/Dholi (3.15%), Sarki (2.41%), Tamang (2.31%), Thakuri (1.65%) and others (10.41%) (CBS, 2011).

142. In the project districts, language wise, 75.92% of total population speak Nepali and 9.95% of people speak Gurung. Magar language is spoken by 5.38% followed by Newari language with 3.04% and Tamang language (1.18%). Along with these languages there are also other languages having users less than 1% (CBS, 2011).

143. The majority of the communities of Tanahun district are found to follow Hinduism (83.16%) followed by Buddhism (15%), Islam (1.02%), and others constitute Kirat, Christian, Jain and Bahai etc. (0.82%). Similarly, in Kaski district majority of population are found to follow Hinduism (81.71%) followed by Buddhism (15.88%), Christian (0.79), Islam (0.69%), and others constitute Kirat, Jain and Sikh etc. (0.93%).

3. Literacy Rate and Education Level

144. Tanahun and Kaski districts have literacy rate of 74.83% and 82.38% respectively. In the project affected area, as per 2011 Census, about 83.37% of population aged 5 years and above can read and write (Source: CBS, Nepal, 2011).

4. Health facilities

145. There are 2 hospitals along with other supporting health services organization in Tanahun district. The supporting centre includes 9 different types of health services. Based on number, the major health services facilities in the district are vaccine centre, Gaunghar clinic, and sub health post, contributing 50%, 36.2%, and 6.6%, respectively. The doctor to population ratio is observed as 1:76319 and Staff to Population ratio as 1:54514. (Annual report, DHO 2012/13, Tanahun).

146. In Kaski district, there are 3 primary health centre, 11 Ilaka health post, 20 sub-health post, 14 health post, 1 regional hospital, 1 eye hospital, 1 regional tuberculosis centre, 1 leprosy hospital, 6 municipal health centre, 2 teaching hospital, 8 private hospitals/nursing home, 40 private pathology clinic, 427 medical halls etc (Source: DHO, Kaski, 2013).

5. Sanitation

147. In the project influence area 96.48 % of the households have toilet facilities. Those who have toilet mostly possess either pan or pit type toilet with flush system (Source: CBS, 2011).

6. Drinking Water

148. In the project area, major source of drinking water is found to be from piped water (90.07%) supplied through community made water tanks. About 4.85 % of the households use well/spring for the purpose of drinking water and about 2.71 % of the household also use spout water as a source of drinking water. Other source of drinking water is river/stream. The use of underground water for drinking water is very insignificant (Source: CBS Nepal, 2011).

7. Occupational Status

149. Households in the project area are found to depend on more than one occupation in all settlements. Major occupation of the households is trade & business which comprises 18.51% of the total household's members. Similarly, 10.07% are engaged in foreign employment whereas about 9% are service holders and about 10% population is unemployed. It is also to note that about 16.60% populations are housewife. Table 24 below presents the main occupation of the households in the project area.

Table 24: Occupation Status of Project area

S. No.	Occupation	Sex			Percent (%)
		Male	Female	Total	
1	Agriculture	256	163	372	5.78
2	Service	373	205	578	8.98
3	Trade & Business	732	459	1191	18.51
4	Agriculture Labour	36	32	68	1.06
5	Non-Agriculture Labour	57	20	77	1.20
6	Students	868	880	1748	27.17
7	Foreign Employment	520	128	648	10.07
8	House wife	0	1021	1068	16.60
9	No job	376	308	684	10.63
10	Total	3218	2908	6434	100.00

Source: PSA Report, 2016

8. Educational Facilities

150. There are 496 numbers of Child Development Centres which provide safe environment for children and proper nurturing, which gradually stimulate cognitive, social and emotional growth and development of each individual. In addition, there are around 107 Lower Secondary School, 90 Secondary School, 51 Higher Secondary School and 15 Campus (District Development Plan 2014/015, Tanahun). In Kaski district, there are 589 pre-primary schools, 291 primary schools, 72 lower secondary schools, 157 Secondary schools and 108 higher secondary schools (Source: DDC Profile, Kaski, 2015).

9. Infrastructure Facilities

Water Supply

151. In the project area, major source of drinking water is found to be from piped water (90.07%) supplied through community made water tanks. About 4.85 % of the households use well/spring for the purpose of drinking water and about 2.71 % of the household also use spout water as a source of drinking water. Other source of drinking water is river/stream. The use of underground water for drinking water is very insignificant (Source: CBS Nepal, 2011).

Communication

152. Telephone service is available in all municipalities and VDCs of project districts. Nepal Telecom and NCell are two telephone service provider companies in the district. Similarly, Mobile communication system both the CDMA and GSM are available in almost all parts of the district. Internet/Email services are easily available to general public from main market centers. In addition, Internet service from CDMA mobiles is also accessible in the district.

153. Most VDCs in Kaski have at least one or more mode of communications: landline, CDMA, GSM mobile or V-SAT telephones. The district has easy access to various national dailies and televisions. Landline connections also provide internet access to government offices and NGOs located in district. Mobile phones have also become a good gateway for internet recently. Most people have a mobile phone equipped with one or more SIM-cards. The district has few FM stations and local newspapers which publish from district headquarter (CBS, 2012)

Transportation

154. Tanahun district consists of 149.5 km Black topped road, 62 km gravel road and 2200 km of rural roads. Five municipalities and 36 VDCs out of total 37 VDCs are connected with road service. Prithivi Highway is the major highway which connects this district with other places of Nepal.

155. All the VDCs and municipalities of Kaski district are connected with road facility. Kaski district has 717.31 km length of road comprising 190.74 km of blacktop road, 82.86 km of gravel road and 443.71 km of fair weather roads (Source: DDC Profile, Kaski, 2015).

Market Centres

156. The major market centres in the project districts include Abukhaireni, Bimalnagar, Dumre, Bandipur, Turture, Damauli, Khairanitar, Dhorphirdi, Kotre, Dulegaunda, Lekhnath (Sisuwa, Gagangaunda, Talchok), Pokhara etc.

10. Power Sources and Transmission

157. In Tanahun district, about 77.09% households use electricity from national grid for lighting. About 10.06% households use kerosene and 9.47% households use solar energy for lighting. Similarly, in Kaski, about 95.45% households use electricity from national grid for lighting. About 2.94% households use kerosene and 0.74% households use solar energy for lighting.

158. In the project affected area, about 96.30% households use electricity from national grid for lighting. About 2.73% households use kerosene and only 0.08% households use solar energy for lighting (Source: National Census, CBS, 2011).

11. Agriculture Development

159. The land use pattern of Tanahun district shows that forest area and agricultural land together covers more than 90%; 50.5 % forest and 41.4 % agricultural land. Remaining land comprises pastureland, river and residential land (DDC Tanahun, 2010). The district is rich in natural resources primarily because of diversified topography.

160. Similarly, Kaski District has 185500 hectare area, of which 105270 hectare is feasible for cultivation. The 52116 hectares area in the district is irrigated land. Major crops of this district are paddy, wheat, Maize, Vegetables and Oilseeds. Dalhan crops are Bodi, Bhattmas, Kerau, Chana, and Maas, simi, beans and Gahat. Vegetables are raddish, rayo, Cauliflower, cabbage, ghiraunla, lauka, pumpkin and potato etc. Fruits are banana, mango and papaya. Vegetable seeds are soyabean, raddish, carrot, cucumber, tomato, cauliflower. Cash crops are ginger, garlic, onion. Major cereal crops are paddy, Wheat and maize. As a substitute for the subsistence agriculture, they are shifting the production from cereal crop to high value crops as vegetable and jute farming as seasonal and non-seasonal as well as horticulture. Similarly, the livestock production mainly milk, meat, egg and wool are significantly produced.

12. Physical or Cultural Heritage

161. The project districts host several religious and cultural structures. People in the project area have different cultural values amongst the different ethnic groups. The major festivals are Buddha Jayanti, Dashain, Tihar, Mha Puja, Bala Chaturdasi, Lhosar and Ramnawami. Most of the ethnic groups celebrate the major festivals such as Dashain and Tihar, although these are Hindu festivals. The major Buddhist celebration is Buddha Jayanti. The project site does not possess archaeological and historical values. However, one historical site exists in the project area at Ghansikuwa VDC (Ch. 36+870) called Ghansikuwa. It is a site of historical

importance where the bust of a famous 19th century literary giant of Nepal, Bhanubhakta Acharya, and the image of a lowly grass-cutter about whom Bhanubhakta wrote in one of the most beloved and famous of all Nepali poems. Bhanubhakta Acharya (1814-1868), who translated the great epic Ramayana from Sanskrit to Nepali, was the first Nepali poet to write in Nepali, when other poets in Nepal usually wrote in Sanskrit. He was given the title of Aadi Kavi, meaning the first poet.

162. Bhanubhakta, who was born in Chundi Beshi of Ramgha of Tanahu district in 1814, was a young boy from a wealthy family and living a luxurious life until he met a poor grass cutter, who despite his poverty, wanted to build a well to help travelers to quench their thirst and be remembered even after his death. This inspired Bhanubhakta to write this poem to honor the grass cutter:

*Devoting his life to cutting grass, he earned some money;
And hoping to be remembered, he dug a well.
The grass-cutter is poor at home, but so rich in spirit.
I, Bhanubhakta have done nothing with my wealth.
I have no well, nor inns nor rest houses
Whatever wealth and riches I have are in my home.
What a lesson this grass-cutter has given!*



Ghasi Kuwa at ch. 36+870 along the road alignment

163. Tanahun district has various hindu temples such as Chhabdi Barahi, Shiv Panchayan temple, Akala temple, Dhor Barahi, Basantpur Thanimai, Chhimkeshwori, Bandipur Khadgamai temple, Devghat. Other historical touristic places are Ghansikuwa, Bhanu Birthplace, Tanahusur plalace, Managkate, Mirlungkate, Bandipur, Chhimkeshwori Lake, Thapke, Bhimad etc. Similarly, it has places of touristic interest such as Manhu Danda (trekking and paragliding, rafting in Madi and Seti River), Siddha Cave, Millennium trekking route of Dhorbhiridi etc.

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

164. Road and bridge improvement projects are likely to bring several changes in the local environment both beneficial and adverse. This section of IEE identifies nature, extent and magnitude of all such likely changes vis-a-vis project activities for all stage of project cycle i.e. pre-construction, construction and operation. Beneficial impacts are mostly long-term and permanent whereas adverse impacts are localized and temporary in nature and are likely to occur mostly during construction stage.

A. Potential Beneficial Impacts

165. The immediate benefits of road and bridge construction and improvement will come in the form of direct employment opportunities during construction for the roadside communities and specially those who are engaged as wage laborers', petty contractors and suppliers of raw materials.

166. During operation stage, road-side economic activities supporting transport like gasoline stations, automotive repair shops, lodging, and restaurants will increase due to increased number of vehicles. Increase in agro-industrial activities are also expected to take advantage of improved access to urban centers where there are higher demands and better prices for agricultural products. Project will accelerate the industrial activities and induced development significantly. Increased industrial activities will significantly reduce migration. One important project specific benefit is avoidance of flooding or water logging by increasing waterway of bridges and provision of side drains. Other generic benefits of road improvement projects are: (i) reduction in travel time (ii) better mode and frequency of transport (iii) access to quality health care, educational and other infrastructural facilities (iv) improved quality of life of rural tribal population (v) reduced accident events and (vi) better investment climate for industries creating more employment opportunities to local people.

B. Potential Adverse Impacts

167. Major anticipated impacts arising from the project road and bridges improvement are: (i) acquisition of private land and other assets impacting livelihood of local population, (ii) cutting of all total 6,644 trees, (iv) borrowing and quarrying, (iv) impact on water bodies due to partial filling in some cases, (v) increased risk of accident due to faster vehicular movement (iv) increase in air pollution and noise pollution due to increased traffic, (v) Soil erosion and landslide. Except for land acquisition, all impacts are reversible, temporary, localized in nature, and can be easily mitigated/minimized/avoided by effective implementation of environment management plan (EMP).

C. Impacts on Physical Environment

168. Project road improvement activities will have no impact on physical environment during pre-construction stage.

1. Micro-Climate

Construction Stage

169. There is a risk of impact on the micro-climate due to change in land use from the removal of 350 trees from seventeen (17) local community forests and 6,294 trees from the RoW in front of private land/road side. All total 6,644 trees need to be cut down (Road: bordering with community forest 350 & 6000 within the ROW, Seti Bridge - 81 and Madi Bridge- 213). increase in paved surface which will increase the change in micro climate.

Mitigation Measures

- Compensatory plantation will be carried out at the rate of 25 saplings for each felled tree. Altogether, plantation of 8,750 trees in community forests and loss of trees from roadside will be compensated by planting of about 157,350 roadside avenue trees during road upgrading in order to ameliorate the micro - climate of the project area.
- Attempts shall be made from every aspect to protect trees during construction to minimize impacts on the micro-climate.
- Roadside plantation of pollution absorbent tree species especially nearby settlements and other public places will be done.

Operation Stage

170. The compensatory afforestation will help to reduce the effects of greenhouse gas emission from vehicle to a certain extent. Further additional plantation of tree will maintain the micro climate of the whole corridor.

Mitigation Measures

171. As part of transport rules condition of vehicles will be monitored regularly and rules will be enforced effectively. In addition, compensatory plantation will reduce the level of GHGs in atmosphere.

2. Air Quality

Construction Stage

172. Potential sources of air pollution during the construction stage include: dust emission from earth works; emissions from the operation of construction equipment and machines; fugitive emissions from vehicles plying on the road; fugitive emissions during transport of construction materials; air pollution from combustion of hydrocarbons particularly from the hot mix plants, and localised increased traffic congestion in construction areas.

173. Most of the emissions will be in the form of coarse particulate matter and will settle down in close vicinity of construction site. Installation of crusher unit will also lead to air pollution. Hot mix plant will generate carbon monoxide (CO), un-burnt hydrocarbon, sulphur di-oxide (SO₂), particulate matters, and nitrogen oxides (NO_x) emissions. This may affect the air quality of nearby areas especially due to emission discharge from low height stack. The impact will be minor, local, short-term, direct and reversible.

174. Construction materials will be transported from Marsyangdi River, Madi River, Seti River Basin at Kotre and these areas are away from settlements. The vehicles that transport construction materials will be covered with tarpaulin. Hence, minimal impact is envisaged.

Mitigation Measures

175. Following mitigation measures shall be applied to avoid or minimize the impacts during construction. They include:

- Water sprinkling, water fogging, broom sweeping shall be carried out in dust prone locations, unpaved haulage roads¹, earthworks, stockpiles including asphalt mixing plant areas.
- Open burning of solid wastes (plastic, paper, organic matters) shall be prohibited.
- Use of dust control methods (such as covers, water suppression on unpaved road surfaces, or increase moisture content for open materials storage piles) shall be practiced.
- Very old vehicles emitting gases beyond prescribed standard shall be checked and avoided.
- Masks and personal protective equipment shall be provided to the construction workers to minimize inhalation of suspended particulate matters.
- Mixing plants including crushers and the batching plants shall be located at least 1 km downwind from the nearest settlement only after receiving permission from the Supervision Consultant. Hot mix plant shall be fitted with stack/chimney of adequate height as prescribed by Supervision Consultant to ensure enough dispersion of exit gases.
- Heaters shall be used for heating purpose to the extent feasible.
- Only crushers licensed by GoN shall be used.
- LPG or kerosene shall be used as fuel source in construction camps instead of wood. Tree cutting for fuel wood shall be restricted.
- Diesel Generating (DG) sets shall be fitted with adequate height.
- Diesel with low sulphur content shall be used in DG sets as well as other machineries.
- Air quality shall be monitored during construction stage and if monitored parameters are above the prescribed limit, suitable control measures shall be applied.

Operation Stage

176. Vehicular emission² will be the main source of air pollution during operation stage. The project road runs mostly through settlements, forests including agriculture lands and grazing patches. Forests will serve as a sink for pollutants and reduce the flow of dust/gaseous pollutants. Generated traffic on the project road will be minimal. Hence, emission impacts will be minimal as well. In addition, uninterrupted flow of existing vehicles and improved road conditions will restrict air pollution in settlement areas.

Mitigation Measures

- It is proposed to maintain the road conditions including shoulders and cut slope turfing. Thick trees shall be planted close to sensitive locations such as hospital, school boundaries and near religious places.
- Caution sign for speed regulation and lane driving shall be fixed near habitat areas. Educative awareness boards for safe and fuel efficient driving shall be fixed at selective locations.
- DoR will coordinate with relevant agencies on the implementation on and enforce Nepal Vehicle Mass Emission Standard, 1999 and will stipulate vehicle owners to engage in proper and regular vehicle maintenance.
- Air pollution by dust will be controlled with provision of paved shoulders, especially in the sensitive/built up areas.

¹ Water Flushing/Broom Sweeping can reduce emission from 0-96%

² Similar to other combustion processes, emissions from vehicles include CO, NO_x, SO₂, PM and VOCs

- DoR will partner with Development organizations (NGO, INGO and CBOs) motivate the local communities to maintain greenery along the road apart from their houses by planting fodder, fuel wood and fruit trees including flowering plants.

3. Noise Level

Construction Stage

177. Level of ambient noise may increase temporarily in the close vicinity of various construction activities including maintenance of workshops and vehicles, and earthmoving equipment. These activities are expected to produce noise levels in the range of 80 - 95 dB (A) (at a distance of about 5 m from the source). Although this level of noise is higher than the permissible limit for ambient noise level for residential/commercial areas, but this range will occur only intermittently and temporary. This noise level will attenuate fast with increase in distance from noise source. Impact due to noise during construction activities will be minor to sensitive receptors since most of the settlements are located at safer distance from the road. There are about 23 schools, 8 hospitals & health post, 5 holly structures (temples/Masjid & Church), 18 Banks and services centres as well as 5 security camps considered sensitive for the project.

Mitigation Measures

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

- Temporary construction facilities such as labour camps, vehicle maintenance workshop and earth moving equipment shall be located away from settlements and other sensitive areas as far as possible.
- The EFP of contractor shall carryout detail survey for the sensitive receptor (Hospitals, health post, Schools, Temples, and other public service centres etc.) and prepare plan to avoid as well as mitigate the perceived impact taking special precaution as per need, during construction stage.
- Noise sources such as stone crushers, vehicles movements and work at stone quarry and borrow pit shall be re-located to less sensitive areas to take advantage of distance and shielding.
- Silencers shall be installed to construction equipment and machinery and maintained properly.
- Equipment and machinery with lower sound power levels shall be selected for the use.
- Protection devices such as ear plugs/ or ear muffs shall be provided to the workers during period of operating high noise generating machines.
- Noise levels shall be measured to ensure the effectiveness of mitigation measures.
- Construction activities shall be carried out only between 6 A. M. to 6 P. M. to avoid disturbance to nearby communities at night.
- Noise barriers such as earth mounts or walls of wood, metal that form a solid obstacle between the road and roadside community shall be used, especially in the schools and hospitals.
- A Grievance Redress Mechanism shall be developed to record and respond to complaints on noise by the local communities.

Operation Stage

179. Noise generated by traffic movement will be the main source of noise during operation stage. Traffic congestion and pedestrian interferences may increase the use of horns. This may disturb nearby sensitive locations such as hospitals, schools, religious and cultural sites.

Mitigation Measures

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

4. Vibration

Construction Stage

180. There is likelihood of damage of infrastructure (crack formation) due to the vibration caused by operation of heavy machines and equipment including blasting.

Mitigation Measures

- Contractor will be responsible to carryout baseline survey of the structures at surrounding of the construction area before starting the construction works. If any damage occurred during construction and proven due to construction work, then contractor has to repair or maintain it as per contract.
- Precaution shall be taken while using the machines and equipment, especially nearby public and private infrastructures.
- Contractor shall aware the operator for careful handling of machines and equipment.
- Where required controlled blasting techniques shall be adopted.
- The Contractor shall inform the VDC and community in due time about operations that bear the risk of nuisance and accidents, especially when blasting operations are underway.

Operation Stage

181. There is high possibility of vibration due to plying of overloaded buses and trucks that may damage the infrastructure.

Mitigation Measures

- The loaded vehicles plying on the road will be monitored by MoPIT as per Nepal Road Standard, 2070 B.S.
- Drivers shall be made aware about the capacity of the road and bridges, and their consequences.

5. Landslide and Soil Erosion

Construction Stage

182. The road alignment between Ch 8+850 to Ch 9+975, Ch 42+725 to Ch 48+125, Ch 53+175 to Ch 53+375, 59+700 to Ch 60+900 and Ch 71+500 to Ch 72+375 are identified as the terrain with possibility of instabilities. Otherwise most of the roadside slopes are naturally vegetated with good vegetation covers.

Mitigation Measures

- Soil erosion shall be stabilised by applying engineering as well as bioengineering techniques.

- During road improvement only required vegetation shall be cleared and eroded bare slopes shall be re-vegetated.

Operation Stage

183. Landslides and soil erosion occur due to both natural and induced phenomena thus continuous monitoring of the road condition is imperative; especially during and after rainy season.

Mitigation Measures

184. DoR has established a system of employing Length-Persons (road maintenance staffs) and their supervisor. They are responsible for routine and recurrent maintenance of roads like cleaning up drains, soil deposited on the roads due to slope failures and erosion.

6. Borrow Pits and Quarry Sites

Construction Stage

185. Collection of construction materials may have long-term and sometimes irreversible effects, for instances, roadside quarry operation may pose slope failure and if left unmanaged may damage road also. Detail investigation has been carried out during detailed design for borrow pits and quarry sites. As much as possible contractor will use the quarry sites as mentioned in table 7 in chapter 3. If other quarry sites have to be followed contractor should follow the IEE approved from the concerned local body which will also be monitored by the monitoring team of the local body. In case of operating the quarry for this project contractor should follow the national guideline.

186. Apart from the availability of suitable quality of the construction materials, selection of locations for borrows pits and quarry sites depend on a large number of other factors. Such factors include fragility of landscape, legal aspects, aesthetic value of the landscape, and ownership of lands, protected and sensitive areas including approval from the prescribed authority.

Mitigation Measures

- Borrow pits and quarry sites shall be selected avoiding protected and sensitive areas, nearby settlements, water sources, and in forest areas and fertile agriculture lands. The potential sites shall be the waste and low quality of barren lands.
- Approval from authorities of government and land owners shall be taken.
- Suitable size of borrow pits and quarry sites shall be operated as per required volume of materials.
- Top soil shall be stockpiled and preserved to spread during reinstatement of sites. In turn, preserved top soil shall be spread and grasses seeding with long mulch and tree planting shall be carried out as a part of bioengineering. Leguminous plant species shall be planted in order to restore nitrogen in the soil.
- Monitoring of borrow pits and quarry sites restoration plan in tune with the proposed restoration plan is given in Appendix G.
- Contractor will prepare borrow pits and quarry sites restoration plan and submit for approval from Engineer before beginning the quarry activity.
- The rehabilitation of the quarry site and land scaping will be done as per the approved plan in case the contractor has opened-up a new quarry for the project purpose.
- Furthermore, the contractor will be responsible for maintenance of any damage to haul roads to their original state.

Operation Stage

187. In Nepal, generally borrow pits and quarry sits are developed nearby the alignment and left without restoring. Such sites eventually have become causes of landslides and soil erosion. Not only that they have also damaged road alignments.

Mitigation Measures

- DoR will orient Supervisor of Length-Persons in order to check and maintain drains and erosion and also to protect vegetative covers on the restored sites of borrows and quarries.

7. Impact on fertile land and soil due to soil contamination and compaction

Construction Stage

188. Soil of the cultivated land nearby road may be contaminated from mixing of construction materials such as stones, sands, gravels including bitumen, lubricants, paints and other chemicals.

189. Soil of haulage roads including labour camps and workshop areas will be compacted due to movement of construction vehicles, machineries, and equipment if haulage roads are unpaved. Such activities will impair productive potentiality of the soil especially in cultivated lands.

190. Soil will be contaminated due to inappropriate disposal of liquid wastes (lubricating oil and fuel spills, and vehicle/equipment washing effluent) and solid wastes (fuel filters, oily rags) likely to be generated from repair and maintenance of transport vehicles, construction equipment and machinery. Further, soil will also be contaminated due to mixing with domestic solid waste, sewage from labour camps, if not disposed of safely and carefully.

Mitigation Measures

- The top soil (0-25 cm) from the productive land (borrow areas, road widening areas, etc.) shall be preserved and reused for plantation and restoration purposes.
- It shall be ensured that any private land taken on lease, used community or/ government land for access road and construction/labour camp shall be restored back to its original land use before handing it over back to land owner
- Detailed plan of action including locations shall be prepared by the Contractor for labour camps, haulage roads, workshop and storage of area for different materials and approval shall be taken through the Supervision Consultant.
- Fuel and lubricants shall be stored as per the plan. Storage area shall be paved with gentle slope to a corner and connected with a chamber to collect and recover any spills of oils.
- All efforts shall be made to avoid and/ minimise the solid and liquid wastes generation. Unavoidable solid and liquid wastes shall be stored at designated places prior to disposal. To avoid soil contamination at the wash-down and re-fuelling areas, "oil interceptors" shall be provided. Oil and grease spill and oil soaked materials shall be collected and stored in labelled containers (Labelled: WASTE OIL; and hazardous sign be displayed).
- Attempt shall be made to minimise soil compaction in the adjoining farm lands through movement of construction vehicles, machinery and equipment. Their movement shall be restricted to designated haulage route.
- Efforts shall be made to design approach roads through the waste/barren land and rocky area to reduce compaction induced impact on soil.
- Farm land shall be restored after the completion of road improvement activity.
- Temporary latrine pits shall be provided in labour camps and shall be restored after completion of the activity.

- Solid wastes generated from labour camp shall be segregated into biodegradable and non-biodegradable wastes. The non-biodegradable and recyclable wastes shall be sold off. Efforts shall be made to compost biodegradable wastes in small size compost pits by the Contractor. Non-biodegradable and non-saleable wastes shall be disposed of in a secured and safe location. They shall not be burnt in any case.

Operation Stage

191. No impact on soil is anticipated during operation stage of the project except near low lying areas where unexpected rainfall may erode soil and deterioration of borrow areas if not rehabilitated properly. Similarly, there will be ribbon settlement along the road which will convert the fertile land to build up area as well as other land forms resulting lapse of the fertility along with increased vehicular movement.

Mitigation Measures

- Rehabilitated labour camp sites including side drains and cross drainage structures shall be monitored regularly to check for blockage.
- Locations of quarry sites and borrow pits shall be monitored and if found not restored properly then the Contractor shall be asked for correction of these works until defect liability period.
- DoR has policy of 50 m RoW protection in the national highways³. However, GON policies and guidelines suggest most economical and practical way possible and make best uses of appropriate technology⁴.
- Continuous maintenance should carry out specially in identified land slide zone.

8. Siltation and Surface Water Quality of Streams

Construction Stage

192. The project area belongs to hilly ecological region where the ground water table is deep and no use of ground water exists except natural dug well. Thus, no impact is anticipated through project improvement activities on ground water.

193. The project corridor contains 35 major streams and rivulets. Thus, there may be scarcity of water sources for labour camp sites including construction activities. Although the secondary information on the quality of these water resources is not available, they are originated from natural spring sources and quality is assumed to be acceptable as per the MoPE, GoN standard. Further, these sources of water are being used for drinking and other household purposes by the people of road corridor since many years.

194. Accidental oil and chemicals spills can contaminate the streams water.

Mitigation Measures

- The Contractor are prohibited to dispose excavated spoils and wastes into streams water.
- All chemicals and oil shall be stored away from water and shall be stored at concreted platform with catchments pits for spills collection.
- The Contractor shall arrange training programme to all equipment operators, drivers, and warehouse personnel on immediate response for spill contamination and eventual clean-up. Further, emergency procedures and reports preferably written in easy to understand local dialects shall be distributed to the workers as well as local people.

³ According to ESMF, the standard ROW of national highway in Nepal is 25 m on either side from the centreline of the road.

⁴ DoR, The Design Standards of Feeder Roads, (Third Revision, GON, DOR, 1997)

- Silt fencing and/or brush barrier shall be installed for collecting sediments before letting them into the water body. Silt/sediment shall be collected and stockpiled for possible reuse as surfacing of slopes for re-vegetation.
- All wastes arising from the construction sites shall be disposed off in an environmentally acceptable manner. The wastes shall be collected, stored and transported at approved disposal sites.
- No vehicles or equipment shall be washed, parked or refuelled near streams water, so as to avoid contamination of streams water from fuel and lubricants.
- Large labour camps shall be avoided along the alignment and shall be located away from settlements and river sides. Construction labourers shall be preferably recruited from the local community. Sewage from labour camps shall be managed in such a way that it shall not be polluted streams water and other public and private areas. No untreated sanitary wastewater shall be discharged into the streams water. All labour camp will be facilitated with sock-pits and safety tank for sewerage management.
- Detailed mitigation measures to protect from solid wastes, chemicals including other hazardous materials have been dealt with under soil contamination and compaction in the study.

Operation Stage

195. No major or long-term impact is anticipated during the operation stage on the streams water due to the project implementation activities. Oil-contaminated runoff from the road during monsoon will have minimal impacts considering their low concentration.

196. The road alignment passes mainly through ridge tops and hill slopes. Hence, impact from the project improvement activities on water will be minimum.

Mitigation Measures

- As in the other roads, DoR will engage road Length-Persons. They will check road condition including cleaning up soils deposited on roads by erosion and slides drain blockage/ chocking. The Length- Person's supervisor will inform to Divisional Engineer in case of large landslides and major roads blockage.

9. Hydrology and Drainage

Design and Construction Stage

197. Obstruction of natural drainage pattern by road may modify the natural flow of surface runoff by concentrating flow at certain points. As a result, velocity of flow may increase. In turn, diversion or disruption of natural surface water and drainage patterns is inevitable.

198. There are thirty five (35) Major/minor River & streams across the road alignment as water resources. There are nine (9) irrigation pipe crossings along the road alignment (Chainages: 27+060, 37+130, 37+725, 48+120, 48+160, 49+150, 52+400, 52+890, and 67+580). In addition, there are 197 RCC slab and 114 pipe culverts along the road alignment. Road upgrading work will impact these irrigation pipe crossings and other cross drainage structures.

199. The activities involved with proposed road improvement will be carried out along with existing alignment. Nine (9) major bridges and twenty six (26) minor bridges are proposed to be constructed. Existing minor cross drainage structures (slab culverts, pipe culverts are only to be improved. Diversion of water channels during rehabilitation of cross drainage structures is not envisaged.

Mitigation Measures

- Existing natural drainage system shall not be disturbed. Causeways shall be provided in each perennial and seasonal streams as well as rivulets. In addition, adequate cross drainage structures shall also be provided to avoid natural flow of water especially for unusual rainfall events.
- The size of the drainage structures shall be designed to accommodate increasing volumes of water.

Operation Stage

200. The road side is prone to erosion due to soil and geological characteristics', hence the process occurs continuously. Consequently, drain blockage/chocking will be perpetual problem. However, these problems will be more severe during rainy season.

Mitigation Measures

- As in the other roads under it, DoR will engage Length- Persons for regular check-up of the road condition including cleaning up erosion, slides, drain blockage/ chocking etc, Length-Person's supervisor will inform Divisional Engineer in case of large landslides and major road blockage.

10. Management of Construction Spoils/Wastes

Construction Stage

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

Mitigation Measures

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

11. Natural Hazard

Construction Stage

202. **Flood and Siltation:** There are 39 small and large streams across the road alignment as water resources. Cross drainage structures are designed based on 100 years return period flood.

203. **Earthquake:** The western region of Nepal where the project lies has experienced several major earthquakes. Recent one is the April 2015 Nepal earthquake (also known as the Gorkha earthquake). Design of the bridge and road has followed IS 1893 and IRC:6-2000 that also considered safe infrastructure construction resilient to earthquake.

Mitigation Measures

- Road embankment level has been designed to be 0.90 m higher than the highest flow level and/or flood level of the streams and rivulets.
- The project structures been designed with the consideration of seismic factors as per IS 1893 and IRC:6-2000 for the road and bridge.

Operation Stage

204. **The** road improvement design and construction assure that it will be better able to cope with natural hazards.

D. Impact on Ecological Resources

1. Forestry and biodiversity

205. The project corridor is rich in ecological resources such as forestry and biodiversity. It contains various types of trees, shrubs and bushes, and grasses. They comprise diverse values and offer habitat for different types of mammals, birds and butterflies. The road alignment passes through different types of forests where protected species of plants such as *Shorea robusta* and *Acacia catechu* is found and around 350 trees need to be cleared from within RoW close to adjoining community forests & 6,294 trees from the RoW, consisting of 6000 from RoW of road, 81 from RoW of Seti Bridge, and 213 from RoW of Madi Bridge, in front of private land/road side and disturbance to wildlife and bird habitat. All total 6,644 tree need to be cut down (Road: bordering with community forest 350 & 6000 within the ROW, Seti Bridge 81 and Madi Bridge 213). However, the road improvement activities will have minor impact on forestry and biodiversity.

206. Construction Stage

207. Around 6,644 trees will be required to be felled during the construction period including the clearing of bushes and shrubs. All trees within the RoW with 300 mm circumference and above will be cut, including the removal of stumps.

Mitigation measures

- The DoR will fix number and types of trees to be felled through the detailed design/or its site verification and will coordinate with CFUGs and then will secure at DFO for clearance.
- Trees shall be felled only after receiving permissions from the concerned authorities.
- The Contractor shall coordinate with CFUGs and manage felled trees as per their suggestions.
- The Contractor shall support/involve CFUGs to carry out compensatory plantation at the rate of 25 saplings for each felled tree in available locations and their management till the age of 5 yrs.
- Plantation and protection of shrubs and bushes including grass seeding shall increase aesthetic value of the area. Thus it is recommended that the project shall arrange for planting suitable species of shrubs and small trees including grass seeding at available spaces and protection of natural forest vegetation.
- During construction only necessary hillside slopes with vegetative covers shall be cut and cleared. The cleared bushes and grasses shall be replanted on bare slopes.
- No spoils including bitumen containers and other waste/spoil generated from roads excavation shall be thrown in and around the forest areas.
- If slopes with the vegetative covers are cleared they shall be re-vegetated by the suitable species.

Operation Stage

208. Positive impacts on forestry and biodiversity are expected during the project operation due to increasing vegetative covers and aesthetic value of landscapes along the road alignment. No adverse impacts are anticipated during operation stage.

Mitigation Measures

209. The project will involve CFUGs in plantation and other forest management activities.

2. Aquatic biodiversity

Construction Stage

210. Through the project improvement activities accidental spill of materials, chemicals, and oils will deteriorate quality of streams water.

Mitigation Measures

- All chemicals, bitumen, oil and fuel shall be stored on impervious floor with drainage facility, so that no leakage or spillage will reach water bodies.
- Used oil and lubricants shall be stored in drums to transport them away from the work site.

Operation Stage

211. No impact is anticipated during operation stage, hence no mitigation measures proposed. However, periodic observation will be carried out by DoR to check siltation, bank erosion and others.

3. Fauna

Construction Stage

212. Movement of wildlife like monkey, leopard, langur, fox, jackal and jungle cat have been reported by the local people in the project corridor. There are no endangered/ species or protected species found in the project area.

Mitigation Measures

- Efforts shall be made to avoid disturbance to these animals to the extent possible.
- Every precaution shall be taken to minimise noise and other human activities during construction within the road corridor.
- Construction activities shall be carried out during day time to prevent disturbance to wildlife.
- The contractor shall ensure that hunting and poaching activities will not be carried out.

Operation Stage

213. The operation of the road may disturb the movement of wild animals, especially along the forest area.

Mitigation Measures

- Mitigation measures to be implemented by DoR includes: preservation of known routes of wildlife and domestic animals, and drivers will be made aware to use horn only in the necessary sharp bends.
-

E. Socio Economic Impacts

214. Improvement of proposed road will have many socioeconomic beneficial impacts compared to adverse ones. In the consultation meetings with communities and stakeholders, they had expressed that improvement of road is vital for the enhancement of quality of life of the people of project area. Furthermore, some benefits will be achieved from the improvement of the project road which is mentioned in section 5.1 above under potential beneficial impacts.

215. Project road improvement activities will have no impact on socio-economic environment during pre-construction stage.

1. Impacts due to Construction/Labour Camp

Construction Stage

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

217. However, in contract package, contractor will establish camp if he brings labors from outside of the area. Siting of camp may cause encroachment of forest, agriculture land, and alteration of drainage, solid waste and waste water problems. Petrol, diesel and grease required for vehicle to operate and kerosene to workers to cook meals. Spillage of these chemicals also damage soil productivity.

Mitigation Measures

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

2. Safety of Construction Workers and Accident Risk to Local Community

Construction Stage

218. Since 45% of the 81-km road passes through bazaar and built-up areas, this will create social disturbance and safety issues for people using the road as well as road construction workers. This social disturbance aspect includes (i) safety of general public, (ii) safety of construction workers, (iii) safety of road users, (iii) safety to cattle, (iv) Unsafe/ hazardous traffic conditions due to construction vehicle movement during design and construction stage, and, (v) conduct of safety audit.

219. Children are one of the most vulnerable to injury from collisions with moving vehicles due to their lack of understanding of traffic hazards, behaviour while at play, and their small size makes it difficult for the motorist to see.

Mitigation Measures

- The Contractor shall ensure that internationally accepted and practiced safety measures are adopted during (i) road works (ii) handling of large construction equipment and machineries (iii) handling of chemicals including hazardous materials and inflammable substances (iii) welding/hot work (iv) electrical works etc. A set of mitigation measures for construction workers have been provided in EMP matrix Appendix B.
- The occupational health and safety (OHS) Clauses established by the DoR shall be included in the work contracts. This refers basically the FIDIC rules for road construction works encompassing all accident prevention measures which can happen at work sites and in the camps.
- The Contractor shall keep at site a full time Safety and Environment Monitoring Officer and a Medical Officer. Safety Officer shall ensure proper safety measures undertaken at camps and work sites. Regular safety drill shall be conducted and safety signs shall be kept at work areas.
- The Contractor shall arrange all personal protective equipment (PPEs) for workers, including first aid facilities at construction sites. An emergency plan shall be prepared duly approved by the Supervision Consultant to respond to any instance of safety hazard.
- Entry of unauthorised persons to the construction sites and equipment storage sites shall be restricted.
- Workers shall not be allowed to enter work areas without wearing proper safety gear (hard hat, work boot, gloves, ear muffs, face mask, reflective jacket, goggles, safety belt etc. as appropriate)
- General medical centre with a bed shall be established at the campsite to treat simple/minor injuries or illness. Arrangement shall be made with the District Hospital to keep a dedicated bed for emergency treatment of project staff and workers, and a doctor of the hospital shall periodically make a visit to the site office for health check-up of workers
- Pedestrian/cyclist and cattle passageways shall be provided at identified locations. The crossing facilities can be designed in conjunction with grade intersections.
- The Contractor shall arrange to prepare a comprehensive traffic management plan to avoid disruption of the existing traffic due to construction activities.
- Installation of speed calming/controlling structures like bumps near designated pedestrian crossing areas shall be arranged.
- The Contractor shall be responsible for erecting signs and signals on sensitive and risky areas, which should be visible from long distance.
- After construction is completed in a particular section, it shall be opened for normal traffic operation.

- Use of delineators, traffic cones, empty bitumen drums, barricades, and flag men shall be used to ensure traffic management and safety.
- Regular safety audit on safety measures shall be conducted during construction. The audit shall cover manpower and their safety, machinery, temporary works, equipment and vehicles, materials storage and handling, construction procedures and environment, site safety guidelines, and miscellaneous services.

Operation Stage

220. The provision of service roads and crossings has been made in the road design for safe movement of people and animals across the roads. Other issues related during operational stage are monitoring of emergencies and establishing procedures to carry out rescues during sudden disasters such as floods and accidents.

Mitigation Measures

- Monitoring and supervision by DoR is required to ensure safe travelling.

3. Impact due to Transportation and Storage of Materials

Construction Stage

221. In general, the sources of construction materials include (i) locally available resources, and (ii) materials that need to be transported from large markets of the country. Locally available resources consist of soil, water, stone, sand, gravel, aggregates and other similar items. Materials that will be transported from large markets/outside the project area include cement, iron, pipes, bitumen large and small equipment and machineries and fuels and lubricating oils. The locally available materials will be transported from nearby locations along the road alignment.

Mitigation Measures

- These materials shall be stored nearby the construction sites without damaging farm lands. While oils, fuels, bitumen and other chemicals shall be stored on concreted platform with spill collection pits and cement shall be covered by water proof tarpaulin. They shall be located at least 500 m away from the habitat.
- Use of haulage trucks heavier than the carrying capacity of the haulage roads and existing roads shall be avoided. The contractor shall be responsible for repair and maintenance of damaged existing road by the haulage trucks.

4. Impact on Land and Private Properties

Construction Stage

222. The total area of land required to be acquired under the project is approximately 3.33 ha (1.22 ha for road, 1.4 ha for Seti and 0.71 ha for Madi bridge) About 834 private structures (519 residential, 155 commercial, 136 residential/commercial and 24 others) will be affected. Overall the total number of affected households (title holder +non titleholder) is 870 and affected persons are 4253, representing 3975 persons will have to physically relocate from their commercial or residential structures. (Source: Resettlement Plan, 2017 + Madi & Seti bridge)

Mitigation Measures

- The project will provide compensation for all land and private properties before commencing road construction. The resettlement study will deal all these aspects in detail.

5. Impact on Common Property Resources

Construction Stage

It is anticipated that 4,020 community & public structures will be affected by the project road upgrading. These community properties need to be relocated during the implementation phase in close coordination and collaboration with the local community. For the temples, only the stairs and outside sitting areas of the 52 local temples will be affected by the project.⁵ As per RP, all the pumps were designed in such a way that all the underground structures are located out of the RoW. All the above ground distribution structures within RoW will be affected. As for the Ghansi Kuwa, road construction will be limited to the RoW and will not affect the well. Moreover, the park will be further developed by the project. The detailed list of community & public structures is presented in Table 25 below.

Table 25: Affected Community & Public structures

S. N.	Resources	Number
1	Public Toilet	15
2	Chautara (Resting Place)	55
3	Passenger Waiting shed	108
4	Public Tap	135
5	Temples	52
6	Petroleum Pump Nozzle, Wall etc.	29
7	Public figure statue & Notice Board etc.	5
8	Police check post Entrance Gate, Traffic direction post etc.	19
9	Transformer	98
10	Electric pole	3110
11	Telephone poles	359
12	Telephone Cabinet	11
13	Irrigation Pipe	9
14	Solar Lamp Post	15
	Total	4020

Source: Resettlement Plan, 2017

Mitigation Measures

- The Contractor shall avoid any actions that bear the risk to destroy the sites or alter their scientific or aesthetic or social values.
- In the case of accidental damage of infrastructure of archaeological importance, the Contractor shall be obliged to inform the DoR immediately through Supervision Consultant. Further, the Contractor shall also be obliged to carry out immediate corrective and repair measures, as suggested by the concerned authority.
- The Project shall reinstate the public and private utilities/facilities that shall be affected by the project improvement activities.
- Community properties such as public toilets will be relocated during the implementation phase in close coordination and collaboration with the local community. Depending on land availability, the community structures will be rebuilt by the project as close as the original location of the affected structures, and upon collaboration with the local community. The Contractor will coordinate with local authority to manage wastes from relocated public toilets, which are mostly pit.

⁵ Resettlement Plan (2017).

- The Contractor will coordinate with Nepal Electricity Authority, who will be responsible for shifting of all electric poles and transformers. The Project will provide budget for the activity as per NEA's estimate.

Operation Stage

223. Due to the movement or plying of vehicles nearby the archaeological sites, there is possibility of nuisance such as air pollution, vibration and noise.

Mitigation Measures

224. The DoR shall install traffic signals such as "NO HORN" and "SPEED LIMIT" nearby the archaeological sites.

F. Induced Impacts

225. According to the ADB Environment Safeguards Sourcebook⁶ induced impact is described as: "Adverse and/or beneficial impacts on areas and communities from unintended but predictable developments caused by a project, which may occur at later or at a different location".

226. Economic activities supporting transport like fuel stations, automotive repair shops, lodging, and restaurants are expected to increase with increase of traffic and induce development in the project area. The improved road will provide better connectivity and result in (i) reduction in travel time (ii) better mode and frequency of transport (iii) access to quality health care facilities, educational and other infrastructural facilities (iv) enhanced tourism activities in the project area and the region which in many terms will boost the local economy (v) better investment climate for industries creating more employment opportunities to local people.

227. In terms of environment safeguard issues, the improved road surface is expected to result in less dust and noise due to traffic plying on the damaged roads. However, the increased traffic due to the improved road will generate more air pollution due to vehicle exhaust and noise. The smoother road conditions will also result in increase of traffic speeds, hence creating more risks for accidents amongst traffic users as well as the local communities in the project area.

228. For addressing the impacts of air pollution and noise, regular maintenance of the road surface, maintenance and monitoring of newly planted trees and installation of noise barriers where necessary have been included in the EMP for implementation during operation stage. For addressing safety related impacts, regular maintenance of the road furniture includes safety related furniture, enforcing rules against encroachment of structures and sensitive structures (schools, temples etc.) inside the RoW and appropriate mitigation measures has been included in the EMP for implementation during operation stage.

229. This road is the gateway to the proposed Tanahu Hydropower Project and Pokhara International Airport. This road provides service for development of other medium and large hydroelectric projects and access to the rural and mountainous villages of Tanahun and Kaski districts.

G. Climate Change Consideration

a. GHG Estimation

⁶ Environment Safeguards, A Good Practice Sourcebook, Draft Working Document, December 2012

230. Transportation sector is one of the major contributors to the increase in greenhouse gas emission. The sector accounts for about 28% of global primary energy consumption⁷, and 13.5% of world greenhouse gas emission, of which road sector accounts for 9.9%.⁸ As far as CO₂ emission is concerned, road transport in Nepal dominates the energy use pattern, accounting for 86.5% of total sectoral consumption.⁹

231. GHG emission likely to be generated from the project road have been computed using the Transport Emissions Evaluation Model for Projects (TEEMP)¹⁰ developed by Clean Air Asia¹¹ and was utilized to assess the CO₂ gross emissions with and without the project improvement. The main improvement from the project that was considered for the model are better surface roughness with less than 2.5m/km and widening of project road from 2-lane to 4 lanes. These were translated into increase in traffic speed and hence fuel consumption. The model has also been used for CO₂ emission assessment during construction stage. The model also allows for the inclusion of impacts related to traffic congestion with and without project through provisions for inserting data on the traffic numbers, lane width, number of lanes and volume/capacity saturation limit.

232. Few assumptions made in this software are:

- a) Fuel efficiency as reckoned in business as usual (BAU) and with project scenario (WPS) is given in the next table. It is assumed that the fuel efficiency of the vehicles would increase due to improvement of the road.
- b) It is assumed that there would be no or minimum number of vehicles with vintage year before 2000 using Euro –I fuel type after 25 years.

Table 26: Fuel efficiency in km/l

Scenario	BAU		WPS	
	Gasoline	Diesel	Gasoline	Diesel
2 Wheeler	40.00		50.00	
Car	12.00	15.00	15.00	20.00
LCV		5.00		8.00

⁷ U.S. Energy Information Administration, Annual Energy Review 2011, DOE/EIA-0384(2011), September 2012, p.37-38. Accessed: January 29, 2013, <<http://www.eia.gov/totalenergy/data/annul/pdf/aer.pdf>>

Scenario Analysis of Road Transport Energy Consumption and Greenhouse Gas Emission in Nepal (PDF Free Download). Available from: https://www.researchgate.net/publication/296348292_Scenario_Analysis_of_Road_Transport_Energy_Consumption_and_Greenhouse_Gas_Emission_in_Nepal [accessed May 25 2018].

⁸ Alex Kirby, 2008. CCCC Kick The Habit, A UN Guide to Climate Neutrality, UNEP, p.34-44. Accessed: January29, 2013, <http://www.grida.no/files/publications/kick-the-habit/kick_full_lr.pdf>.

Scenario Analysis of Road Transport Energy Consumption and Greenhouse Gas Emission in Nepal (PDF Free Download). Available from: https://www.researchgate.net/publication/296348292_Scenario_Analysis_of_Road_Transport_Energy_Consumption_and_Greenhouse_Gas_Emission_in_Nepal [accessed May 25 2018].

⁹ Government of Nepal, Water and Energy Commission Secretariat (WECS), 2010. Energy Sector Synopsis Report, p.88-92.

¹⁰ TEEMP is an excel-based, free-of-charge spreadsheet models to evaluate emissions impacts of transport projects.

¹¹ A network of 250 organizations in 31 countries established by the Asian Development Bank, World Bank, and USAID to promote better air quality and livable cities by translating knowledge to policies and actions that reduce air pollution and greenhouse gas emissions from transport, energy and other sectors.

Scenario	BAU		WPS	
	Gasoline	Diesel	Gasoline	Diesel
Bus		5.00		8.00
HCV		5.00		8.00

Table 27: Emission Standards of Fleet (%)

Vehicle Type	Current Scenario				Post 20 Years		
	Pre-Euro	Euro I	Euro II	Euro III	Euro I	Euro II	Euro III
2 Wheeler		50%	50%			30%	70%
Car		40%	40%	20%		40%	60%
LCV		70%	20%	10%	10%	40%	50%
Bus		70%	20%	10%	10%	40%	50%
HCV		70%	20%	10%	10%	40%	50%

233. The model demands information on length of road or section, lane configuration, mode wise count of AADT in vehicles, average trip length, share or local traffic, trip length of local traffic, fleet characteristics i.e. breakdown of fleet based on fuel type, percentage breakdown of vehicle- fuel type based on Euro standard. Traffic forecasts were taken from the detailed project report, which is having variable increase depending upon the vehicle type and is presented in the next table. Error! Reference source not found.

Table 28: Traffic Growth Rates Adopted, %

Period	2-Wheelers	Car	Bus	2-Axle	Multi-Axle
2019 - 2022	9.12	6.85	4.69	6.85	4.15
2023 - 2032	5.86	4.39	3.02	4.39	3.52
2033 - 2042	6.89	5.16	3.55	5.16	3.47

Source: DPR Consultant

234. Input parameters as considered for all the project road section are as given in the next table. Design period is 25 years and volume capacity saturation limit based on the current traffic velocity is considered as 1.5 for the entire project road. Traffic data, expressed in AADT, is shown in the next table.

Table 29: Input Parameters for TEEMP

S. No.	Particular	Parameters
1	Length of Road (km)	80.333
2	BAU - No. of Lanes	2
3	WPS - No. of Lanes	4
4	BAU - Lane Width (m)	3.25
5	WPS - Lane Width (m)	3.5
6	BAU - Roughness (m/km)	4.0
7	WPS - Roughness (m/km)	2.5
8	Induced Traffic	0.2
9	Start of Assessment Year	2019

Source: DPR Consultant

Table 30: Traffic Data and Projection

AADT, volume per day	Mugling – Abukhaireni (7.74 km)		Abukhaireni – Dhamauli (35.03 km)		Dhamauli – Bandipur (41.03 km)		Bandipur – Pokhara (4.63 km)	
	2019	2043	2019	2043	2019	2043	2019	2043
2-wheelers	1515	7238	2567	12265	4790	22893	12996	62109
Car	793	2585	919	2996	1638	5341	3579	12256
Multi-axle	843	1958	701	1629	1010	2348	997	2316

AADT, volume per day	Mugling – Abukhaireni (7.74 km)		Abukhaireni – Dhamauli (35.03 km)		Dhamauli – Bandipur (41.03 km)		Bandipur – Pokhara (4.63 km)	
	2019	2043	2019	2043	2019	2043	2019	2043
Bus	1364	3093	1524	3457	1841	4176	3326	7542
Two-axle	1013	2602	932	2668	743	1789	3239	6281

Source: DPR Consultant

235. Maximum PCU for 2 and 4 lanes were considered as 36,000 and 80,000, respectively. In the absence of emission factors data for vehicles in Nepal, emission factors were mostly taken from the CPCB/ MoEF & CC, India (2007) Draft Report on Emission Factor Development for Indian Vehicles, The Automotive Research Association of India, and C. Reynolds et. al (2011) Climate and Health Relevant Emissions from in-use Indian three-wheelers rickshaw as presented in the next table. Furthermore, it has been assumed that after 25 years, there will be reduction of 15% in the emissions, due to advancement of technology and improved efficiency:

Table 31: CO₂ Emission Factors for different vehicle types¹²

Vehicle Type	CO ₂ Emission Factor (kg/L)	
	Gasoline	Diesel
2-Wheel	2.28	
3-Wheel		2.63
Cars/ Jeeps	2.59	2.68
Multiaxle		3.21
Bus		3.61
Two-axle		3.50

236. Emissions from road construction were estimated by using the emission factor for rural/urban roads, by using ADB - Carbon footprint (<http://www.adb.org/documents/reports/estimating-carbon-footprints-road-projects/default.asp>), which is equivalent to 48,400 kg CO₂/km of road construction.

237. The proposed road widening and upgrading resulting to surface roughness and road capacity improvements have implications in CO₂ emissions. Improved roughness results to higher speed and lesser emissions while increase road users increases emissions. These factors are further affected by traffic congestion once the volume/capacity saturation limit.

238. Total CO₂ emissions at business-as-usual (BAU), and with project (including construction) scenario (WPS) were estimated at 87,844.21 tons/year and 89,457.64 tons/year (without induced traffic) and 104,556.55 tons/year (with induced traffic), respectively. The with project scenario (without induced traffic) is below 100,000 tons/year threshold set in ADB SPS 2009, while the with project scenarios (induced traffic) is slightly above the threshold.

b. Climate Change Impacts

239. The detail engineering design of project road have been done considering the potential effects of climate change. From a road development perspective in Nepal, impact of climate change mainly takes the form of concentrated high rainfall resulting in the accelerated surface run-off from slopes and increased flows in gullies, drainage channels, streams, and rivers. These phenomena have a consequent effect on the stability and performance of road sections, bridges, and other structures.

¹²It has been assumed that the emission factors will be reduced by 15% in 24 years.

240. The road section falls on hilly terrain so particularly susceptible because of the location. Effects of climate change could include the possibility of flash floods/rapids, mud flows in rivers/streams, and an increase in incidence of landslides along the alignment. Other existing roads in the Hilly areas are also susceptible to landslides due to the limited drainage capability and nature of the soil type. For this reason, particular consideration has been given in the detail design of road formation and embankment heights and the size of waterways and soffit levels of cross drainage structures.

241. During detailed design, detail hydrological study/analysis has been conducted to determine water ways, span/length and height (i.e. soffit, invert levels) of major cross-drainage works. Design flood has been calculated considering 50 years return period for cross drainage and 5 years for side drains. The road structures have been designed considering the probability of natural hazards (i.e. floods, earthquakes etc.). Pavement surface has been designed considering the effect of temperature variation.

242. To ameliorate the impact on micro-climate due to cutting of trees, compensatory plantation 166,100 (8,750 CF+157,350 Road side) saplings including road side plantation at the ratio of 1:25 has been proposed in this road project, which will also help to reduce the level of GHG in the atmosphere. The road improvement design assures that it will be better able to cope with the effects of climate change impacts.

The Anticipated Components and Activities

243. Upgrading of the existing road to increase its resilience to climate change will include:

- Raising embankment and strengthening the road pavement- to avoid deterioration due to high flood,
- Strengthening the road surface- improving resistance to traffic wear and tear, and enhancing runoff, thereby reducing deterioration,
- Improving longitudinal and cross-drainage – to avoid surface flooding which contributes to road deterioration,
- Improving protection of road embankment – to avoid erosion of road works during extreme rainfall

244. The specific intervention can be considered as three components, which will involve the following activities:

1. Road carriageway/upgrading of existing road

245. The existing carriageway is double lane, mostly 6.0-6.5 meter wide, with bituminous surface in fairly good condition. Depending on the detailed assessment of the road condition, the scope of upgrading of existing road is fixed and the following interventions are proposed:

246. Construction have been proposed for Abhukherini – Pokhara Section with new 300 mm sub-base with river gravel, 150 mm crushed stone base course, and 50 mm Double Bituminous Surface Treatment (DBST) on surface over existing sub-grade.

2. Shoulder improvements

247. For upgrading of the road section, 1 m and 2.5 m shoulder on both sides has been provided in whole section.

3. Drainage:

- Drainage system has been upgraded in new design has been considered for drainage requirement along the road as per hydrological data for extreme rainfall of the year.

- The drainage design and proposed drainage works have been reviewed hydrologically and hydraulically, on the basis of extreme rainfall data of the year.
- The existing 60 diameter pipe has been replaced by 90 diameter RCC hume pipe due to climate change consideration (flash flood).

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Consultation Method and Information Disclosure

248. Public consultations were organized at two levels namely, (i) district level, and (ii) Project level. The key objectives of consultations were to disseminate the project concept, activities, and policies, rules, and regulations and effects and impacts of the project activities on the environment and to seek suggestions and opinions from all stakeholders and affected people. The more vigorous consultations were held at the project levels among the affected people and stakeholders.

B. Compliance with Relevant Regulatory Requirements

249. As per GoN rule, a 15 days Public Notice on the project is published in a national daily newspaper and inclusion of opinions and suggestions received into the IEE report is mandatory (EPR 97, clause 7.2). The ADB SPS 2009, requires consultation to be carried out during the early stage of IEE report preparation. Public consultations were undertaken consistent with the ADB requirements. All the five principles of information dissemination, information solicitation, integration, coordination and engagement into dialogue were incorporated in the consultation process.

250. Similarly, as per requirement of Rule 7 (1) of EPR 1997 of GoN, a 15 days Public Notice, seeking the written opinions from the concerned stakeholders and institutions on possible impacts from implementation of the Proposal, was published in Annapurna Post, a national daily newspaper on November 11, 2016 AD. A team was mobilized in the field with copy of public notice along with cover letters to the concerned municipalities, VDCs, CFUGs, district level line agencies and other local stakeholders. Copy of the notice was displayed in the project sites and proof of deed (Muchulkas) was collected. Recommendation (consent) letters was collected from the affected municipalities, VDCs. In addition, recommendations and suggestions were collected from the affected municipalities, VDCs, CFUGs and concerned stakeholders (government bodies). Summary of the draft report was distributed to the concerned municipalities, VDCs and DDCs for public viewing and comments. However, none of the written comments were found for the project.

251. The consultation purposes and methods that were undertaken during the process are highlighted in **table 32**.

Table 32: Consultation with Affected People and Stakeholders

Project Section	Date of Consultation	Place	Consulted Persons	Female	Concerns and Suggestions
MP Road Section	2073/08/07 Nov 22, 2016	Bimalnagar	8	2	Minimum loss of forest area and resources Compensatory plantation for trees required to be cut To consider the possible landslides, soil erosion issues into consideration Provide adequate compensation for private and public properties losses To implement the project as soon as possible
	2073/08/07 Nov 22, 2016	Abukhaireni-6	9	2	
	2073/08/08 Nov 23, 2016	Bandipur Municipality-6	12	4	
	2073/08/09 Nov 24, 2016	Bandipur-8	8	3	
	2073/08/09 Nov 24, 2016	Ghasi Kuwa-5,	10	5	
	2073/08/09 Nov 24, 2016	Ghasi Kuwa	8		
	2073/08/10 Nov 25, 2016	Maanpang-2,	9	3	
	2073/08/11 Nov 26, 2016	Suklagandaki-1, Kotre	9	3	

Project Section	Date of Consultation	Place	Consulted Persons	Female	Concerns and Suggestions
	2073/08/14 Nov 29, 2016	Suklagandaki-1, Ghaledi	3	0	
Madi Bridge	24/02/2075,	Ward no. 5, chapaghat	13	•	Proper management of existing electric poles along the road Provision of the resting place and waiting sheds Road side plantation Proper management of environment impacts from the construction activities
	24/02/2075	Ward no. 4 office	7	•	Compensation to private land acquisition Maintain Greenery by road side plantation on both side
	24/02/2075	Ward no. 5 office	8		Compensation to private land acquisition and affected HHs Conservation of the existing bridge No impacts from the construction works on environment Maintain greenery through road side plantation on both side Traffic signs and signals should be installed for ease movement of travelers and their safety
Seti Bridge	22/02/2075,	Ward no. 10, Shiva Tol, Pokhara Lekhnath Metropolitan City	12	2	Minimal impacts on environment and social environment from the construction of proposed project.
	22/02/2075	Ward no. 10 office, Pokhara Lekhnath Metropolitan City	9	4	Proper management of electric lines and other utilities along the existing road Widening of the road up to Buddha chock Restoration of the existing structures Restoration of the existing environmental condition of the project area
	23/02/2075	Ward no. 9 office, Pokhara Lekhnath Metropolitan City	9	3	Proper management of electric lines and other utilities along the existing road Provision of resting places along the approach road Conservation of the environment properly No impacts on public health and environment from the construction activities Plantation on both side of the road and bridge

Source: IEE field Visit for road 2016 and Field visit of Bridges 2018

C. Information Disclosure

252. Information was disclosed through public consultation and more formally by making documents and other materials available in a form and at a location in which they can be easily accessed by stakeholders. This involved making a summary of draft reports available (in the local language) at public locations/VDC in the community and providing a mechanism for the receipt of comments and making documents available more widely. In this regard, ADB encourages governments to upload all documents onto their own website. The full IEE report will be disclosed on the ADB and DoR website and made available to the interested parties upon request. IEE will also be disclosed locally to solicit updated public opinion and minimize grievances related to the project. Public disclosure must comply with ADB Access to Information Policy (AIP) 2018.

253. Monitoring is one of the components of EMP. Monitoring of physical, biological and socio-economic parameters of the environment of this project will be carried out. The outcomes of the monitoring activities will be maintained in a database. The results of monitoring will also be disclosed in the form of charts, figures, graphs, and samples, etc., to the local people, school students and other interested stakeholders. In the process of compliance monitoring of the project construction, local people and construction workers will be consulted. The monitoring reports will also be disclosed on the ADB website.

254. The Implementing Agency (DoR) will extend and expand the consultation and disclosure process during the implementation (construction) of the project. The feedback of the affected people, stakeholders and the public has been incorporated in the detailed project design for implementation during construction.

255. Several meetings, and focus group discussions (FGDs) were held with stakeholders and affected people to keep them abreast of the project and to get feedback and incorporated in the Detailed Design. DoR will also make copies of the IEE report and any other project reports for interested people available in the Nepali language.

D. Public Consultation and Communication Plan for future

256. This IEE and other relevant project documents will be made available at public locations in the project affected municipality/VDCs and posted on the websites of executing agency and ADB. The consultation process will be continued and expanded during the project implementation to ensure stakeholders participate fully in project execution, as well as to implement comprehensive information, education, and communication plan.

257. The public consultation and disclosure program with all interested and affected parties will remain a continuous process throughout the project implementation, and shall include the following:

1. Consultations during construction phase

258. Public meetings with affected communities to discuss and plan work programs and allow issues to be raised and addressed once construction has started; and

259. Smaller-scale meetings to discuss and plan construction work with individual communities to reduce disturbance and other impacts, and to provide a mechanism through which stakeholders can participate in project monitoring and evaluation.

2. Project disclosure

260. Public information campaigns (via newspaper, flyers, and media) to explain the project to the wider population of the project area and prepare them for disruptions they may experience once construction is underway;

261. Public disclosure meetings at key project stages to inform the public of progress and future plans, and to provide copies of summary documents in local language;

262. Formal disclosure of completed project reports by making copies available at convenient locations in the project area, and informing the public of their availability; and

263. Providing a mechanism through which comments can be made.

264. For the benefit of the community, relevant information from the IEE will be translated in the local language and made available at (i) Offices of executing and implementing agencies, (ii) Division offices, (iii) Consultant teams' offices; and (iv) Contractor's campsites. It will be ensured that the hard copies of IEE are kept at places which are conveniently accessible to people, as a means to disclose the document and at the same time creating wider public awareness. An electronic version of the IEE Report will be placed in the official website of executing and implementing agencies and the ADB website after approval of the IEE by ADB.

VII. ENVIRONMENTAL MANAGEMENT PLAN

A. Environmental Management Plan

265. The Environmental Management Plan (EMP) contains the agreement between DOR and ADB detailing the implementation of mitigation measures, monitoring program, cost estimates, and institutional arrangement to ensure that no significant adverse impacts results from the project intervention.

266. The basic objectives of the EMP are to:

- establish the roles and responsibilities of all parties involved in the project's environmental management;
- ensure implementation of recommended actions aimed at environmental management and its enhancement; and
- ensure that the environment and its surrounding areas are protected and developed to meet the needs of the local communities including other stakeholders and safeguard and the interests of the common people.

267. A detailed Environmental Management Plan (EMP and Environmental Monitoring Plan (EMOP) is prepared for Abukhaireni – Pokhara road, Seti and Madi bridge and presented in appendices B to G and will form part of the bidding documents. The total budget for implementing the EMP for Abhukherini-Pokhara Road and Madi Seti bridge is NRs. 844,574,625 (NRs. 614,595,360 + Seti bridge NRs. 61,283,171 and Madi bridge NRs. 168,696,094) including relocation and road furniture structures. The costs for the mitigation measures other than the compensatory plantation are dealt under the engineering (civil works) and resettlement (compensation) estimate.

268. To be more effective during implementation the EMP will be attached to the tender documents (Particular Conditions of Contract of the FIDIC format). As part of the environmental management, the procedures for workers' health and safety; public safety and reducing inconvenience and disposal of construction wastes, etc., are also included.

269. A Site Specific EMP (SEMP) is to be prepared by the contractor based on the generic EMP provided in the IEE. The SEMP will perform a risk assessment of all mitigation options and will propose site specific mitigation options that would be appropriate and commensurate with the actual impact. The contractor shall submit SEMP for Engineer's endorsement. The Contractor will not be able to start the construction works before the approval of SEMP from the Engineer.

B. Environmental Management Cost

270. The total environmental management cost is summarised in Table 33 below.

Table 33: Environmental Safeguard Budget for all packages (AP road and Madi, Seti bridges) in NRs.

SN	Item	Abukhaireni - Pokhara road	Madi bridge	Seti bridge	Total	Budget source	Remarks
1	Training on environment related matters	500,000	300,000	300,000	1,100,000	Provisional sum of contractor budget	
2	Safety gadgets and equipment (PPE)	1,834,518			1,834,518	BOQ item	
3	Traffic management during construction	28,432,264	73,112,878	49,237,133	150,782,275	BOQ item	
4	Spoil management	40,123,000	NA	NA	40,123,000	BOQ item	
5	Utility shifting	425,212,424	1,563,530	8,813,091	435,589,045	BOQ item	
6	Tree felling	915,730	881,961	572,947	2,370,638	BOQ item	
7	Compensatory plantation	1,3025,000			1,3025,000	BOQ item for 6000 trees (NRs. 9,000,000); Project Management costs for 8,750 forestry trees (NRs. 4,687,500)	350 forestry trees x 25 @NRs. 250 per tree including maintenance; 6000 DOR trees x 1 @ NRs. 1500 per tree including fencing and maintenance; includes all trees for AP road, Madi and Seti bridge
8	Bioengineering measures	68,212,424	48,323,475	NA	116,535,899	BOQ item	
9	Land development at Dhamauli and Dumre camp		41,654,250		41,654,250	BOQ item	
10	Environment and Social enhancement measures	32,500,000	1,500,000	1,000,000	35,000,000	PS item	Such as Aesthetic improvement, livelihood programs, community and CFUG focused programs as well as landscaping and beautification of Ghasikuwa etc.
11	Environmental Monitoring (air, noise, water quality)	3,040,000	960,000	960,000	4,960,000	BOQ item	
12	Environmental monitoring (site inspections by MOPIT, DOR, GESU etc.)	800,000	400,000	400,000	1,600,000	Project Management Costs	NRs. 200,000/year x 4 years for AB road; NRs. 100,000/year x 4 years each for Madi and Seti bridge
	TOTAL	614,595,360	168,696,094	61,283,171	844,574,625		

Note: All amount allocated in BOQ for environment management should done by contractor.

C. Environmental Monitoring Programme (EMoP)

271. Environmental monitoring is an essential component of the implementation of IEE recommendation. The environmental monitoring programme (EMoP) is prepared to monitor the implementation performance of the EMP.

272. Environmental monitoring plan is prepared focussing the following objectives:

- To ensure that impacts do not exceed the established legal standards
- To check the implementation of mitigation measures in the manner described in the IEE report
- To monitor implementation of the EMP.
- To provide an early warning of potential environmental damage
- To check whether the proposed mitigation measures have achieved the intended results, and or/ other environmental impacts occurred

273. The monitoring plan will be used for performance monitoring of the project. A monitoring plan defining all parameters to be monitored, with tentative location, project stages for measurements, implementation and institutional responsibility for different environmental components is prepared for all stages of project and presented in **Appendix C**.

D. Cost for Environmental Monitoring

274. Being category B project in terms of Environment Safeguard as per SPS, annual environmental monitoring report will be prepared which will be submitted to PD & ADB for approval and disclosure in ADB as well as DoR's website. This monitoring will be done by the Environment Specialist procured through construction supervision consultant. Similarly, responsibility for undertaking environmental monitoring of proposed road upgrading during – and post construction phase is rested on the shoulders of MoPIT and GESU at the policy and proponent level. Cost to be incurred to its undertaking is provisioned in proposed subproject as outlined below.

Table 34: Environmental Monitoring Cost for all projects

Particulars	Total (NRs.)
Air quality monitoring	3,200,000.00
Noise level monitoring	1,200,000.00
Water quality monitoring	480,000.00
Total cost	4,880,000.00

Table 35: Environmental Monitoring Budget, Mugling - Pokhara road

Particulars	Unit rate	Total (NRs.)
Air quality monitoring	6 sites x 2 times x 4 years x NRs. 40,000	1,920,000.00
Noise level monitoring	6 sites x 2 times x 4 years x NRs. 15,000	720,000.00
Water quality monitoring	10 sites x 2 times x 5000 X 4 years	400,000.00
Total monitoring for MP-Road section		3,040,000.00

Table 36: Environmental Monitoring Budget, Madi bridge

Particulars	Unit rate	Total (NRs.)
Air quality monitoring	2 sites x 2 times x 4 years x NRs. 40,000	640,000.00
Noise level monitoring	2 sites x 2 times x 4 years x NRs. 15,000	240,000.00
Water quality monitoring	2 sites x 2 times x 5000 X 4 years	80,000.00
Total cost for Air water noise monitoring in Madi bridge		960,000.00

Table 37: Environmental Monitoring Budget, Seti bridge

Particulars	Unit rate	Total (NRs.)
Air quality monitoring	2 sites x 2 times x 4 years x NRs. 40,000	640,000.00
Noise level monitoring	2 sites x 2 times x 4 years x NRs. 15,000	240,000.00
Total cost for Air water noise monitoring in Seti bridge		880,000.00

E. Institutional Setting and Proposed Implementation Arrangement

1. Project Organisation

275. Ministry of Physical Infrastructure and Transport (MoPIT) will be the Executing Agency (EA) and DoR will be the Implementing Agency (IA) for the project.

276. More specifically, the PIU Project Directorate will be the key institution for the successful implementation of the project and ensure compliance to ADB safeguards as contemplated in the environmental management and monitoring plans.

277. The GESU will provide both technical advisory and independent audit roles to the Project Directorate to ensure the project stays in compliance. The GESU, after reviewing and approving the EMP will review monitoring reports submitted by the SC. On an annual basis, the GESU is authorized to conduct environmental audits of road projects. The overall organisation structure of project is shown in Figure 8.

2. Capability to Implement Environmental Safeguards

278. Both the EA and the IE have extensive experience in implementing ADB-financed road projects. The Project Directorate (ADB), established in 1987, will be maintained within DoR and serve as the Project Implementation Unit (PIU). The Project Director will have overall responsibility for all aspects of project implementation and management including procurement, contract administration, progress monitoring, financial management, reporting, land acquisition and resettlement.

3. Capacity Building

279. To enhance the capacity of staff for effective implementation of proposed mitigation measures and monitoring the resultant effect, as well as create awareness amongst workers and public the trainings and awareness programmes will be prepared by the Supervision Consultant-Environmental Specialist in consultation with the GESU/DoR. No later than 2 months from the issuance of notice to proceed, the appointed environment focal person of the Contractor will meet with the SC to review and enhance the EMP. All environment focal person will undergo regular training and workshop organized by the SC and GESU/DoR.

4. Environmental and Social Safeguards Monitoring

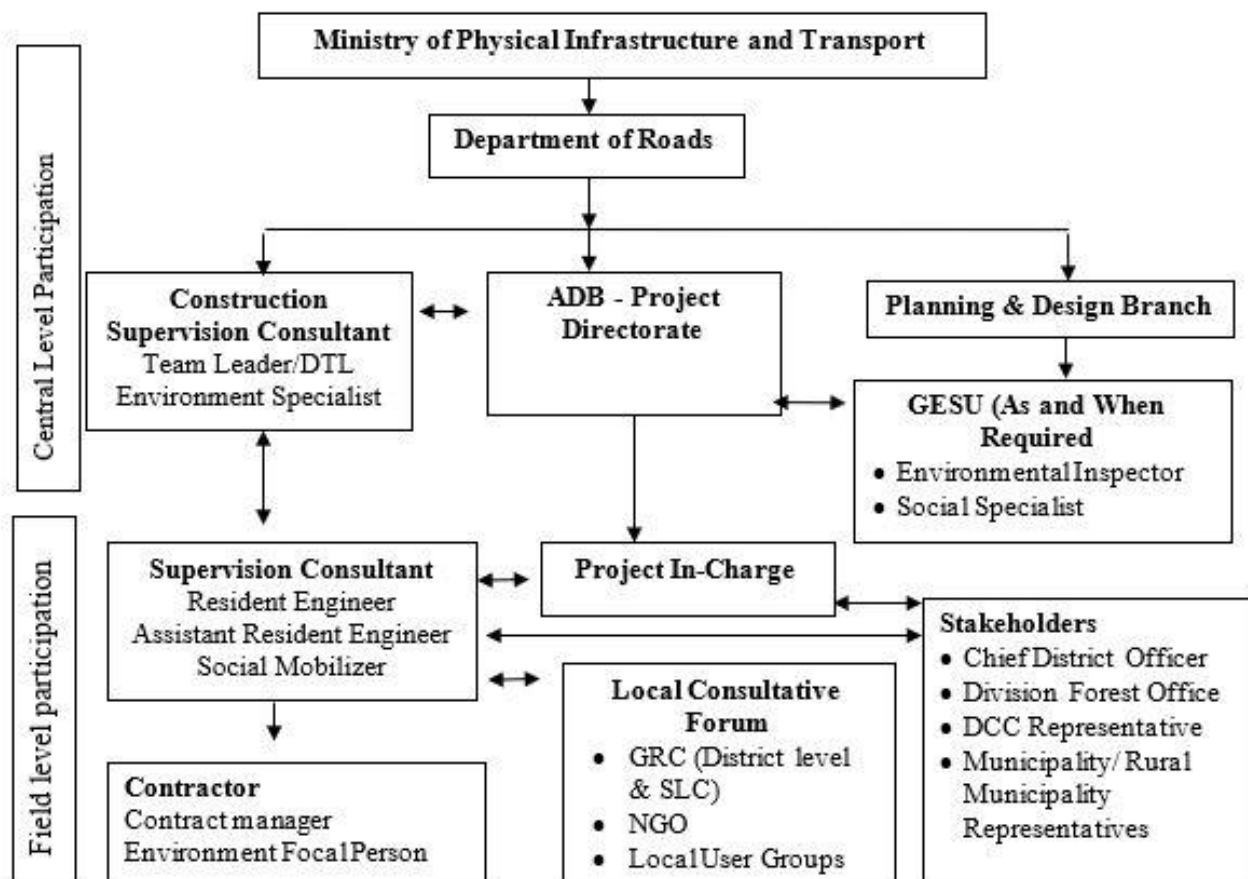
280. It is proposed that DoR's GESU with the support of the supervision consultants is given responsibility for monitoring implementation of the Environmental Management Plan (EMP) in the construction contract, the Resettlement Plan and the poverty reduction programme. The project should support the sustainability of this capacity in DoR by involving GESU in the project implementation. It is proposed that the project provides support for transport, field visits and acquiring national environmental and social consultant support.

F. Reporting

281. Following reports shall be prepared and submitted for ADB approval and disclosure:

- Environmental Safeguards Matrix for Quarterly Country Program Review
- Environmental Safeguards Monitoring Chapter in the Quarterly Project Progress Report
- Semi-annual Environmental Compliance Monitoring Report (Jan-June in July, and July-Dec in January next year)
- Analytical Project Completion Report on Environmental Performance of the Project

Figure 7: Project Organisation Structure for EMP Implementation



VIII. GRIEVANCE REDRESSAL MECHANISM

282. The concern/grievances from local/affected people may come up related to inappropriate implementation of various components of EMP or the overall road upgrading itself. These issues will be addressed through acknowledgement, evaluation and corrective action and response approach. A grievance redress mechanism (GRM) will be established to receive, evaluate, and facilitate the resolution of affected people's concerns, complaints, and grievances about the social and environmental performance of the project. The GRM aims to provide a trusted way to voice and resolve concerns linked to the project, and to be an effective way to address affected people's concerns. The GRM for the project is outlined below, and consists of three levels with time-bound schedules and specific persons to address grievances.

283. If any issue of conflict arose along with project implementation the victim/affected people can make written complain to the project office/CSC office at the beginning, similarly if the issue remain unresolved then can be successively delivered to second level to fourth level under grievance redress mechanism of this project as described below;

1. First Level GRM

284. The first level and most accessible and immediate contact for the fastest resolve of grievances are the contractors, and design and supervision consultants on site. Prior to construction of any works, the PIU (PD-ADB) and PIC (Project Manager) will ensure local community meetings are held to notify local residents and businesses of any temporary disturbances, and to inform them of the Project. If a local area committee (LAC) exists in the area, they should also be informed. If any complaints arise, the contractors, consultants, and PIC can immediately resolve the complaint on site. The PIU can also be involved in grievance redress at this stage. The PIU and PIC office phone number will be posted in public areas within the project area and construction sites. Any person with a grievance related to the project works can contact the project to file a complaint. The PIC office will have a safeguards focal person to field and resolve complaints. The safeguards (environment and resettlement) focal person will document the complaint, and immediately address and resolve the issue with the contractor within 1-2 days, if the complaint remains unresolved at the field level. The PIC may seek the assistance of the consultant safeguards specialists (the environmental specialist or social safeguards specialist) to resolve the issue. The PIC safeguards focal person will notify the PIU safeguards focal person that a complaint was received, and whether it was resolved. The PIC safeguards focal person will fully document the following information: (i) name of the person; (ii) date complaint was received; (iii) nature of complaint; (iv) location, and (v) how the complaint was resolved.

2. Second Level GRM

285. Should the grievance remain unresolved; the PIC will forward the complaint to the PIU safeguards focal person. The person filing the grievance will be notified by PIC safeguards focal person that the grievance was forwarded to the PIU safeguards focal person. The PIU will address the grievance. Grievances will be resolved through continuous interactions with affected persons, and the PIU will answer queries and resolve grievances regarding various issues including environmental or social impacts. Corrective measures will be undertaken at the field level by the PIU safeguards focal person within 7 days. He/she will fully document the following information: (i) name of the person; (ii) date complaint was received; (iii) nature of complaint; (iv) location and (v) how the complaint was resolved.

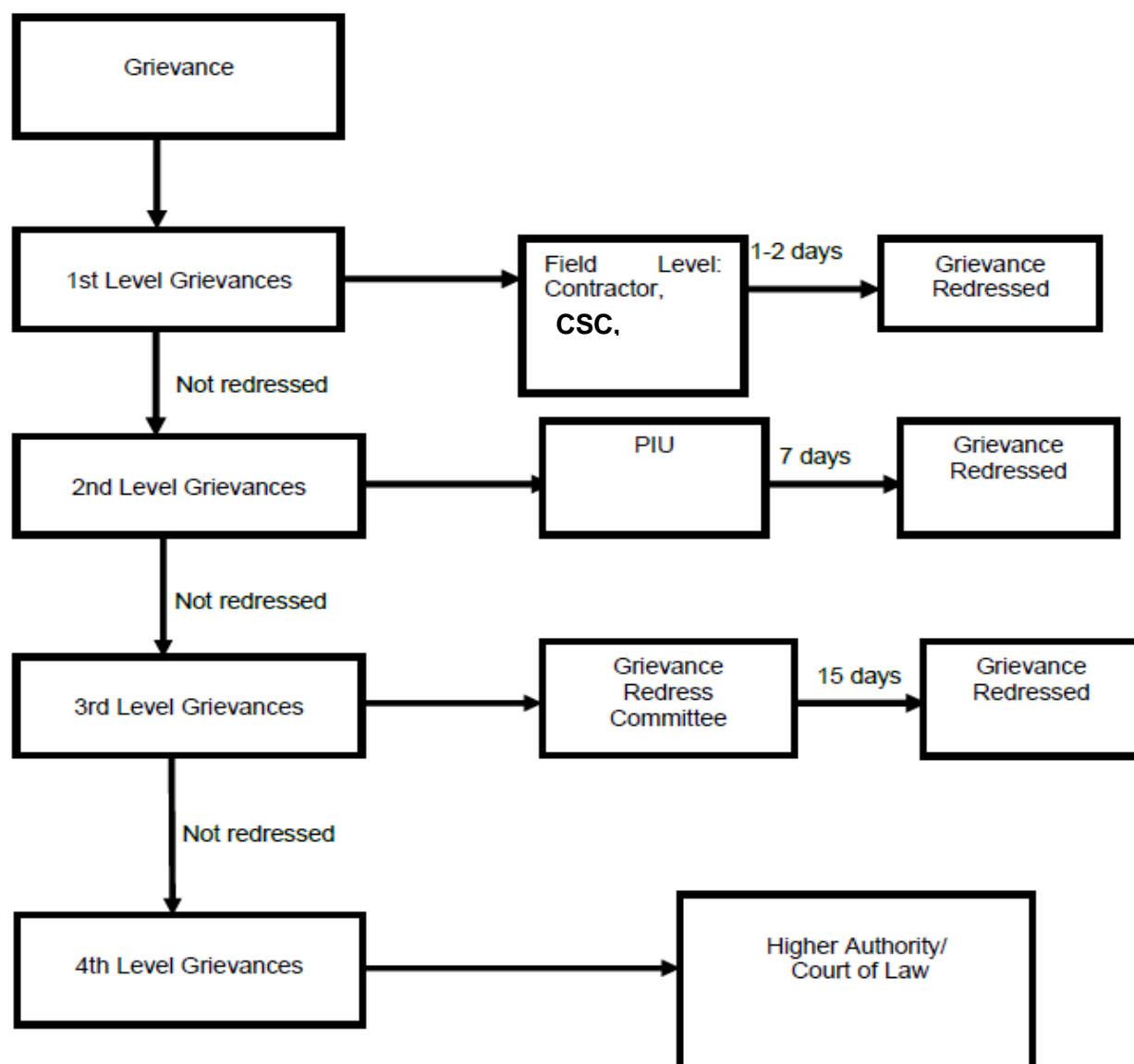
3. Third Level GRM

286. Should the grievance remain unresolved, the PIU's project director will activate the third level of the GRM by referring the issue (with written documentation) to a Grievance Redress Committee (GRC) constituted by the EA, which will, based on review of the grievances, address them in consultation with the PMU, PIU, PIC and affected persons. The GRC will consist of PIC leadership, affected persons, and local area committee, among others—determined to provide impartial, balanced views on any issues. The GRC should consist of at least five persons. A hearing will be called with the GRC, if necessary, where the affected person can present his/her concern and issues. The process will promote conflict resolution through mediation. The GRC will meet as necessary when there are grievances to be addressed. The GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 days. The functions of the GRC are as follows: (i) to provide support to affected persons on problems arising from environmental or social disruption, asset acquisition (where required), and eligibility for entitlements, compensation, and assistance; (ii) to record grievances of affected persons, categorize and prioritize them, and provide solutions within 15 days; and (iii) to report to the aggrieved parties developments regarding their grievances and decisions of the GRC. The PIC safeguards focal person will be responsible for processing and placing all papers before the GRC, recording decisions, issuing minutes of the meetings, and taking follow-up action to see that formal orders are issued and the decisions carried out.

4. Fourth Level GRM

287. In the event that a grievance is not addressed by the contractor, CSC, PIC, PIU or GRC, the affected person can seek legal redress of the grievance in the appropriate courts, the fourth level of the GRM, which is the formal legal court system. The GRM however does not prevent affected persons from seeking legal redress at any time. The grievance redress mechanism and procedure are depicted in Figure 8.1.

Figure 8: Grievances Resolution Steps and Processes



Note: DIU=district implementation unit, DSC=design and supervision consultant, PIU= project implementation unit

IX. CONCLUSION AND RECOMMENDATION

288. The proposed road project has been categorized as Category 'B' based on environmental screening and assessment of likely impacts while the initial environmental examination ascertains that it is unlikely to cause any significant environmental impacts. Few impacts have been identified attributable to the proposed project, all of which are localized and temporary in nature and easy to mitigate.

289. The project area does not fall under any national park, wildlife reserve, and conservation area, hunting area, buffer zone and world heritage site of historical, archaeological, paleontological or architectural significance. The land use patterns of the corridor of impact cover agriculture lands, settlements, grazing lands and others (stream beds). Around 6,644 trees will be required to be felled which will have minor impact on micro-climate. But to ameliorate this impact compensatory plantation has been proposed in the IEE study Report.

290. The significant impacts during construction stage are temporary disruption of public utilities and existing services as electrical poles/line, telephone poles/line, existing cross-drainage structures including nine (9) irrigation crossings. Altogether 834 private structures (519 residential, 155 commercial, 136 residential/commercial and 24 others) will be affected due to the implementation of the proposed subproject. Also 98 transformers, 3110 electric poles, 135 public tap stands and 298 community structures are likely to be affected during construction of road. Labours and local people will be prone to adverse health effects and accidents relating to construction activities.

291. Other impacts include air quality deterioration due to increase in fugitive dust emissions from materials hauling and unloading, ground shaping, and unpaved road travel. Nuisance to nearby residents due to increase in noise from heavy equipment operation, hindrance in accessibility to common property resources and increase in traffic on road sections will cause where construction is on-going. Land use conversion from agricultural or residential to built-up area (road) will take place due to expansion of road width. Surface water quality of the rivers and rivulets will be deteriorated, and result in siltation of waterways from silt-laden surface runoff coming from the construction sites. Health and safety risk due to increase in heavy equipment traffic particularly to children and near pedestrian crossing points. During operation stage, the main impact may be on the surface water hydrology since the construction of a road across several river/rivulets in the flood-affected sections can act as impediment to natural flow of water.

292. Other than the permanent change in land use, all identified impacts are of short-duration and co-terminus with the construction stage, and are easy to mitigate. All private lands and structures that will be disturbed will be compensated in compliance to existing laws.

293. The initial environmental examination of the project ascertains that the project is unlikely to cause any significant environmental impacts. No additional studies or need of undertaking detailed EIA is envisaged at this stage. The Executing Agency shall ensure that EMP and EMoP is included in Bill of Quantity (BOQ) and forms part of bid document and civil works contract, compensation for land and structures will be in compliance with existing laws of GoN and ADB SPS. The same shall be revised if necessary, during project implementation or if there is any change in the project design and with approval of ADB.

X. SELECTED REFERENCES

- ADB, 2009. ADB Policy Paper: Safeguard Policy Statement. The Asian Development Bank, Manila.
- ADB, 2003. Environmental Assessment Guidelines. The Asian Development Bank, Manila.
- DDC, Tanahun, 2013, District Transport Master Plan (DTMP), Tanahun
- DDC, Tanahun, 2014. District Profile (Nepali) of Tanahun. District Development Committee, Tanahun, Nepal.
- District Technical Office, Kaski, 2015, District Transport Master Plan (DTMP) of Kaski District
- DDC Kaski, 2014. District Profile (Nepali) of Kaski. District Development Committee, Kaski, Nepal.
- DOR, 2002. Twenty Year Road Plan 2002. The Department of Roads, Ministry of Physical Planning and Works, Kathmandu.
- DOR, GESU. 2003. Reference Manual for Environmental and Social Aspects of Integrated Road Development, the Department of Roads, Ministry of Physical Planning and Works, Kathmandu.
- DOR, GESU. 2009. Roadside Geotechnical Problems: A Practical Guide to Their Solution, Geo-Environment and Social Unit, Department of Roads, Ministry of Physical Planning and Works, Kathmandu.
- DOR, GESU, 2008. Environmental and Social Management Framework, Geo-Environment and Social Unit, Department of Roads Ministry of Physical Planning and Works, Kathmandu.
- DOR, GESU, 2000. Policy Document (Draft), Environmental Assessment in the Strategic Road Network, Geo-Environment and Social Unit, Department of Roads Ministry of Physical Planning and Works, Kathmandu.
- DOR, GESU, 1997. Environmental Management Guidelines, MoWT, Kathmandu.
- HMGN. 1995. Forest Act, 1992, and its Rules, 1995. Ministry of Forest and Soil Conservation, Kathmandu, A guide to the Environment and Social Issues Associated with New Road Construction and Upgrading.
- HMGN. 1973. National Parks and Wildlife Conservation Act, 1973 and Conservation Area Management Rules, 1996. Ministry of Forest and Soil Conservation, Kathmandu.
- HMGN. 2000. Local Self-Governance Act, 1999, and Local Self-Governance Rules, 2000. HMGN
- HMGN, Ministry of Physical Planning and Works 2001 (2058 BS). The National Transport Policy, Kathmandu.
- HMGN. 2000. Environment Protection Act, 1997 and Environment Protection Rules, 1997 (amended in 1999). Ministry of Law, Justice and Parliamentary Affairs, Law Books Management Board for MoPE, Kathmandu.
- IUCN. 2005. Nepal's Illustrated Biodiversity Primer. The World Conservation Union, Kathmandu.
- MOFSC, 2014. Revised Forestry Sector Policy. Ministry of Forest and Soil Conservation (MOFSC) GON, Kathmandu.
- IEE report of Madi Bridge
- IEE report, Seti Bridge

Appendix A: REA

Rapid Environmental Assessment (REA) Checklist**Instructions:**

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES), for endorsement by Director, RSES and for approval by the Chief Compliance Officer.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title:

NEP - Transport Project Preparatory Facility (TPPF)

Sector/Division:

Improvement of Mugling - Pokhara Road

SCREENING QUESTIONS	YES	NO	REMARKS
A. Project Siting			
Is the Project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		√	
▪ Protected area		√	
▪ Wetland		√	
▪ Mangrove		√	
▪ Estuarine		√	
▪ Buffer zone of protected area		√	
▪ Special area for protecting biodiversity		√	
Potential Environment Impacts			
Will the Project cause:			
▪ Encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?		√	<p>Road crosses a historical site, Ghansi Kuwa at Ch. 36+870 in Ghansikuwa VDC of Tanahu district.</p> <p>Impacts will be low, long-term and site specific. Recommended mitigation measures include:</p> <ul style="list-style-type: none"> - Provision of quarry and borrow pit operation sites in the appropriate location are needed during design phase - Reduce provision of embankments, cuts and fills as far as possible in the design

SCREENING QUESTIONS	YES	NO	REMARKS
			<ul style="list-style-type: none"> - Project will seal existing gravel road and improve drainage, geometry, landslide stabilization - Restrict haphazard extraction of construction materials from quarry sites
<ul style="list-style-type: none"> ▪ Encroachment on precious ecology (e.g. sensitive or protected areas)? 	√		The subproject will affect 350 trees within 17 community forests along the road and bridges alignment.
<ul style="list-style-type: none"> ▪ Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site? 		√	<p>Impacts will be minor, short-term and site specific. Recommended mitigation measures include:</p> <ul style="list-style-type: none"> - Provision of sufficient drains with adequate capacity for easy drainage flow - Protection of hill side and valley slopes through engineering and bio-engineering measures - Prevention of dumping of construction spoils and debris in streams and rivers
<ul style="list-style-type: none"> ▪ Deterioration of surface water quality due to silt runoff and sanitary wastes from work-based camps and chemicals used in construction? 		√	<p>Impacts will be minor, short-term and site specific. Recommended mitigation measures include:</p> <ul style="list-style-type: none"> - Proper waste management facilities to be provided in labor camps - Disallow storage of chemicals within 100 m periphery of permanent water course or spring - Contaminated run off from storage areas need to be captured in ditches or ponds - Apply sealing or binding materials in the case of major spills of hazardous materials (liquids)
<ul style="list-style-type: none"> ▪ Increased local air pollution due to rock crushing, cutting, and filling works, and chemicals from asphalt processing? 	√		<p>Impacts will be minor, site specific, and short-term. Recommended mitigation measures include:</p> <ul style="list-style-type: none"> - Locate static plants at least 100 m away from occupied buildings and sites deemed by the Engineer - Locate asphalt plants 1 km away from residential areas, schools, hospitals.

SCREENING QUESTIONS	YES	NO	REMARKS
			<ul style="list-style-type: none"> - Stone crushing plants shall be fitted with approved dust control devices and operate in accordance with manufactures specifications and should be operated in day time only - Sprinkle water on sites with ongoing construction activities in order to control dust nuisance
<ul style="list-style-type: none"> ▪ Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation? 		√	<ul style="list-style-type: none"> - Facilities for occupational health and safety will be provided and detailed in the EMP. - Training will be provided on materials and, equipment handling and use of protective gear and clothing.
<ul style="list-style-type: none"> ▪ Noise and vibration due to blasting and other civil works? 		√	<ul style="list-style-type: none"> - Blasting should be avoided as far as possible - Provision of certificates of noise standard for the equipment
<ul style="list-style-type: none"> ▪ Dislocation or involuntary resettlement of people 	√		Some people likely to shift their houses. Mitigation measures include: <ul style="list-style-type: none"> - A resettlement plan for affected families shall be prepared
<ul style="list-style-type: none"> ▪ Dislocation and compulsory resettlement of people living in right -of -way? 	√		<ul style="list-style-type: none"> - Resettlement plan to be prepared
<ul style="list-style-type: none"> ▪ Disproportionate impacts on the poor, women and children, indigenous people or other vulnerable groups 		√	<ul style="list-style-type: none"> - Improvement of the road is likely to increase several beneficial impacts such as girls' enrollment in schools, regular health check up facility for pregnant women including delivery in the health facilities. Similarly, the project activity is expected to increase employment and income opportunities for local people.
<ul style="list-style-type: none"> ▪ Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress? 		√	<ul style="list-style-type: none"> - Impacts will be minor, site specific, and short-term. Mitigation measures include: - Locate hot mix and batching plants 1 km away from residential areas, schools, hospitals, and other sensitive areas. - Control dust nuisance by periodic sprinkling of water
<ul style="list-style-type: none"> ▪ Hazardous driving conditions where construction interference 		√	<ul style="list-style-type: none"> - Impacts will be minor, site specific, and short-term. Recommended mitigation measures include: - Provide proper alternative traffic management plan during construction - Construct interchanges in such a way that traffic flow is not disturbed - Define alternative routes

SCREENING QUESTIONS	YES	NO	REMARKS
			- Ensure proper traffic management on the road crossings near proposed interchanges
<ul style="list-style-type: none"> Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable (such as STI's, HIV/AIDS) diseases from workers to local population? 	√		<p>Impacts will be minor, site specific, and short-term since most labour will be locally recruited. Recommended mitigation measures include:</p> <ul style="list-style-type: none"> Avoid construction camps near settlement areas, near water sources, religious and cultural sites Ensure cleanliness and appropriate management of construction camp sites Provision of waste disposal at designated sites Educate workers on transmission of communicable diseases
<ul style="list-style-type: none"> Creation of temporary breeding habitats for mosquito vectors of diseases? 		√	Road doesn't pass through the areas that are prone to mosquito diseases vectors.
<ul style="list-style-type: none"> Accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials and loss of life? 		√	<p>Impacts will be minor. Recommended mitigation measures include:</p> <ul style="list-style-type: none"> Enforcing of speed limits, and imposing penalties on the traffic rules violators Provide provision of rest places Provide traffic signs for speed limits and rest areas. Displayed "Warning Messages" such as "better late than never" Employ sufficient numbers of Flagmen in the construction sites
<ul style="list-style-type: none"> Increased noise and air pollution resulting from traffic, leading from traffic volume? 		√	<p>Impact will be minor. Recommended Mitigation measures include:</p> <ul style="list-style-type: none"> Enforcing and monitoring of GoN Rules for gaseous emissions generated by traffics Encourage road side plantation to control noise pollution
<ul style="list-style-type: none"> Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road? 		√	<p>Impacts will be minor. Recommended mitigation measures include:</p> <ul style="list-style-type: none"> Restrict washing of vehicles in streams Awareness raising of vehicle drivers on negative impacts of washing vehicles in streams and river
<ul style="list-style-type: none"> Social conflicts if workers from other regions or countries are hired? 	√		Impacts will be limited as majority of the workers will be from the locality.
<ul style="list-style-type: none"> Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)? 		√	<p>Impacts will be minor as majority of workers will be from the locality. Recommended mitigation measures include:</p> <ul style="list-style-type: none"> The workers camp sites should be located outside residential and

SCREENING QUESTIONS	YES	NO	REMARKS
			<p>market areas.</p> <ul style="list-style-type: none"> - Water and other social services and infrastructure will be sourced/used through ways that do not interfere with the local community
<ul style="list-style-type: none"> ▪ Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation? 	√		<p>Impacts will be minor and temporary in nature. Recommended mitigation measures include:</p> <ul style="list-style-type: none"> - Raise awareness among drivers and store keepers for safe handling and disposal of the hazardous materials and their containers. - Educate communities on risk to health due to explosives, fuel and other chemicals during construction and thereby precautions should be taken during construction and operation of the road.
<ul style="list-style-type: none"> ▪ Community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning. 	√		<p>Impacts will be minor and temporary in nature. Recommended mitigation measures include:</p> <ul style="list-style-type: none"> - Restriction of the local people to the construction areas, - Use of traffic and warning signs at and near the construction site - Employ sufficient numbers of Flagmen in the construction sites - Educate the contractors and the local people on safety issues - Enforcement of speed limits, traffic rules and regulations; - Installation of warning signs, speed breakers, pedestrian crossings and specific areas for bus stops due to increased number of vehicles and increased speeds.

Appendix B: Environmental Management Plan, Abukhaireni – Pokhara Road

Appendix B: Environmental Management Plan

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
[0] Pre-Construction Stage (Upon issuance of Notice to Proceed)						
The Contractor shall complete the following activities no later than 30 days upon issuance of Notice to Proceed: 1.) Submit appointment letter and resume of the Contractor's Environmental Focal Person (EFP) to DoR Project Directorate 2.) EFP will engage SC-Environment Specialist and DoR/PD to a meeting to discuss in detail the EMP, seek clarification and recommend corresponding revisions if necessary 3.) EFC will request SC-ES copy of monthly monitoring formats and establish deadlines for submission. 4.) EFC will submit for SC-ES approval an action plan to secure all permits and approvals needed to be secured during construction stage which include but not limited to: i) operation of crushers and hot mix plants, ii) transport and storage of hazardous materials (e.g. fuel, lubricants, explosives), iii) waste disposal sites, iv) temporary storage location, iv) water use, and v) emission compliance of all vehicles. Arrangements to link with government health programs on hygiene, sanitation, and prevention of communicable diseases will also be included in the action plan. 5) EFC will submit for approval of SC-ES the construction camp layout before its establishment. 6) The Contractor shall submit the following subplans to DOR: a. Structures relocation and site clean-up; b. Physical cultural resources management; c. Solid wastes, borrow pits and quarry management, and disposal management based on Appendix K guidelines.						
[A]Construction Stage						
Physical Environment						
Micro-Climate 350 trees from community forest and 6,294 trees will be removed along the right of way (ROW), or a total of 6,644 trees	- 1:25 compensatory plantation - Avoid or minimize clearing of trees, shrubs and bushes as far as possible.	Throughout the road alignment especially at forest areas	Before tree felling	350 trees x 25 x 1.1 (mortality) x NRS 100 =	Compensatory plantation to be implemented by DepartmentOf Forest for trees affected within community forests. Funds will come from DOR	SC, DOR/PD
	- Aware and support community with regard to plantation of trees in the available spaces		During implementati on period	NRs 9,62,500.00 6,294 trees x 25 x 1.1 (mortality) x NRS 100 = NRS 17,308,500		
Air Quality Emissions from plants, vehicles, unpaved	- Carryout water sprinkling and fogging, broom sweeping in dust prone locations, unpaved haulage roads, earthworks, stockpiles and asphalt mixing plant areas.	Throughout the road corridor mainly nearby settlements, bazaar, religious,	During Construction Stage	Dust and noise control NRs. 200,000.00	Supervision Consultant and Contractor	SC, DOR/PD

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
road travel, and hauling of materials.	<ul style="list-style-type: none"> - Prohibit open burning of solid wastes (plastic, paper, organic matters). - Control dust nuisance using covers, spraying water on unpaved road surfaces, or increase moisture content for open materials storage piles. - Include in bid document to avoid use of very old vehicles, emitting gases beyond standards. - Provide masks and personal protective equipment (PEP) to workers to minimize inhalation of respiration of suspended particulate matters. - Locate mixing and asphalt (hot mix) plants, and crushers and batching plants at least 1 km downwind from the nearest settlements only after receiving approval from the SC. - Operate Hot Mix plant with stack of adequate height as prescribed by SC to ensure enough dispersion of exit gases. - Use heaters for heating purpose, if possible - Use crushers only licensed by GoN. - As far as possible, use LPG or kerosene as fuel source for cooking purpose. - Restrict tree cutting for use of fuel- wood. - Operate Diesel Generating (DG) sets with adequate height. - Use diesel with low sulphur content in DG sets as well as other machineries. 	cultural and archeological sites				
Noise Level Temporary increase in ambient noise level in the close vicinity of various construction activities	<ul style="list-style-type: none"> - Locate temporary construction facilities such as labour camps, vehicle maintenance workshops and earth moving equipment away from settlements and other sensitive areas as far as possible. 	Throughout the road corridor mainly nearby settlements, bazaar, religious, cultural and archeological sites	During Construction	Included in Engineers' Estimate	Supervision Consultant and Contractor	SC, DOR/PD

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
	<ul style="list-style-type: none"> -Relocate noise sources such as stone crushers, vehicles movements, and operation of quarry and borrow pits to less sensitive areas to take advantages of distance and shielding. -take advantages of natural topography as a noise buffer -Install silencers in construction equipment and machinery, and repair and maintain in time. -Select equipment and machinery with lower sound power levels for the use. -Provide protection devices such as ear plugs/ or earmuffs to workers during operation of high noise generating machines. -Perform construction activities only between 5 A.M. and 8 P.M. to avoid disturbance to nearby communities at night. -Initiate multilayered plantation during construction near built up areas close to the road alignment. -Use noise barriers such as earth mounds or walls of wood, metal that form a solid obstacle between the road and roadside community, especially in schools and hospitals sites. 					

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
Vibration and Blasting Damage to infrastructures due to vibration caused by operation of heavy machines and equipment including blasting	<ul style="list-style-type: none"> - Observe precaution while operating machines and equipment, especially nearby public and private infrastructures. - Avoid/minimize the use of blasting as far as possible. - Give prior information to VDC and community on blasting operations. 	Throughout the road length	During Construction stage	Included in Engineers' Estimate	Contractor	SC, DOR/PD
Impact on Land and Soil Contamination from inappropriate construction and management practices	<ul style="list-style-type: none"> - Preserved top soil for reuse for plantation and restoration purposes. - Restore back to any land taken on lease or used 	Throughout the road alignment	During Construction	Included in Engineers' Estimate	Contractor	SC, DOR/PD
Landslide and Soil Erosion Occurrence of landslide and soil erosion due to construction	<ul style="list-style-type: none"> - Clear only required vegetation and re-vegetate eroded bare slopes by the cleared vegetation. - Apply civil and bioengineering techniques to stabilize landslide and soil erosion. 	Throughout the road COI at landslide and erosion prone area	During Construction stage	NRs 68,212,424.00 (This cost of bio-engineering works is based on Engineers' Estimate)	Contractor	SC, DOR/PD

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
Borrow Pits and Quarry Sites Slope failure, sedimentation, water logging, change in the aesthetic values of the landscape, damage to sensitive areas due to improper selection and management of borrow pit and quarry sites for the construction materials	<ul style="list-style-type: none"> - Avoid protected and sensitive areas, nearby settlements, water sources, forest areas and fertile agriculture lands in siting borrow pit. - Select borrow and quarry sites at waste and low quality of lands. - Obtain approval from authorities of government and private land owners. - Operate borrow pits and quarry sites as per required volume of materials. - Stockpile and preserve top soil to spread for restoration of sites. 	Throughout the sub-project road corridor wherever additional soil and stones required	During Construction Stage	Included in Engineers' Estimate	Contractor	SC, DOR/PD
Soil Contamination and Compaction Contamination of land due to mixing of construction materials and wastes/spoils; and compaction due to movement of heavy construction equipment along haulage roads and workshop areas, and construction camps	<ul style="list-style-type: none"> - Before operation obtain approval for labour camps, haulage roads, workshop and storage area for different materials through the SC. - Store fuel and lubricants as per the approved plan. The storage area should be paved covered, paved, with interceptor drains, and oil/water separator. Collected fuels and contaminated materials should be re-use, stored and disposed outside. All hazardous materials should be properly labeled. - Restrict movement to the designated haulage route. - Design approach roads through waste/barren land and rocky area to reduce compaction induced impact on soil. - Restore affected farm land after completion of road improvement activity. - Provide temporary latrine pits in labour camps and restore after completion of activity. 	Throughout the road alignment mainly at haulage roads and labour camp locations	During Construction Stage	Included in Engineers' Estimate	Contractor	SC, DOR/PD

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
	- Segregate solid wastes generated into biodegradable and non-biodegradable wastes. Recycle, re-use, and compost waste accordingly.					
Siltation and Surface Water Quality of Streams Likelihood of increased siltation through soil erosion due to borrow pits and quarry sites operation, and contamination of water due to solid and liquid wastes from the labour camps and construction equipment	- No mitigation measures are proposed for impact on ground water due to deep water table and limited uses. - Orient workers not to throw excavated spoils and wastes into stream water. - Store all chemicals and oil away from water and provide concrete platform with catchments pits for spills collection. - Arrange training programme to all equipment operators, drivers, and warehouse personnel on immediate response for spill contamination and eventual cleanup. Distribute emergency procedures and reports preferably written in easy to understand local dialects to the local people. - Install silt fencing and/or brush barrier for collecting sediments before letting them into the water body. Collect silt/sediment and stockpile for possible reuse as surfacing of slopes for re-vegetation. - Dispose of all wastes generating from construction sites in an environmentally acceptable manner so as not to block the flow of water in the channels. Collect, store and transport wastes to dispose at approved sites. - No vehicles or equipment washing, parking or refueling near streams water, so as to	Nearby rivers, and water bodies streams, rivulets throughout the road alignment	During Construction Stage	Included in Engineers' Estimates	Contractor	SC, DOR/PD

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
	avoid contamination of streams water from fuel and lubricants. - Provide chute drains to drain surface runoff and prevent erosion from slopes. - Avoid large labour camps along the alignment and locate away from settlements and river sides. - Recruit construction labours preferably from the local community. - Manage sewage of labour camps without creating pollution in streams water and other public and private areas. - No untreated sanitary wastewater shall be discharged into streams water.					
Hydrology and Drainage Modification of the surface water due to intersection of the drainage basin by the road	- Retain existing natural drainage system without disturbing them. - Provide causeways in each perennial and seasonal streams as well as rivulets. - Consider adequate cross drainage structures to avoid natural flow of water especially for unusual rainfall. - Maintain channels used by the farmers for irrigation purpose as they are.	Throughout the road COI especially rivers, streams, rivulets and bridge site areas	During Construction	Included in Engineers' Estimate	Contractor	SC, DOR/PD
Management of Construction Spoils/Wastes Generation of spoils due to the excavation of existing road that constitute subgrade and pavement materials	- All disposal sites shall have consent of local community, VDC representatives. - Use spoils/wastes for construction purposes as far as possible.	Throughout the road COI wherever spoils need to be managed	During Construction Stage	NRs 40,123,000.00 (This cost is based on Engineers' Estimate)	Contractor	SC, DOR/PD

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
Natural Hazard Possibility of damage to road due to natural hazard such as flooding and siltation, and earthquake	<ul style="list-style-type: none"> - Road embankment level has been designed to be higher than the highest flow level and/or flood level of the streams and rivulets. - Sub-project structures are designed with the consideration of probability of earthquakes. 	As required at the road alignment	During Construction	Included in Engineers' Estimate	Contractor	SC, DOR /PD
Biological Environment						
Forestry and Biodiversity Likely impact from clearance of trees, shrubs and bushes along the roadside	<ul style="list-style-type: none"> - The Contractor shall determine number and types of trees to be felled through the detailed design/or its verification and shall coordinate with CFUGs then apply to DFO for clearance process - The Contractor shall seek necessary help with SC to obtain approval for clearing trees, if needed - Trees shall be felled only after receiving permissions from the concerned authorities. - The Contractor shall coordinate with CFUGs and manage felled trees. - Clear only necessary hillside slopes with vegetative covers in connection with road improvement. - Prohibit throwing spoils including bitumen containers and other wastes/spoils generated from roads excavation in and around the forest areas. 	Throughout the road alignment especially at forest areas	At the beginning of construction	350*25*1.1*100= Rs 9,62,500.00 (Cost is calculated assuming 10% mortality and per sapling & caring cost for 5 years Rs 95)	Contractor	SC, DOR/PD
Aquatic Biodiversity Possibility of destructive fishing activities by the construction workers	<ul style="list-style-type: none"> - Discourage destructive fishing by the construction workers. 	All areas of water bodies throughout the alignment	During Construction Stage	-	Contractor	SC, DOR/PD
Socio-economic Environment						

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
Impacts due to Construction/Labour Camp Likely haphazard disposal of solid waste, competition on public facilities, impairment of aesthetic value of the landscape, poor sanitation, transmission of communicable diseases and other social conflicts	<ul style="list-style-type: none"> - To the extent possible, utilize existing houses for workers/staff lodging. - Provide basic facilities such as fire precaution, lavatories and showers, potable water supply, clean eating area, lighting, safe access, air supply, LPG gas/kerosene, and others. - Make available first aid facilities at camp sites. Prepare contingency plan for emergency and large injury cases in collaboration with VDC level health/sub-health posts. - Appropriate facilities for women and children will be provided in the construction campsites - All workers, staff, and communities undergo STD, HIV awareness by linking with existing government programs. - Restrict open space defecation and pollution of stream sites and public places by workers. - Ensure that sufficient and good quality of food stuff at reasonable price including adequate and safe drinking water has been supplied to the workers. 	All labour camp locations throughout the road alignment	During Construction	Included in Engineers' Estimate	Contractor	SC, DOR /PD
Safety of Construction Workers and Accident Risks to Local Community Increased risk of accidents to construction workers and local community	<ul style="list-style-type: none"> - Ensure that internationally accepted and practiced safety measures are adopted during (i) road works (ii) handling of large construction equipment and machineries (iii) handling of chemicals including hazardous materials and inflammable substances (iii) welding/hot work (iv) electrical works etc. - Include the occupational health and safety (OHS) Clauses established by the DOR in the work contracts encompassing all 	All construction camps and throughout the road alignment	During Construction Stage	Personal protective equipment NRs 1,834,518.00	Contractor	SC, DOR /PD

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
	<p>accident prevention measures which can happen at work sites and in the camps.</p> <ul style="list-style-type: none"> - Arrange all personal protective equipment (PPEs) for workers, including first aid facilities at construction sites. - Prepare an emergency plan duly approved by the SC to respond to any instance of safety hazard. - Restrict entry of unauthorized persons to the construction sites and equipment storage sites. - Prepare and implement comprehensive traffic management plan to avoid disruption of the existing traffic due to construction activities. - Conduct regular safety audit on safety measures during construction. The audit shall cover manpower and their safety, machinery, temporary works, equipment and vehicles, materials storage and handling, construction procedures and environment, site safety guidelines, and miscellaneous services. 					
<p>Transportation and Storage of Materials</p> <p>Likely impact due to transportation and storage of materials such as oils, fuel, bitumen, blasting materials, construction materials, etc.</p>	<ul style="list-style-type: none"> - Proper storage (paved, covered, with interceptor drains and oil/water separator) and labeled for storage. - Equip with fire extinguishers and first aid kit all storage and transporter of hazardous materials. - Avoid the use of haulage trucks higher than the carrying capacity of the haulage roads and existing roads. The contractor will be responsible for repair and maintenance of damaged existing road by the haulage trucks. 	Construction camp and approved temporary storage areas	During Construction Stage	Included in Engineers' Estimate	Contractor	SC, DOR/ PD

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
Impact on common Property Resources Likely damage of common properties such as public utilities and facilities, religious, historical and cultural sites etc.	<ul style="list-style-type: none"> - Implement mitigation measures to control dust, noise, and traffic - Chance find of archeological artifacts importance, the Contractor shall immediately inform SC and DOR to seek further guidance. - Avoid any actions that bear the risk to destroy the sites or alter their scientific or aesthetic or social values. - In the case of accidental damage of infrastructure of archaeological importance, the contractor will be obliged to inform DOR immediately through SC. Further, he (the Contractor) shall also be obliged to carry out immediate corrective and repair measures, as suggested by concerned authority. 	Throughout the road COI	During Construction	Included in Engineers' Estimate	Contractor	SC, DOR /PD
[B] Operation Stage						
Physical Environment						
Micro-Climate Change in the micro-climate due to emission of GHG from operation of vehicles	<ul style="list-style-type: none"> - As part of transport rules, condition of vehicles will be monitored regularly and rules will be enforced effectively. In addition, reduction in emission of GHG is also anticipated due to the reduced travel time and improved road condition. 	Throughout the road corridor	During Operation Stage	To be determined by DoR	DoR	DoR
Air Quality Emission of GHG from the operation of vehicles	<ul style="list-style-type: none"> - Shifting cropping /land use patterns from traditional cereals to high value horticultural crops along the ROW in the cultivated area could be one of the preferred solutions to maintain environmental and economic sustainability. - DOR will maintain roadside planted trees especially nearby settlements and other public places. 	Throughout the road corridor	During Operation Stage	To be determined by DoR	DoR	DoR

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
	<ul style="list-style-type: none"> - GON will control and enforce Nepal vehicle mass emission standard, 1999 and will stipulate vehicle owners to engage in proper and regular vehicle maintenance. - Local petrol pump stations will make aware to ensure proper use and sale of clean fuel. - Air pollution by dust will be controlled with provision of paved shoulders, especially in the sensitive/built-up areas. - Road signs will be provided reminding the motorist to properly maintain their vehicles to economize on fuel consumption and protect the environment. - Development organizations (NGO, INGO and CBOs) can motivate the local communities to maintain greenery along the road apart from their houses by planting fodder, fuel wood and fruit trees including flowering plants. 					
Noise Level Likelihood of increase in ambient noise level due to operation of vehicles and use of horns	<ul style="list-style-type: none"> - Effective traffic management and good riding conditions shall be maintained to reduce the noise level throughout the stretch. - Speed limitation and honking restrictions shall be enforced near sensitive locations, like hospitals, schools etc. - Effectiveness of the multilayered plantation shall be monitored. - Awareness will be created amongst the residents about likely noise levels from road operation at different distances. 	Throughout the road corridor especially nearby, wildlife habitat, settlements, bazaar areas, religious, cultural and archeological sites	During Operation Stage	To be determined by DoR	DoR	DoR
Vibration Possibility of vibration due to plying of heavy	<ul style="list-style-type: none"> - Loaded vehicles plying on the road shall be monitored by MoPIT as per Nepal Road Standard, 2027 B.S. (First revision-2045 B.S.). 	Throughout the road COI	During Operation	To be determined by DoR	DoR	DoR

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
and over loaded vehicles	- Drivers shall be made aware about capacity of the road and bridges, and their consequences.					
Impact on Land and Soil Conversion of agricultural land to built up areas for commercial purpose, especially in market centres	In general, the policy of DoR is of 15 and 25 m either sides from the centreline for feeder road and highway, respectively. But in case of this road 8 m of corridor of impacts (COI) for 5.5 m of formation width has been followed.	Throughout the road COI mainly nearby built-up areas and farm lands	During Operation Stage	To be determined by DoR	DoR	DoR
Soil Erosion Occurrence of landslide and soil erosion due to both natural and induced phenomena.	- DOR has established a system to check roads employing Length-Persons and their supervisor. They are responsible for routine and recurrent maintenance of roads like cleaning up drains, soil deposited on the roads due to minor slope failure and erosion.	Along the road corridor, especially near bridges where embankment level is high	During Operation Stage	To be determined by DoR	DoR	DoR
Borrow Pits and Quarry Sites Likelihood of landslide and soil erosion due to incomplete restoration of borrow pits and quarry sites along the road alignment	- DOR shall orient supervisor in order to check and maintain drains and erosion and also to protect vegetative covers on the restored sites of borrows and quarries.	Especially at borrow pits and quarry sites used areas throughout the alignment	During Operation Stage	To be determined by DoR	DoR	DoR

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
Soil Contamination and Compaction Possibility of soil erosion and deterioration of borrow areas if not rehabilitated properly	- Locations of quarry sites and borrow pits shall be monitored and if found not restored properly then the Contractor will be asked for correction of these works under defect liability period	All borrow, quarry and construction camp sites throughout the alignment	During Operation	To be determined by DoR	DoR	DoR
Siltation and Surface Quality of Rivers Possibility of contamination of surface water by oil and lubricants during monsoon season	- As provisioned, DOR will engage road Length-Persons. They will check road condition including cleaning up soils deposited on roads by erosion and slides drain blockade/ chocking. The Length-Persons supervisor will inform to Regional Engineer in case of large landslide and major road blockade.	All areas nearby streams and rivulets throughout the road alignment	During Operation	To be determined by DoR	DoR	DoR
Hydrology and Drainage Blockage/Chocking of natural drainage pattern due to landslide and soil erosion	- As provisioned, DOR will engage Length-persons for regular checkup of the road condition including cleaning up the erosion, slides, drain blockade/ chocking etc. Length-Persons supervisor will inform to regional engineer in case of large landslides and major road blockade.	All areas nearby streams and rivulets throughout the road alignment	During Operation Stage	To be determined by DoR	DoR	DoR
Natural Hazard Likely impact of natural hazard such as flooding, siltation and earthquake	- Development organizations will play role in awareness raising about the risk of natural hazards including preventive cure and preparedness on safety measures to local communities.	All sites nearby streams and rivulets throughout the road alignment	During Operation Stage	To be determined by DoR	DoR	DoR
Ecological Resources						
Forestry and Biodiversity Increased possibility of poaching and logging	- The project shall involve local people in maintaining of planted trees and their management activities.	All forest areas along the road Corridor	During Operation Stage	To be determined by DoR	DoR	DoR

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
due to improved access						
<i>Socio-economic Environment</i>						
Accident Risks to Local Community Increased risk of road accident	- Monitoring and supervision by DoR is required, to ensure the safe travelling.	Throughout the road alignment	During Operation	To be determined by DoR	DoR	DoR
Impact on Common Property Resources Increased noise, vibration and air pollution	- The DoR will install traffic signals such as “NO HORN” and “SPEED LIMIT” nearby the archaeological sites.	Throughout the road COI especially at sensitive locations	During Operation Stage	To be determined by DoR	DoR	DoR

Appendix C: Environmental Monitoring Plan, Abukhaireni – Pokhara Road

Environmental Monitoring Plan

Environmental Indicators	Project Stage	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
Air Quality	Construction Stage	TSPM, PM ₁₀ , NO _x , SO _x , CO _x	Stack emission testing	Crusher, hot mix plants, diesel generator	Annual in line with permit renewal	National Ambient Air Quality Standards (NAAQS) Nepal Vehicle Mass Emission Standards 2069 (2012)	Part of permit renewal 6 sites x 2 x 40,000/sampling = NRs 480,000.00	Contractor	SC, /DoR
	Operation		Emission testing for all vehicles Ambient air quality sampling and analysis at selected sites/sensitive spots using through High Volume Sampler 24-hour	Construction camp Abukhaireni, Dumre Bazaar, Damauli, Kotre Bazaar, Gagangaunda and Buddhachok	Annual as part of permit renewal Baseline: 1 sampling each before construction			Contractor SC	
Water Quality	Pre-construction / Construction	BOD, Turbidity, pH, <i>E.Coli</i> , TSS, Oil and Grease Drinking water quality parameters	<ul style="list-style-type: none"> Collect and analyze sample from source Observation of blockage of waterways - extent and secondary impacts Water pollution incidents due to unsafe disposal of waste and spoil, analyzing effects on local fisheries Observations on vehicle and equipment washing practices in rivers Water sampling	Streams and rivers (Trishuli River, Madi River, Kotre khola, Buldi khola, Kumle khola and Bijaypur Khola) Construction camp final discharge effluent Construction camp	Once prior to construction to serve as baseline; Quarterly during construction	Nepal Water Quality Guidelines for the Protection of Aquatic Ecosystems Nepal Water Quality Guidelines for the Protection of Aquatic Ecosystems	10 sites x 2 x 5,000/sampling = NRs 100,000.00	SC	PD/DoR
								SC	
								Contractor	
	Operation	Clogging of drains from silt with oil	Visual	All drains	Annually before the onset of rainy season	National Drinking Water Quality Standards (NDWQS)	Agency budget	DoR	

Environmental Indicators	Project Stage	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
Soil Quality	Construction Stage	Check for contamination from material spills and compaction due to heavy equipment	Visual	Agricultural Land, oil spillage locations and other probable hazardous materials contamination location or as suggested by SC	Continuing during construction	Should be the same as baseline before start of construction	Part of construction cost and Grievance redress mechanism	Contractor	SC, DoR
	Operation Stage			Agricultural Land, oil spillage locations and other probable hazardous materials contamination location or as suggested by SC (3 Locations)	Continuing		Clean up of spills is responsibility of polluter	DoR	
Noise Levels	Construction Stage	(1 hr Leq dB(A)) WHO Standards	<ul style="list-style-type: none"> Point source measurements in dB (A) at settlement sites/sensitive spots for noise level at 2, 5 and 15 m from road shoulder Traffic volume measurements 	Camp site and major settlement sites	Twice a year during the construction	Nepal Ambient Noise Level as per NHRC	6 sites x 2 x 15,000/sampling = NRs 180,000.00	Contractor	SC, PD/DoR
	Operation			Major road intersections, residential, commercial and sensitive receivers along the road alignment or suggested by SC (6 Locations)	Once during the first year of operation		Part of agency budget	DoR	
Landslide and Soil Erosion	Construction	Magnitude, extent and location	Visual	Along the entire stretch	Regular	None	Part of construction cost	Contractor	SC, PD/DoR
	Operation	Magnitude, extent and location		Throughout the road alignment	Regular		Part of agency budget	DoR	

Environmental Indicators	Project Stage	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
Siltation by rivers and drainage congestion	Construction	<ul style="list-style-type: none"> Siltation and presence of construction spoils and wastes Blockage of waterways - extent and secondary impacts 	Direct Observation	Throughout the road alignment, especially at the drainage congestion areas as mentioned in the IEE report or as suggested by SC	Continuing during construction phase	Visual Observation	Construction contract	Contractor	SC, PD/DoR
	Operation	<ul style="list-style-type: none"> Siltation Blockage of waterways - extent and secondary impacts 			Annual		DoR Length Person System	DoR	
Borrow Areas and Quarry Sites	Construction	Location, drainage condition, siltation, erosion, spoil management, etc	Site observation, discussion with workers and local people	Borrow areas, quarry sites location	Quarterly during construction period	Visual Observation	Construction Contract	Contractor	SC, PD/DoR
	Operation	Restoration as recommended in the EMP	Site observation, discussion with workers and local people		Once immediately after the completion of construction		DoR	DoR	
Labour Camps	Construction	Proper siting of food stalls, camp sanitation facilities	Site observation, discussion with workers and local people	Construction and camp sites	Quarterly during construction period	Visual Observation	Construction Contract	Contractor	SC, PD/DoR
	Operation	Restoration of construction camp as recommended in the EMP	Site observation and discussion with local people	Construction sites and camps	Once immediately after the completion of construction		DoR	DoR	
Tree Plantation	Construction	Maintenance of saplings planted as compensation for trees felled	Direct Observation, discussion with workers and local people	Throughout the road alignment	Once a month for one year immediately after plantation	Visual Observation	Included in environmental mitigation cost	CFUGs	DFO, DoR
	Operation	<ul style="list-style-type: none"> Maintenance of saplings planted during construction Survival rate of trees 	Direct Observation and discussion with local people		<ul style="list-style-type: none"> Once a month for one year for saplings that are 			CFUGs	DFO, DoR

Environmental Indicators	Project Stage	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
		<ul style="list-style-type: none"> Growth and development of saplings 			<ul style="list-style-type: none"> less than a year old Once in a year for 5 years 				
Road Safety and Accidents	Construction	<ul style="list-style-type: none"> Accidents (Major and minor) Safety 	<ul style="list-style-type: none"> Record numbers and types of road accidents recorded by the traffic police and the local health service centres Suitability of signs at construction sites Direct observation and discussion with workers and local people 	Throughout the road alignment	Once after the construction begins	Visual Observation, Verification and discussion with workers and local people	Construction contract	Contractor	SC, PD/DoR
	Operation		<ul style="list-style-type: none"> Record numbers and types of road accidents recorded by the traffic police and the local health service centres Suitability of local road signs Records on public road safety awareness campaigns Direct observation and discussion with local people Speed measurements at selected spots 	Throughout the road alignment	Once a year		DoR	DoR	

Appendix D: Environmental Management Plan, Seti Bridge

Environmental Management Plan, Seti ridge

Environmental Issues/Impacts	Enhancement/Mitigation Measures	Monitoring Method	Monitoring Indicator (MI) /Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
PRE-CONSTRUCTION PHASE					
The Contractor shall submit the following subplans to DOR: a. Structures relocation and site clean-up; b. Physical cultural resources management; c. Solid wastes, borrow pits and quarry management, and disposal management based on Appendix K guidelines.					
Grubbing & levelling at Bridge and approach construction site	<ul style="list-style-type: none">Removal of remains of trees to facilitate construction and carting away of remainsContractor will carry out the clearing of stumps and levellingCarting away will be done by Contractor after the stumps are removed from the ground.	Site inspection	MI: Presence/absence of cut tree stumps in the construction site PT: Tree stumps must be removed soon after tree cutting	CSC/Contractor	Project/PD/DoR
Siting of construction Camp	<ul style="list-style-type: none">Site will be located at least 500 m from settlementsSupervision Consultant (SC) and PIU will approve the site chosen by the contractorsConditions will be put in contract document for location of site at above specified distances.Machinery and equipment area will be protected.Vehicle refuelling sites will be avoided in the flood plains of Rivers	Site Inspection	MI: Location of camp site and nearby land use PT: Campsite is at least 100m away from the river	Contractor	SC/PD/DoR
Employment to Project affected people	Number of project affected people employed	Interaction with project affected people, recording	Periodically during construction phase	Contractor	SC/PD/DoR
Restoration, rehabilitation of infrastructures damaged by the project activities	Continued services by the facilities and functional public life	Site observation; VDC/DDC records; Public Consultation Meetings; Photos	Once in a month during construction phase	Contractor	SC/Project/MoPI T
CONSTRUCTION PHASE					

Environmental Issues/Impacts	Enhancement/Mitigation Measures	Monitoring Method	Monitoring Indicator (MI) /Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
Loss of Private Properties	Compensation given to the owner as described in resettlement plan	<ul style="list-style-type: none"> Interview with affected persons Check status of employment given to local people during construction 		Contractor	SC/Project/MoPI T
Occupational Health and Safety, STDs and Nuisance from construction camps	<ul style="list-style-type: none"> First aid facility at sites with health treatment arrangement, contingency planning; Proper drinking water and toilet facility for construction crew. Insurance of workers against injuries and fatal accidents during works 	Spot checks at work sites, photos, accident records, interviews	Health and safety regulations, first aid and medical arrangements, contingency plan, number and type of safety equipment such as mask, helmet, glove, safety belt	Contractor	SC/PD/DoR
Stress on Public Utilities and Facilities	<ul style="list-style-type: none"> Contractor will provide own suitably equipped and staffed site emergency medical facilities. Inclusion of appropriate clauses in construction contracts; monitoring of compliance during construction and proper administration of contracts will be ensured. 	Observation and site inspection	Periodically during construction phase	Contractor	SC/PD/DoR
Social and cultural conflicts due to influx of construction workers	Number of days lost due to conflict, bandhs at project level etc.	Interview with contractor, site consultant, locals	Periodically during construction phase	Contractor	SC/PD/DoR
Loss of public properties/infrastructures	3 resting place, 3 transformers, 33 electric poles, 22 solar lamps, 1 police bit and 3 bus sheds are falling in the proposed RoW. These need to be relocated/rebuild	Observation and site inspection	MI: Affected stakeholders consultation; Coordination with appropriate agencies PT: Zero complaint from affected stakeholders.	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/Mitigation Measures	Monitoring Method	Monitoring Indicator (MI) /Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
			Once during construction phase		
CONSTRUCTION PHASE					
Physical Environment					
Borrow pit use causing loss of productive land (Borrow area development)	<ul style="list-style-type: none"> Contractors will submit plans to Engineer and PIU for borrow pit exploitation and post-use restoration before commencement of work and implementation of approved plans. Contractor will verify that enough quantity of borrow materials is available at identified borrow pits Equitable agreement for borrow pit development will be reached between land owners and contractors including measures for post restoration. Supervision Consultant will check restoration and post restoration use. Inclusion of appropriate clauses in construction contracts, monitoring of compliance during construction and proper administration of contracts will be ensured. 	Site inspection. Check estimates for borrow material requirements	MI: Capacity and Location of borrow pits Top soil storage area PT: Zero complaints or disputes registered against contractor by land owner	Contractor	SC/PD/DoR
Erosion/damage to embankments at approaches	Inclusion of appropriate items in specification for retaining wall or slope stabilisation measures, monitoring of compliance during construction of retaining wall and appropriate administration of contracts will be ensured.	Site inspection. Review engineering drawing for road and retaining walls	MI: Design of road embankment and protection wall PT: No erosion of embankment during monsoon	Contractor	SC

Environmental Issues/Impacts	Enhancement/Mitigation Measures	Monitoring Method	Monitoring Indicator (MI) /Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
Sanitation and disposal facilities at construction workers' camp	<ul style="list-style-type: none"> • Proper availability of • Drinking water and sanitation facilities at workers' camp • Contractor will install temporary toilets with septic tank/soak pits. • Contractor will provide suitable collection and • disposal system for domestic refuse. For collection of domestic refuse dustbins will be provided. The collected waste may be disposed off at the nearest municipal land fill site. • Hazardous waste will be stored, transported and disposed based on existing regulations. 	Site inspection. Review of Environment, Health and Sanitation practices and solid waste management system	MI: Sanitation and solid waste management plans PT: No water-borne diseases reported within the camp. No overflowing of septic tanks. No foul odour emanating from toilets. Wastes are segregated, recycled and properly disposed.	Contractor	SC
Cooking fuel at workers' camp	Workers' will be prohibited from using fuel wood for cooking. Contractor will ensure availability of kerosene oil/LPG. Inclusion of the above conditions in contract document will be ensured.	Site inspection	MI: Indoor air quality PT: No fuel wood gathered and used for cooking No respiratory diseases reported arising from use of fuel wood.	Contractor	SC/PD/DoR
Health facilities at workers' camp	The contractor will ensure first aid boxes in adequate numbers and make shift dispensary at camp. The above condition will be put in contract document.	Site inspection.	MI: Log book of patients who availed of health facilities. Log book of available medicines. PT: Patients who availed of health facilities treated or referred to other hospitals.	Contractor	SC/PD/DoR
HIV/AIDs awareness campaign at workers' camp	Workers to be made aware of HIV/AIDs and protection measures. To organize awareness programme every month	Observation and checking attendance of workers who attended campaign /awareness programmes.	MI: Number of workers who attended HIV / AIDS seminars. PT: Zero HIV/AIDS incidence	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/Mitigation Measures	Monitoring Method	Monitoring Indicator (MI) /Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
Damage to services running parallel or across the alignment of Bridges and approaches during construction leading to interruption especially electric lines	<ul style="list-style-type: none"> Relocation of any potentially affected services prior to commencement of any construction works, including water supply. Potentially affected services will be identified in design stage. 	Site inspection and observation	MI: No. of utilities that need to be relocated PT: Zero damage to utilities that will be affected	Contractor	SC/PD/DoR
Presence of contractor's workforce increasing pressure on already strained local facilities including health & medical facilities	<ul style="list-style-type: none"> Contractor will provide own suitably equipped and staffed site emergency medical facilities. Inclusion of appropriate clauses in construction contracts; monitoring of compliance during construction and proper administration of contracts will be ensured. 	Observation and site inspection.	MI: Medical facilities availability on site PT: Patients who availed of health facilities treated or referred to other hospitals.	Contractor	SC/PD/DoR
Incomplete post-use clearance and reinstatement of construction camps leading to loss of land productivity or additional costs for land owners to reinstate land	<p>Contractor will prepare site restoration plans for approval of Engineer and PIU to implement these plans fully prior to demobilization. All temporary works sites to be notified by the contractor prior to use</p> <p>Inclusion of appropriate clauses in construction contracts; monitoring of compliance during construction and proper administration of contracts will be ensured.</p> <p>All sites will be photographed to record pre-use state.</p>	Observation	MI: Site restoration plan PT: Zero complaint from affected land owners. Full use of reinstated construction camps	Contractor	SC/PD/DoR
Pollution of land, ground water and surface water arising from sanitary and	<ul style="list-style-type: none"> During construction it will be ensured that contractor does not dispose off debris in River 	Water quality sampling	MI: Water quality parameter levels	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/Mitigation Measures	Monitoring Method	Monitoring Indicator (MI) /Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
	<p>diversions. The contractor will maintain two way traffic at diversions and will inform the local traffic police about the traffic diversion</p> <ul style="list-style-type: none"> Monitoring of compliance during construction and strict administration of contracts will be ensured. 	Observation: Monitoring of traffic accidents	<p>Presence of traffic personnel to manage the traffic, Number of accidents</p> <p>PT: Zero accidents or incidents</p> <p>Smooth flow of traffic</p>		
Air pollution from Hot Mix Plant, concrete batching plant, construction yard and due to movement and operation of construction vehicles and machinery	<ul style="list-style-type: none"> Construction camps will be located in open areas and away from residential areas Monitoring of air pollution and timely action to reduce the pollutant concentration by appropriate measures will be taken up. Trucks carrying construction material will be covered with tarpaulin sheet to avoid spilling. Supervision Consultant will enforce the mitigation measures suggested through efficient monitoring. Water sprinkling will be carried out in mornings and evenings on haul roads and compact surface. Vehicles and construction machinery will be maintained to conform emission standards specified by GoN Stockpiled sand and stone will be wetted before loading. Construction debris shall be disposed only at designated sites. 	Observation Air quality sampling	<p>MI: Presence of construction debris</p> <p>PT: Zero construction debris</p>	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/Mitigation Measures	Monitoring Method	Monitoring Indicator (MI) /Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
of Trees and removal of vegetation	<ul style="list-style-type: none"> The project authority will deposit necessary funds to the Department of Forest, Government of Nepal as part of tree cutting permission for the compensatory plantation Only marked trees to be felled. Compensatory plantation of 2025 tree saplings. Removal of trees only within the corridor of impact (Col) after joint verification with Division of Forest Office, Pokhara 		PT: At least 90% survival of trees.		
Impact on aquatic life		Interview with local people & observation	MI: Record of fish species (Increase and decrease of aquatic lives in Seti River) Water pollution PT: At least 90% survival of fish species	Contractor	SC/PD/DoR
Pressure on forest and wildlife	Use of firewood or fossil fuel by upgrading crew, events of hunting and killing of wildlife/fishes	Inspection and interview with local people	MI: Complaints from DFO Felling of trees haphazardly at upper stream of the project PT: No disturbance to forest products and its resources	Contractor	SC/PD/DoR
Chemical Environment					
Use of fuel, lubricants, oils, acids, and other chemicals for construction	<ul style="list-style-type: none"> Chemicals (oils, paints, acids etc) will be disposed in pit safely after use. Used lubricants and oils will be collected and recycled or disposed off site. Plastic sheeting will be placed under hazardous material storage 	Periodically/Once in a month	MI: Spillage of chemical components on site Complaints from the locals Haphazard storage of chemical on site PT: No hazardous to human health	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/Mitigation Measures	Monitoring Method	Monitoring Indicator (MI) /Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
	<p>area to collect and retain leaks and spills.</p> <ul style="list-style-type: none"> Contaminated runoff from storage areas will be captured in ditches or ponds with an oil trap at the outlet. Contaminated and worn plastic sheeting will be packed into drums and disposed off site. 				
Use and Storage of chemicals like bitumen etc	<ul style="list-style-type: none"> The permission from the land owner must be obtained before commencing the storage activities. Bitumen drums will be stored in dedicated areas, not scattered along the road and any small accidental spills will be cleared up immediately Bitumen will be melted in heaters using kerosene, diesel or gas fuel. No bituminous material will be discharged into side drains. Bitumen will not be applied in strong wind or rainy conditions. Fuel wood will not be used for heating bitumen. The bitumen storage must not be on fertile land and nearby water bodies. The bitumen handler must be careful while handling the bitumen with safety gears. 	Periodically/Once in a month	<p>MI: Spillage of bitumens on site Complaints from the locals Haphazard storage of bitumen on site Using forest woods for heating</p> <p>PT: No hazardous to human health</p>	Contractor	SC/PD/DoR

Appendix E: Environmental Monitoring Plan, Seti Bridge

Appendix E: Environmental Monitoring Plan, Seti Bridge

Environmental Indicators	Project Stage	Parameters	Methods/ Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
Air Quality	Construction Stage	TSPM, PM ₁₀ , NOx, SOx, COx	Stack emission testing	Crusher, hot mix plants, diesel generator	Annual in line with permit renewal	National Ambient Air Quality Standards (NAAQS)	Part of permit renewal	Contractor	SC, /DoR
	Operation		Emission testing for all vehicles Ambient air quality sampling and analysis at selected sites/sensitive spots using through High Volume Sampler 24-hour	Construction camp bridge location Major settlements	Annual as part of permit renewal Baseline: 1 sampling each before construction			Contractor SC 3 times x 22,000/sampling x 5 sites = NRs 330,000.00	SC, /DoR DoR
Water Quality	Construction	BOD, Turbidity, pH, E.Coli, TSS, Oil and Grease Drinking water quality parameters	<ul style="list-style-type: none"> Collect and analyse sample from source Observation of blockage of waterways - extent and secondary impacts Water pollution incidents due to unsafe disposal of waste and spoil, analyzing effects on local fisheries Observations on vehicle and 	Seti River	Quarterly	Nepal Water Quality Guidelines for the Protection of Aquatic Ecosystems National Drinking Water Quality	3 times x 4,000/sampling x 4 sites= NRs 48,000.00	SC	PD/DoR
				Construction camp final discharge effluent				SC	PD/DoR
				Construction camp				Contractor	PD/DoR

Environmental Indicators	Project Stage	Parameters	Methods/ Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
		Clogging of drains from silt with oil	equipment washing practices in rivers			Standards (NDWQS)			
			Water sampling						
			Visual						
	Operation			All drains	Annually before the on-set of rainy season		Agency budget	DoR	
	Operation Stage			Agricultural Land, oil spillage locations and other probable hazardous materials contamination location or as suggested by SC (3 Locations)	Continuing		Clean up of spills is responsibility of polluter	DoR	
Noise Levels	Construction Stage	(1 hr Leq dB(A)) WHO Standards	<ul style="list-style-type: none"> Point source measurements in dB (A) at settlement sites/sensitive spots for noise level at 2, 5 and 15 m from road shoulder Traffic volume measurements 	Camp site and major settlement sites	Twice a year during the construction	Nepal Ambient Noise Level as per NHRC	3 times x 15,000/sampling * 5 sites = NRs 120,000.00	Contractor	SC, PD/DoR
	Operation			Major residential, commercial and sensitive receivers along the project	Once during the first year of operation		Part of agency budget	DoR	

Environmental Indicators	Project Stage	Parameters	Methods/ Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
				corridor or suggested by SC (6 Locations)					
Landslide and Soil Erosion	Construction	Magnitude, extent and location	Visual	Along the entire stretch	Regular	None	Part of construction cost	Contractor	SC, PD/DoR
	Operation	Magnitude, extent and location		Throughout the road alignment	Regular		Part of agency budget	DoR	
Siltation by rivers and drainage congestion	Construction	<ul style="list-style-type: none"> • Siltation and presence of construction spoils and wastes • Blockage of waterways - extent and secondary impacts 	Direct Observation	Seti River or as suggested by SC	Continuing during construction phase	Visual Observation	Construction contract	Contractor	SC, PD/DoR
	Operation	<ul style="list-style-type: none"> • Siltation • Blockage of waterways - extent and secondary impacts 			Annual		DoR Length Person System	DoR	
Borrow Areas and Quarry Sites	Construction	Location, drainage condition, siltation, erosion, spoil management, etc	Site observation, discussion with workers and local people	Borrow areas, sites, quarry location	Quarterly during construction period	Visual Observation	Construction Contract	Contractor	SC, PD/DoR

Environmental Indicators	Project Stage	Parameters	Methods/ Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
	Operation	Restoration as recommended in the EMP	Site observation, discussion with workers and local people		Once immediately after the completion of construction		DoR	DoR	
Labour Camps	Construction	Proper siting of food stalls, camp sanitation facilities	Site observation, discussion with workers and local people	Construction and camp sites	Quarterly during construction period	Visual Observation	Construction Contract	Contractor	SC, PD/DoR
	Operation	Restoration of construction camp as recommended in the EMP	Site observation and discussion with local people	Construction sites and camps	Once immediately after the completion of construction		DoR	DoR	
Tree Plantation	Construction	Maintenance of saplings planted as compensation for trees felled	Direct Observation, discussion with workers and local people	Throughout the project corridor	Once a month for one year immediately after plantation	Visual Observation	Included in environmental mitigation cost	DFO	DFO, DoR
	Operation	<ul style="list-style-type: none"> • Maintenance of saplings planted during construction • Survival rate of trees • Growth and development of saplings 	Direct Observation and discussion with local people		<ul style="list-style-type: none"> • Once a month for one year for saplings that are less than a year old • Once in a year for 5 years 			DFO	
Road Safety and Accidents	Construction	• Accidents (Major and minor)	• Record numbers and types of road accidents recorded by the	Throughout the road alignment	Once after the construction begins	Visual Observation, Verification and	Construction contract	Contractor	SC, PD/DoR

Environmental Indicators	Project Stage	Parameters	Methods/ Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
		<ul style="list-style-type: none"> • Safety 	<ul style="list-style-type: none"> • traffic police and the local health service centres • Suitability of signs at construction sites • Direct observation and discussion with workers and local people 			discussion with workers and local people			
	Operation		<ul style="list-style-type: none"> • Record numbers and types of road accidents recorded by the traffic police and the local health service centres • Suitability of local road signs • Records on public road safety awareness campaigns • Direct observation and discussion with local people • Speed measurements at selected spots 	Throughout the road alignment	Once a year		DoR	DoR	

Appendix F: Environmental Management Plan, Madi Bridge

Appendix F: Environmental Management Plan, Madi Bridge

Environmental Issues/Impacts	Enhancement/ Mitigation Measures	Monitoring Method	Monitoring Indicator (MI)/ Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
PRE-CONSTRUCTION PHASE					
The Contractor shall submit the following subplans to DOR: a. Structures relocation and site clean-up; b. Physical cultural resources management; c. Solid wastes, borrow pits and quarry management, and disposal management based on Appendix K guidelines.					
Land and property acquisition and compensation	Compensation to the owner The existing DoR office compound will turn into beautiful park with museum	<ul style="list-style-type: none">• Check land acquisition records; design drawings versus land plans• Interview with affected persons• Check status of employment given to local people during construction	MI: Payment of compensation and assistance to DPs as per RP Number of complaints/ grievances related to compensation and resettlement PT: Minimal number of complaints/ grievances. All cases of resettlement and rehabilitation if any are resolved at GRC level. No case referred to arbitrator or court.	Contractor	SC/PD/DoR
Grubbing & levelling at Bridge and approach construction site	<ul style="list-style-type: none">• Removal of remains of trees to facilitate construction and carting away of remains• Contractor will carry out the clearing of stumps and levelling• Carting away will be done by Contractor after the stumps are removed from the ground.	Site inspection	MI: Presence/absence of cut tree stumps in the construction site PT: Tree stumps must be removed soon after tree cutting	Contractor	SC/PD/DoR
Siting of construction Camp	<ul style="list-style-type: none">• Site will be located at least 500 m from settlements• Supervision Consultant (SC) and PIU will approve the site	Spot Inspection	MI: Location of camp site and nearby land use PT: Campsite is at least 100m away from the river	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/ Mitigation Measures	Monitoring Method	Monitoring Indicator (MI)/ Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
	chosen by the contractors <ul style="list-style-type: none"> • Conditions will be put in contract document for location of site at above specified distances. • Machinery and equipment area will be protected. • Vehicle refuelling sites will be avoided in the flood plains of Rivers 				
Employment to Project affected people	Number of project affected people employed	Interaction with project affected people, recording	Periodically during construction phase	Contractor	SC/PD/DoR
Restoration, rehabilitation of infrastructures damaged by the project activities	Continued services by the facilities and functional public life	Site observation; VDC/DDC records; Public Consultation Meetings; Photos	Once in a month during construction phase	Contractor	SC/PD/DoR
CONSTRUCTION PHASE					
Loss of Private Properties	Compensation given to the owner as described in resettlement plan	<ul style="list-style-type: none"> • Interview with affected persons • Check status of employment given to local people during construction 		Contractor	SC/PD/DoR
Occupational Health and Safety, STDs and Nuisance from construction camps	<ul style="list-style-type: none"> • First aid facility at sites with health treatment arrangement, contingency planning; • Proper drinking water and toilet facility for construction crew. Insurance of workers against injuries and 	Spot checks at work sites, photos, accident records, interviews	Health and safety regulations, first aid and medical arrangements, contingency plan, number and type of safety equipment such as mask, helmet, glove, safety belt	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/ Mitigation Measures	Monitoring Method	Monitoring Indicator (MI)/ Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
	fatal accidents during works				
Stress on Public Utilities and Facilities	<ul style="list-style-type: none"> Contractor will provide own suitably equipped and staffed site emergency medical facilities. Inclusion of appropriate clauses in construction contracts; monitoring of compliance during construction and proper administration of contracts will be ensured. 	Observation and site inspection	Periodically during construction phase	Contractor	SC/PD/DoR
Social and cultural conflicts due to influx of construction workers	Number of days lost due to conflict, bandhs at project level etc.	Interview with contractor, site consultant, locals	Periodically during construction phase	Contractor	SC/PD/DoR
Loss of public properties/infrastructures	5 electric poles need to be relocated/rebuild	Observation and site inspection	MI: Affected stakeholders consultation; Coordination with appropriate agencies PT: Zero complaint from affected stakeholders. Once during construction phase	Contractor	SC/PD/DoR
CONSTRUCTION PHASE					
Physical Environment					
Borrow pit use causing loss of productive land (Borrow area development)	<ul style="list-style-type: none"> Contractors will submit plans to Engineer and PIU for borrow pit exploitation and post-use restoration before commencement of work and 	Site inspection. Check estimates for borrow material requirements	MI: Capacity and Location of borrow pits Top soil storage area PT: Zero complaints or disputes registered against contractor by land owner	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/ Mitigation Measures	Monitoring Method	Monitoring Indicator (MI)/ Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
	<p>implementation of approved plans.</p> <ul style="list-style-type: none"> Contractor will verify that enough quantity of borrow materials is available at identified borrow pits Equitable agreement for borrow pit development will be reached between land owners and contractors including measures for post restoration. Supervision Consultant will check restoration and post restoration use. Inclusion of appropriate clauses in construction contracts, monitoring of compliance during construction and proper administration of contracts will be ensured. 				
Erosion/damage to embankments at approaches	Inclusion of appropriate items in specification for retaining wall or slope stabilisation measures, monitoring of compliance during construction of retaining wall and appropriate administration of contracts will be ensured.	Site inspection. Review engineering drawing for road and retaining walls	<p>MI: Design of road embankment and protection wall</p> <p>PT: No erosion of embankment during monsoon</p>	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/ Mitigation Measures	Monitoring Method	Monitoring Indicator (MI)/ Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
Sanitation and disposal facilities at construction workers' camp	<ul style="list-style-type: none"> • Proper availability of drinking water and sanitation facilities at workers' camp • Contractor will install temporary toilets with septic tank/soak pits. • Contractor will provide suitable collection and • Disposal system for domestic refuse. For collection of domestic refuse dustbins will be provided. The collected waste may be disposed off at the nearest municipal land fill site. • Hazardous waste will be stored, transported and disposed based on existing regulations. 	Site inspection. Review of Environment, Health and Sanitation practices and solid waste management system	MI: Sanitation and solid waste management plans PT: No water-borne diseases reported within the camp. No overflowing of septic tanks. No foul odour emanating from toilets. Wastes are segregated, recycled and properly disposed.	Contractor	SC/PD/DoR
Cooking fuel at workers' camp	<ul style="list-style-type: none"> • Workers' will be prohibited from using fuel wood for cooking. • Contractor will ensure availability of kerosene oil/LPG. Inclusion of the above conditions in contract document will be ensured. 	Site inspection	MI: Indoor air quality PT: No fuel wood gathered and used for cooking No respiratory diseases reported arising from use of fuel wood.	Contractor	SC/PD/DoR
Health facilities at workers' camp	The contractor will ensure first aid boxes in adequate numbers and make shift dispensary at camp. The above condition will be put in contract document.	Site inspection.	MI: Log book of patients who availed of health facilities. Log book of available medicines. PT: Patients who availed of health facilities treated or referred to other hospitals.	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/ Mitigation Measures	Monitoring Method	Monitoring Indicator (MI)/ Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
HIV/AIDs awareness campaign at workers' camp	<ul style="list-style-type: none"> Workers to be made aware of HIV/AIDs and protection measures. To organize awareness programme every month 	Observation and checking attendance of workers who attended campaign /awareness programmes.	MI: Number of workers who attended HIV / AIDS seminars. PT: Zero HIV/AIDS incidence	Contractor	SC/PD/DoR
Damage to services running parallel or across the alignment of Bridges and approaches during construction leading to interruption in supply (5 electric poles)	<ul style="list-style-type: none"> Relocation of any potentially affected services prior to commencement of any construction works, including water supply. Potentially affected services will be identified in design stage. 	Site inspection and observation	MI: No. of utilities that need to be relocated PT: Zero damage to utilities that will be affected	Contractor	SC/PD/DoR
Presence of contractor's workforce increasing pressure on already strained local facilities including health & medical facilities	<ul style="list-style-type: none"> Contractor will provide own suitably equipped and staffed site emergency medical facilities. Inclusion of appropriate clauses in construction contracts; monitoring of compliance during construction and proper administration of contracts will be ensured. 	Observation and site inspection.	MI: Medical facilities availability on site PT: Patients who availed of health facilities treated or referred to other hospitals.	Contractor	SC/PD/DoR
Incomplete post-use clearance and reinstatement of construction camps leading to loss of land productivity	<ul style="list-style-type: none"> Contractor will prepare site restoration plans for approval of Engineer and PIU to implement these plans fully prior 	Observation	MI: Site restoration plan PT: Zero complaint from affected land owners. Full use of reinstated construction camps	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/ Mitigation Measures	Monitoring Method	Monitoring Indicator (MI)/ Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
or additional costs for land owners to reinstate land	<p>to demobilization. All temporary works sites to be notified by the contractor prior to use</p> <ul style="list-style-type: none"> • Inclusion of appropriate clauses in construction • contracts; monitoring of compliance during • Construction and proper administration of contracts will be ensured. • All sites will be photographed to record pre-use state. 				
Pollution of land, ground water and surface water arising from sanitary and other wastes and spillages	<ul style="list-style-type: none"> • During construction it will be ensured that contractor does not dispose off debris in River • Monitoring of compliance during construction and strict administration of contracts will be ensured. • Vehicle maintenance and refuelling will be confined to areas under construction yard to trap discarded lubricant and fuel spills. • Condition will be included in contract document 	<p>Water quality sampling</p> <p>Site observation</p>	<p>MI: Water quality parameter levels</p> <p>PT: Monitoring result within Nepal's water quality standards.</p>	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/ Mitigation Measures	Monitoring Method	Monitoring Indicator (MI)/ Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
	<ul style="list-style-type: none"> Sanitary waste from workers' camp will not be diverted to River. The waste water will be diverted to septic tank. 				
Construction traffic causing pavement and structure damage to roads due to overloading, increasing congestion and increased road safety hazards	<ul style="list-style-type: none"> Contractor will use appropriate vehicles and to comply with legal gross vehicle and axle load limits Monitoring of compliance during construction and strict administration of contracts will be ensured. Contractor will minimise road safety hazards and inconvenience to other road users by taking appropriate measures such as proper diversions, signages, etc. 	Site observation	MI: Presence of signages relevant to contractor's work PT: Zero accidents or incidents	Contractor	SC/PD/DoR
Road safety hazards associated with temporary traffic diversions	<ul style="list-style-type: none"> Contractor will take all reasonable measures to minimise interference with traffic flow at bridge locations and to provide safe transit at diversions. The contractor will maintain two way traffic at diversions and will inform the local traffic police about the traffic diversion 	Site observation , Traffic management plan Observation: Monitoring of traffic accidents	MI: Presence of signages relevant to contractor's work Presence of traffic personnel to manage the traffic, Number of accidents PT: Zero accidents or incidents Smooth flow of traffic	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/ Mitigation Measures	Monitoring Method	Monitoring Indicator (MI)/ Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
	<ul style="list-style-type: none"> Monitoring of compliance during construction and strict administration of contracts will be ensured. 				
Air pollution from Hot Mix Plant, concrete batching plant, construction yard and due to movement and operation of construction vehicles and machinery	<ul style="list-style-type: none"> Construction camps will be located in open areas and away from residential areas Monitoring of air pollution and timely action to reduce the pollutant concentration by appropriate measures will be taken up. Trucks carrying construction material will be covered with tarpaulin sheet to avoid spilling. Supervision Consultant will enforce the mitigation measures suggested through efficient monitoring. Water sprinkling will be carried out in mornings and evenings on haul roads and compact surface. Vehicles and construction machinery will be 	Observation: Air quality sampling	<u>MI:</u> Presence of construction debris <u>PT:</u> Zero construction debris	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/ Mitigation Measures	Monitoring Method	Monitoring Indicator (MI)/ Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
	maintained to conform emission standards specified by GoN <ul style="list-style-type: none"> • Stockpiled sand and stone will be wetted before loading. • Construction debris shall be disposed only at designated sites. 				
Noise Levels	<ul style="list-style-type: none"> • Construction camp will be located in open areas as far as possible from residential areas • Condition will be included in contract document • Construction work will be prohibited between 10.0 PM – 6.00 A.M. near residential areas. 	Noise level sampling	MI: Noise level appropriate for the zone PT: Zero complaint from residents Noise level within permissible standard	Contractor	SC/PD/DoR
Relocation of common property resources	<ul style="list-style-type: none"> • 1 Tube well is falling in the proposed RoW (Ch. 221+190). This needs to be relocated/rebuild • Condition will be included in contract document 	Site inspection.	MI: Affected stakeholders consultation; Coordination with appropriate agencies PT: Zero complaint from affected stakeholders. Resettlement plan followed.	Contractor	SC/PD/DoR
Accidents Hazards and Safety	<ul style="list-style-type: none"> • The contractor will prepare a safety manual for all activities of construction as well as activities at construction camps. This manual will have 	Safety Manual provisions Observation	MI: Safety protocols; Number of incidents and accidents First aid and medical arrangement Safety awareness programs Provision of toilet and waste management facilities to the workers	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/ Mitigation Measures	Monitoring Method	Monitoring Indicator (MI)/ Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
	safety measures to be adopted. <ul style="list-style-type: none"> The safety procedure for transportation of construction materials will also be detailed. Condition will be included in the contract document 		PT: Zero incidents and accidents.		
Quarrying of construction material from recommended quarry sites	Rehabilitation of quarry sites after completion of work.	Site observation, interaction with local people	No cases of material extraction reported from unauthorized sites During construction phase/Once a year	Contractor	SC/PD/DoR
Biological Environment					
Impact on Flora due to Cutting of Trees and removal of vegetation	<ul style="list-style-type: none"> To compensate for 213 numbers of trees to be cut, 5325 numbers of trees will be planted. The project authority will deposit necessary funds to the Department of Forest, Government of Nepal as part of tree cutting permission for the compensatory plantation 	Afforestation Plan	MI: Percent survival of replaced trees PT: At least 90% survival of trees.	CSC/Contractor	DFO/Ilaka Forest Office/SC/PD
Impact on aquatic life	Disturbance to aquatic ecosystem in the water bodies	Interview with local people & observation	MI: Record of fish species (Increase and decrease of aquatic lives in Seti River) Water pollution PT: At least 90% survival of fish species	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/ Mitigation Measures	Monitoring Method	Monitoring Indicator (MI)/ Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
Measures to avoid pressure on forest and wildlife	Use of firewood or fossil fuel by upgrading crew, events of hunting and killing of wildlife/fishes	Inspection and interview with local people	MI: Complaints from DFO Felling of trees haphazardly at upper stream of the project PT: No disturbance to forest products and its resources	Contractor	SC/PD/DoR
Chemical Environment					
Construction Phase					
Use of fuel, lubricants, oils, acids, and other chemicals for construction	<ul style="list-style-type: none"> Chemicals (oils, paints, acids etc) will be disposed in pit safely after use. Used lubricants and oils will be collected and recycled or disposed off site. Plastic sheeting will be placed under hazardous material storage area to collect and retain leaks and spills. Contaminated runoff from storage areas will be captured in ditches or ponds with an oil trap at the outlet. Contaminated and worn plastic sheeting will be packed into drums and disposed off site. 	Periodically/Once in a month	MI: Spillage of chemical components on site Complaints from the locals Haphazard storage of chemical on site PT: No hazardous to human health	Contractor	SC/PD/DoR
Use and Storage of chemicals like bitumen etc	<ul style="list-style-type: none"> The permission from the land owner must be obtained before commencing the storage activities. 	Periodically/Once in a month	MI: Spillage of bitumens on site Complaints from the locals Haphazard storage of bitumen on site	Contractor	SC/PD/DoR

Environmental Issues/Impacts	Enhancement/ Mitigation Measures	Monitoring Method	Monitoring Indicator (MI)/ Performance Target (PT)	Responsible Agency	
				Implementation	Monitoring
	<ul style="list-style-type: none"> • Bitumen drums will be stored in dedicated areas, not scattered along the road and any small accidental spills will be cleared up immediately • Bitumen will be melted in heaters using kerosene, diesel or gas fuel. • No bituminous material will be discharged into side drains. • Bitumen will not be applied in strong wind or rainy conditions. • Fuel wood will not be used for heating bitumen. • The bitumen storage must not be on fertile land and nearby water bodies. • The bitumen handler must be careful while handling the bitumen with safety gears. 		Using forest woods for heating <u>PT:</u> No hazardous to human health		

Appendix G: Environmental Monitoring Plan, Madi Bridge

Appendix G: Environmental Monitoring Plan, Madi Bridge

Environmental Indicators	Project Stage	Parameters	Methods/ Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
Air Quality	Construction Stage	TSPM, PM ₁₀ , NOx, SOx, COx	Stack emission testing	Crusher, hot mix plants, diesel generator	Annual in line with permit renewal	National Ambient Air Quality Standards (NAAQS)	Part of permit renewal	Contractor	SC, /DoR
			Emission testing for all vehicles	Construction camp	Annual as part of permit renewal			Contractor	SC, /DoR
			Ambient air quality sampling and analysis at selected sites/sensitive spots using through High Volume Sampler 24-hour	bridge location	Baseline: 1 sampling each before construction			3 times x SC 22,000/sampling x 5 sites = NRs 330,000.00	DoR
	Operation			Major settlements				DoR	
Water Quality	Construction	BOD, Turbidity, pH, <i>E.Coli</i> , TSS, Oil and Grease	<ul style="list-style-type: none"> Collect and analyse sample from source Observation of blockage of waterways - extent and secondary impacts Water pollution incidents due to unsafe disposal of waste and spoil, analyzing effects on local fisheries Observations on vehicle and equipment washing practices in rivers 	Seti River	Quarterly	Nepal Water Quality Guidelines for the Protection of Aquatic Ecosystems	3 times x 4,000/sampling x 4 sites= NRs 48,000.00	SC	PD/DoR
				Construction camp final discharge effluent				SC	PD/DoR
		Drinking water quality parameters		Construction camp		National Drinking Water Quality Standards (NDWQS)		Contractor	PD/DoR
			Water sampling						

Environmental Indicators	Project Stage	Parameters	Methods/ Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
		Clogging of drains from silt with oil							
	Operation		Visual	All drains	Annually before the on-set of rainy season		Agency budget	DoR	
	Operation Stage			Agricultural Land, oil spillage locations and other probable hazardous materials contamination location or as suggested by SC (3 Locations)	Continuing		Clean up of spills is responsibility of polluter	DoR	

Environmental Indicators	Project Stage	Parameters	Methods/ Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
Noise Levels	Construction Stage	(1 hr Leq dB(A)) WHO Standards	<ul style="list-style-type: none"> Point source measurements in dB (A) at settlement sites/sensitive spots for noise level at 2, 5 and 15 m from road shoulder Traffic volume measurements 	Camp site and major settlement sites	Twice a year during the construction	Nepal Ambient Noise Level as per NHRC	3 times x 15,000/sampling * 5 sites = NRs 120,000.00	Contractor	SC, PD/DoR
	Operation			Major residential, commercial and sensitive receivers along the project corridor or suggested by SC (6 Locations)	Once during the first year of operation		Part of agency budget	DoR	
Landslide and Soil Erosion	Construction	Magnitude, extent and location	Visual	Along the entire stretch	Regular	None	Part of construction cost	Contractor	SC, PD/DoR
	Operation	Magnitude, extent and location		Throughout the road alignment	Regular		Part of agency budget	DoR	
Siltation by rivers and drainage congestion	Construction	<ul style="list-style-type: none"> Siltation and presence of construction spoils and wastes Blockage of waterways - extent and secondary impacts 	Direct Observation	Seti River or as suggested by SC	Continuing during construction phase	Visual Observation	Construction contract	Contractor	SC, PD/DoR
	Operation	<ul style="list-style-type: none"> Siltation Blockage of waterways - extent and secondary impacts 			Annual		DoR Length Person System	DoR	

Environmental Indicators	Project Stage	Parameters	Methods/ Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
Borrow Areas and Quarry Sites	Construction	Location, drainage condition, siltation, erosion, spoil management, etc	Site observation, discussion with workers and local people	Borrow areas, quarry sites location	Quarterly during construction period	Visual Observation	Construction Contract	Contractor	SC, PD/DoR
	Operation	Restoration as recommended in the EMP	Site observation, discussion with workers and local people		Once immediately after the completion of construction		DoR	DoR	
Labour Camps	Construction	Proper siting of food stalls, camp sanitation facilities	Site observation, discussion with workers and local people	Construction and camp sites	Quarterly during construction period	Visual Observation	Construction Contract	Contractor	SC, PD/DoR
	Operation	Restoration of construction camp as recommended in the EMP	Site observation and discussion with local people	Construction sites and camps	Once immediately after the completion of construction		DoR	DoR	
Tree Plantation	Construction	Maintenance of saplings planted as compensation for trees felled	Direct Observation, discussion with workers and local people	Throughout the project corridor	Once a month for one year immediately after plantation	Visual Observation	Included in environmental mitigation cost	DFO	DFO, DoR
	Operation	<ul style="list-style-type: none"> Maintenance of saplings planted during construction Survival rate of trees Growth and development of saplings 	Direct Observation and discussion with local people		<ul style="list-style-type: none"> Once a month for one year for saplings that are less than a year old Once in a year for 5 years 			DFO	DFO, DoR

Environmental Indicators	Project Stage	Parameters	Methods/ Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
Road Safety and Accidents	Construction	<ul style="list-style-type: none"> Accidents (Major and minor) Safety 	<ul style="list-style-type: none"> Record numbers and types of road accidents recorded by the traffic police and the local health service centres Suitability of signs at construction sites Direct observation and discussion with workers and local people 	Throughout the road alignment	Once after the construction begins	Visual Observation, Verification and discussion with workers and local people	Construction contract	Contractor	SC, PD/DoR
	Operation		<ul style="list-style-type: none"> Record numbers and types of road accidents recorded by the traffic police and the local health service centres Suitability of local road signs Records on public road safety awareness campaigns Direct observation and discussion with local people Speed measurements at selected spots 	Throughout the road alignment	Once a year		DoR	DoR	

Appendix H: NAAQS

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) FOR NEPAL

Parameters	Units	Averaging Time	WHO Guideline	Concentration in Ambient Air, maximum	Test Method
TSP (Total Suspended Particulates)	$\mu\text{g}/\text{m}^3$	Annual	120-230	-	HVS 24 hour sampling(one weak sample on 2 road side station
		24-hours*		230	
PM ₁₀	$\mu\text{g}/\text{m}^3$	Annual	70	-	Light Volume Sampling
		24-hours*		120	
Sulphur Dioxide	$\mu\text{g}/\text{m}^3$	Annual	125	50	Diffusive sampling based on weekly average
		24-hours**		70	
Nitrogen Dioxide	$\mu\text{g}/\text{m}^3$	Annual	150	40	Diffusive sampling based on weekly average
		24-hours**		80	
Carbon Monoxide	$\mu\text{g}/\text{m}^3$	8 hours**	100000	10,000	To be determined before 2005
		15 minute		100,000	Indicative sampler
Lead	$\mu\text{g}/\text{m}^3$	Annual	0.5-1.0*	0.5	Atomic absorption spectrometry analysis of PM ₁₀ samples
		24-hours		-	
Benzene	$\mu\text{g}/\text{m}^3$	Annual	-	20****	Diffusive sampling based on weekly average
		24-hours		-	

Notes:

*24 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,

**24 hourly standards for NO₂ and SO₂ and 8 hours standard for CO are not to be controlled before MOPE has recommended appropriate test methodologies. This will be done before 2005,

***If representativeness can be proven, yearly averages can be calculated from PM₁₀ samples from selected weekdays from each month of the Year,

****To be re-evaluated by 2005.

Source: Nepal Gazette B.S. 2060/4/19 (4 August, 2003)

Appendix I: Noise Quality Standard

APPENDIX I

Ambient Noise Level Limits (in Leq dB (A), Nepal)

Environmental Setting	Typical Range of Ldn, dBA	Average Ldn, dBA
High Traffic Area	64-86	74.36
Old Residential Area	59-73	66.28
New Residential Area	48-69	62.00
Commercial Cum Residential Area	69-75	72.75
Commercial Cum Tourist Area	59-76	69.25

Source: Nepal Health Research Council, 2003

Guideline values for community noise in specific environments

Specific environment	Critical health effect(s)	LAeq [dB]	Time base [hours]	LAmx fast [dB]
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
School class rooms and pre-schools, indoors	Speech intelligibility, disturbance of information extraction, message communication	35	during class	-
Pre-school Bedrooms, indoors	Sleep disturbance	30	sleeping -time	45
School, playground outdoor	Annoyance (external source)	55	during play	-
Hospital, ward rooms, indoors	Sleep disturbance, night-time	30	8	40
	Sleep disturbance, daytime and evenings	30	16	-
Hospitals, treatment rooms, indoors	Interference with rest and recovery	#1		
Industrial, commercial, shopping and traffic	Hearing impairment	70	24	110

Specific environment	Critical health effect(s)	LAeq [dB]	Time base [hours]	LAmx fast [dB]
areas, indoors and Outdoors				
Ceremonies, festivals and entertainment events	Hearing impairment (patrons:<5 times/year)	100	4	110
Public addresses, indoors and outdoors	Hearing impairment	85	1	110
Music through headphones/ Earphones	Hearing impairment (free-field value)	85 #4	1	110
Impulse sounds from toys, fireworks and firearms	Hearing impairment (adults)	-	-	140 #2
	Hearing impairment (children)	-	-	120 #2
Outdoors in parkland and conservation areas	Disruption of tranquillity	#3		

Source: WHO, 1999

Appendix J: Drinking Water and Irrigation Water Quality Standards

APPENDIX J**Nepal's Drinking Water Quality Standards & Water Quality for Irrigation**

Group	Parameter	Unit	Maximum Concentration Limits
	Turbidity	NTU	5 (10)**
	pH		6.5-8.5*
	Color	TCU	5 (15)**
	Taste & Odor		Would not be objectionable
	Total Dissolved Solids	mg/l	1000
	Electrical Conductivity	µc/cm	1500
	Iron	mg/l	0.3 (3)**
Physical	Manganese	mg/l	0.2
	Arsenic	mg/l	0.05
	Cadmium	mg/l	0.003
	Chromium	mg/l	0.05
	Cyanide	mg/l	0.07
	Fluoride	mg/l	0.5-1.5*
	Lead	mg/l	0.01
	Ammonia	mg/l	1.5
	Chloride	mg/l	250
	Sulphate	mg/l	250
	Nitrate	mg/l	50
	Copper	mg/l	1
Chemical	Total Hardness	mg/l	500
	Calcium	mg/l	200
	Zinc	mg/l	3
	Mercury	mg/l	0.001
	Aluminum	mg/l	0.2
	Residual Chlorine	mg/l	0.1-0.2*
Micro Germ	E-Coli	MPN/100ml	0
	Total Coli form	MPN/100ml	95 % in sample

Notes:

* These standards indicate the maximum and minimum limits.

** Figures in parenthesis are upper range of the standards recommended.

Source: Ministry of Physical Planning and Works (Nepal Gazette (B.S. 2063/03/12))

Nepal Water Quality Guidelines for the Protection of Aquatic Ecosystem

S.N.	Parameter name		Target Water Quality Range	Chronic Effect Value	Acute Effect Value
1.	Aluminium (mg/l)		At pH <6.5: 5	10	100
			At pH >6.5:10	20	150
2.	Ammonia (µg/L)		< 7	< 15	< 100
3.	Arsenic (µg/L)		< 10	< 20	< 130
4.	Atrazine (µg/L)		< 10	< 19	< 100
5.	Cadmium				
	Soft water	(60 mg/l CaCO ₃)	< 0.15	0.3	3
	Medium water	(60 – 119 mg/l)	< 0.25	0.5	6
	Hard water	120 – 180 mg/l	< 0.35	0.7	10
	Very Hard	> 180 mg/l	< 0.40	0.8	13
6.	Chlorine (Residual) µg/L		< 0.2	0.35	5
7.	Chromium (VI) µg/L		7	10	200
8.	Chromium (III) µg/L		< 12	24	340
9.	Copper µg/L				
	Soft water	(60 mg/l CaCO ₃)	< 0.3	0.53	1.6
	Medium water	(60 – 119 mg/l)	< 0.8	1.5	4.6
	Hard water	120 – 180 mg/l	< 1.2	2.4	7.5
	Very Hard	> 180 mg/l	< 1.40	2.8	12
10.	Cyanide µg/L		1	4	110
11.	Dissolved Oxygen (% saturation)		80 – 120	> 60	> 40
12.	Endosulphan (µg/L)		< 0.01	0.02	0.2
13.	Fluoride (µg/L)		< 750	1500	2540
14.	Iron		The iron concentration should not be allowed to vary by more than 10 % of the background dissolved iron concentration for a particular site or case, at a specific time.		
15.	Lead µg/L				
	Soft water	(60 mg/l CaCO ₃)	< 0.2	0.5	4
	Medium water	(60 – 119 mg/l)	< 0.5	1.0	7
	Hard water	120 – 180 mg/l	< 1.0	2.0	13
	Very Hard	> 180 mg/l	< 1.2	2.4	16
16.	Manganese (µg/L)		< 180	370	1300
17.	Mercury (µg/L)		< 0.04	0.08	1.7
18.	Nitrogen (inorganic)		Inorganic nitrogen concentrations should not be changed by more than 15 % from that of the water body under local unimpacted conditions at any time of the year; The trophic status of the water body should not increase above its present level, though a decrease in trophic status is permissible (see Effects); The amplitude and frequency of natural cycles in inorganic nitrogen concentrations should not be changed.		
19.	pH				
	All aquatic ecosystems		pH values should not be allowed to vary from the range of the background pH values for a specific site and time of day, by > 0.5 of a pH unit, or by > 5 %, and should be assessed by whichever estimate is more conservative.		
20.	Phenols (µg/l)		<30	60	500

S.N.	Parameter name	Target Water Quality Range	Chronic Effect Value	Acute Effect Value
21.	Phosphorus (inorganic) All surface waters	Inorganic phosphorus concentrations should not be changed by > 15 % from that of the water body under local, unimpacted conditions at any time of the year;		
		The trophic status of the water body should not increase above its present level, though a decrease in trophic status is permissible (see Effects);		
		The amplitude and frequency of natural cycles in inorganic phosphorus concentrations should not be changed.		
22.	Selenium (µg/l)	< 2	5	30
23.	Temperature (All aquatic ecosystems)	Water temperature should not be allowed to vary from the background average daily water temperature considered to be normal for that specific site and time of day, by > 2 oC, or by > 10 %, whichever estimate is the more conservative.		
24.	Total Dissolved Solids (All inland waters)	<ul style="list-style-type: none"> TDS concentrations should not be changed by > 15 % from the normal cycles of the water body under un impacted conditions at any time of the year; The amplitude and frequency of natural cycles in TDS concentrations should not be changed. 		
25.	Total Suspended Solids (All inland waters)	Any increase in TSS concentrations must be limited to < 10 % of the background TSS concentrations at a specific site and time.		
26.	Zinc (µg/l)	< 2	3.6	36

Source: Department of Irrigation, Ground Water Project (Nepal Gazette (Number 10, B.S., 2065-03-02))

Appendix K: Solid Wastes, Borrow Pits and Quarry Sites Management, and Disposal Management Guidelines

Appendix K**Solid Waste Management Plan**

The document provides guidance on the management of solid waste arising from the rehabilitation of 81-km road and 2 bridges. The Contractor shall prepare the solid waste management plan prior to mobilization and road construction. The Contractor shall be responsible for managing solid wastes to be generated by the project.

A, Sources of Solid Wastes

The sources of solid wastes for the proposed project will come from demolition / site clearing of existing roads and bridges. These include excavated natural material, excavated public road and bridges, vegetation (logs, mulched trees, and weeds), recovered aggregate and reclaimed asphalt.

B. Classification of Waste Streams and Proposed Actions

Aspects	Type of Wastes	Proposed Action
Demolition / Site clearing	Vegetation	Offsite reuse as timber Reuse onsite for erosion and sediment control Weeds to be buried onsite or used as compost for agriculture purpose
	Concrete, asphalt and gravel	As found suitable, reuse of scarified materials as filling materials for local earthen roads Inert construction wastes to be used to reclaim borrow pits (see F. Site Reclamation, Appendix K)
	Scrap metal	For recycling
Earthworks	Soil	Optimize reuse by balancing cut and fill earthworks Excess soil can be used to rehabilitate borrow pits
Road construction	Steel reinforcement	Recycling
	Pipes	Disposal
	Concrete and asphalt	Disposal
	Formwork (timber)	Disposal / Recycling as applicable
	Empty drums used for oil / fuel storage	Disposal
	Hazardous wastes including paint	Disposal
	Metals and electric cables	Recycling

Equipment, vehicle, workshop operation and workers' campsite	Wastes from equipment maintenance	Disposal
	Oil, grease, fuel, chemicals and other fluids	Recycling or disposal, where applicable
	Batteries	Recycling
	Domestic wastes from workers	Disposal
	Sewage	Disposal
Contractor's office	Paper, cardboard and plastics	Recycling
	Glass bottle and aluminum cans	Recycling
	Food wastes	Disposal
	Effluent	Disposal
	Ink cartridges	Recycling

C. Responsibilities

The Contractor will coordinate with local authorities, who will be responsible for the collection, treatment and final disposal of solid wastes generated within their jurisdiction, in the disposal of solid wastes that will be generated by the project. Bulk of the wastes will be generated during demolition / site clearing of the existing road and bridges. As maybe found suitable, concrete, asphalt and gravel from site clearing can be used as filling materials for local earthen roads. The Contractor will also be responsible in coordinating with service providers to recycle and to dispose wastes that will not be accepted by the local authorities. The management of solid wastes will be governed by the Solid Waste Management Act of 2011.

D. Disposal Site Guidelines

The guidelines for disposal of solid wastes from the construction of the road and two bridges will be governed by the Solid Waste Management Act of 2011. The law assigns responsibility to the local body for the management of solid waste by construction and operation of infrastructure like transfer station, landfill site, processing plant, compost plant, biogas-plant and also collection of waste, final disposal and processing. On the other hand, the responsibility for the processing and management within the set standard of harmful waste, health institution related waste, chemical waste or industrial waste shall be of the individual or body producing such solid waste. For the project, this means that all harmful wastes identified above in section B will be the responsibility of the contractor or the service provider that will be engaged by the contractor. The rest of the wastes, except for earthworks spoils and inert wastes from the demolition of the road that can be used to reclaim borrow pits, will be disposed in the landfill sites available within the 81-km road project.

The Solid Waste Management Act mandates that specific guidelines for the operation of the landfill as well as its closure shall be carried out according to the prescribed environmental standard. In Nepal only six municipalities i.e. Kathmandu, Lalitpur, Pokhara, Dhankuta, Tansen and Ghorahi practice sanitary landfill for waste management and other municipality practices open dumping which has become major cause of environmental and human health hazards (ADB, 2013). This means that for wastes destined for disposal to sanitary landfill, only Pokhara can accept the wastes as the other municipalities with landfill are too distant from the project.

To ensure that wastes to be disposed to sanitary landfills are within environmental standards, albeit existing specific guidelines are not yet available, the following minimum criteria are proposed:

- Landfill shall have fence in its perimeter to clearly demarcate its boundary and only authorized persons are allowed to enter the landfill.
- Disposed wastes must be regularly covered with soil.
- The landfill shall have facilities for waste segregation and storing of recyclable materials such as plastics.
- There must be provision for organic composting inside the landfill.
- Runoff and leachate shall be collected by a network of drains leading to a leachate treatment system.
- A buffer zone shall be established within the landfill.

Borrow Pit and Quarry Site Management Plan

The document provides guidance on the management of borrow pits. The Contractor shall prepare a site specific borrow pit management plan prior to mobilization and road construction. The Contractor shall be responsible for managing borrow pit operation.

A. Site Assessment and Selection

- Contractor must identify the borrow areas before start of construction and submit these details with rehabilitation plan. A preliminary assessment prior to excavation works should include written approval for use of the proposed site from the local authorities, confirmation of extent and quality of materials through geotechnical site investigation, and defined boundary through survey to limit the extent of excavation. Hydrogeological investigation must also be conducted to determine the presence and depth of groundwater table.
- Borrow area will be from land acquired temporarily and located at least 500m away from the road;
- Borrow areas will be located in wasteland and not cultivable lands. However, if it becomes necessary to borrow earth from temporarily acquired cultivated lands, their depth will not exceed 45 cm
- The borrow pit operational site must have an undisturbed buffer area of natural vegetation of a minimum of 25 meters in width around the perimeter of the site – excluding entry roadway with a maximum width of 5 meters.
- Quarry site should be located at least 1 km away from the villages/settlement area, drinking water supply sources, community infrastructure such as school, health post, bridge, etc., religious sites, cultivated land, protected forests, and natural drainage systems.
- Quarry and borrow pit should not be located in wetland or wildlife conservation area.
- River gravel will not be extracted from flowing water due the disturbance of increased sediment and danger of resulting oil/fuel leaks.
- Quarry sites should be selected in stable area, in agriculturally unsuitable land and away from the abovementioned sites. In addition to this, local communities will be consulted and take approval from respective owner before selecting the place for quarry operation.

E. Borrow Pit Operation

The area for borrow pit operation shall include extraction site, buffer zone, perimeter berm, stockpiles (i.e. top soil and overburden) and area for general operations.

1. Stockpiles

- Depending on geotechnical site assessment, topsoil, with a depth that ranged between 15 and 50 cm, shall be stripped and stockpiled away from other materials. Topsoil shall only be used for reclamation purposes when the operation of the borrow pit is complete. The height of the stripped topsoil should not exceed 2 meters and with side slopes not steeper than 1:2 (vertical to horizontal ratio).
- Overburden soil (i.e. the layer of soil below the topsoil and above the material of interest) shall be used as a perimeter berm to channel drainage on the site or stockpiled separately from topsoil and later used to landscape and backfill exhausted areas of the borrow pit.

2. Excavation slopes

- Pit excavations shall have a maximum depth of 6 meters with a maximum slope of 2:1 (horizontal to vertical).
- Pit excavations exceeding 6 meters should be fenced around the excavation.

3. Lifespan of operation of borrow pit

- The lifespan of the borrow pit site should be based on the geotechnical assessment, extraction rate and the duration to reclaim the site.

F. Environmental protection and public safety measures

- The contractor must install a barrier or perimeter berms in borrow pit extraction area to restrict public access. A full-time guard may also be posted on the site until borrow pit reclamation is completed.
- The entrance to the borrow pit site must be gated to discourage illegal access.
- Warning signs must also be posted around the perimeter of the borrow pit area to prevent people from entering.
- Stagnant water in borrow pit is not permitted. Water must be extracted by pumping, or through drainage structures. Excavated sites with standing water must be fenced with warning signs. In addition, guard maybe posted full time to prevent illegal access. Community will not be allowed to use the standing water for purpose such as watering animals or washing of clothes.
- The contractor must constantly liaise with the local community on borrow pit operation and the potential hazards on people accessing the site illegally.
- Allow a minimum of 25-meter vegetation as buffer between the borrow pit site and nearby residents and road.
- Implement erosion control measures in all aspects of pit operations including stockpiles and access roads. These include reduced slopes (less than 50% grade), seeding, water spraying, speed limit for vehicles and stockpile covers to protect stockpiles and the adjacent land.
- If a rock crusher is used, dust control measures shall be undertaken by using water truck or sprinklers on crushing equipment.

G. Site Reclamation

Site reclamation (reinstatement) should be completed prior to handover of completed road section.

- Overburden stockpiles and perimeter berms shall be placed on the excavated site and graded to the desired slopes and drainage paths.
- Reserved topsoil shall be spread on top of the overburden stockpiles.
- Drainage canals shall be constructed as needed to prevent water from stagnating at the site.
- Final slopes within the site shall be a maximum horizontal to vertical slope (H:V) of 3:1.
- The borrow pit operational site including access roads shall be thoroughly free from debris to help establish vegetative cover.

Disposal Management Plan

- Redevelopment plan will be prepared by the contractor before the start of work which should be duly agreed upon by land owner.
- Borrow pits will be backfilled with rejected construction wastes and covered with vegetation.
- Borrow areas might be used for aquaculture in case landowner wants such development.
- Borrow pits located near habitat areas will be re-developed immediately after borrowing is completed.
- Prohibit dumping of waste except inert construction rubble

Records: The following records will be maintained:

1. List of Borrow areas identification with capacity and rehabilitation plan
2. Agreement with land owners where applicable
3. Details of Earth excavated
4. Closure report of rehabilitated borrow pits.

Reporting:

The Borrow area opening, earth borrowed and borrow area rehabilitation details will form part of half yearly report

Responsibility:

- Prime Responsibility: Contractor will be responsible for borrow area management and reporting
- Supervisory Responsibility: Supervision Consultant will check compliance with the above guidelines.

Payment

The payment of each works structure should only be made after filling of the data by the Contractor for borrow pit and quarry management and restoration plan and acceptance by the Supervision Consultant. Final payment will be dependent on verification and approval by SC at the end construction of each respective structure.

Appendix L: Photographs

	
<p>Plate 1: New Bridge Location, Trishuli River</p>	<p>Plate 2: Marsyangdi Hydropower Powerhouse, (Ch. 4+100)</p>
	
<p>Plate 3: Abukhaireni Bazar, (Ch. 6+800)</p>	<p>Plate 4: Road section through Bimal Nagar (Ch-20+075 to Ch-21+400)</p>

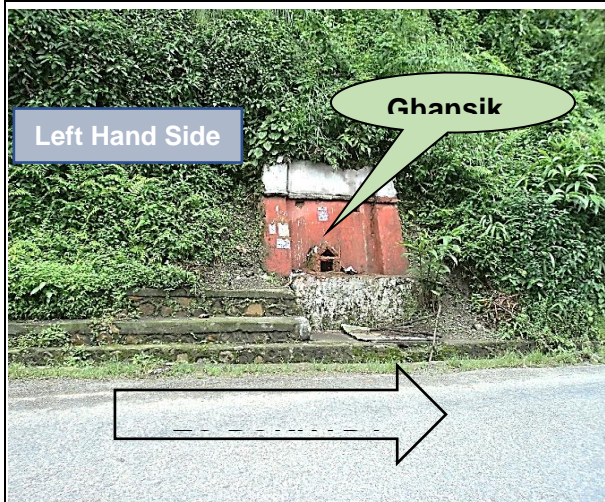


Plate 5: Ghasikuwa at ch. 36+870 along the road alignment



Plate 6: Dumre Bazaar at Ch. 23+668



Plate 7: Major landslide between Ch. 5+825 to Ch. 5+875



Plate 8: Forest in the project area



Plate 9: Tree measurement



Plate 10: Affected Structure



Plate 11: Affected Structure



Plate 12: End Point, Seti Bridge, Ch. 88+583