



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

**Development Cooperation Implementation Division
(DCID)**
Jwagal, Lalitpur

Strategic Road Connectivity and Trade Improvement Project (SRCTIP)

**Improvement of
Naghdhunga-Naubise-Mugling (NNM) Road**

**Environmental and Social Impact
Assessment (ESIA)**

Prepared by

**Environment & Resource Management Consultant (P) Ltd.
JV with Group of Engineer's Consortium (P) Ltd., and Udaya Consultancy (P)
Ltd.Kathmandu**

April 2020

EXECUTIVE SUMMARY

Introduction

The Government of Nepal (GoN) has requested the World Bank (WB) to support the improvements of existing roads that are of vital importance to the country's economy and regional connectivity through the proposed Strategic Road Connectivity and Trade Improvement Project (SRCTIP). The project has four components: (1) Trade Facilitation; (2) Regional Road Connectivity; (3) Institutional Strengthening; and (4) Contingency Emergency Response. Under the second component, this project will carry out the following activities: (a) Improvement of the existing 2-lane Nagdhunga-Naubise-Mugling (NNM) Road; (94.7 km on the pivotal north-south trade corridor connecting Kathmandu and Birgunj) to a 2-lane with 1 m paved shoulders, and (b) Upgrading of the Kamala-Dhalkebar-Pathlaiya (KDP) Road of the Mahendra Highway (East West Highway) from 2-lane to 4-lane. An Environmental and Social Impact Assessment (ESIA) was undertaken during the detailed design phase of the NNM Road to assess the environmental and social risks and impacts of the NNM Road before execution of the project in accordance with the Government of Nepal's (GoN) requirements and the World Bank's Environmental and Social Framework (ESF). The KDP Road is covered by a separate upstream Environmental and Social Assessment (ESA) based on pre-feasibility information since the feasibility study of KDP road has just commenced recently. The ESA will serve as the basis for the detailed ESIA during the detailed design stage of the KDP Road.

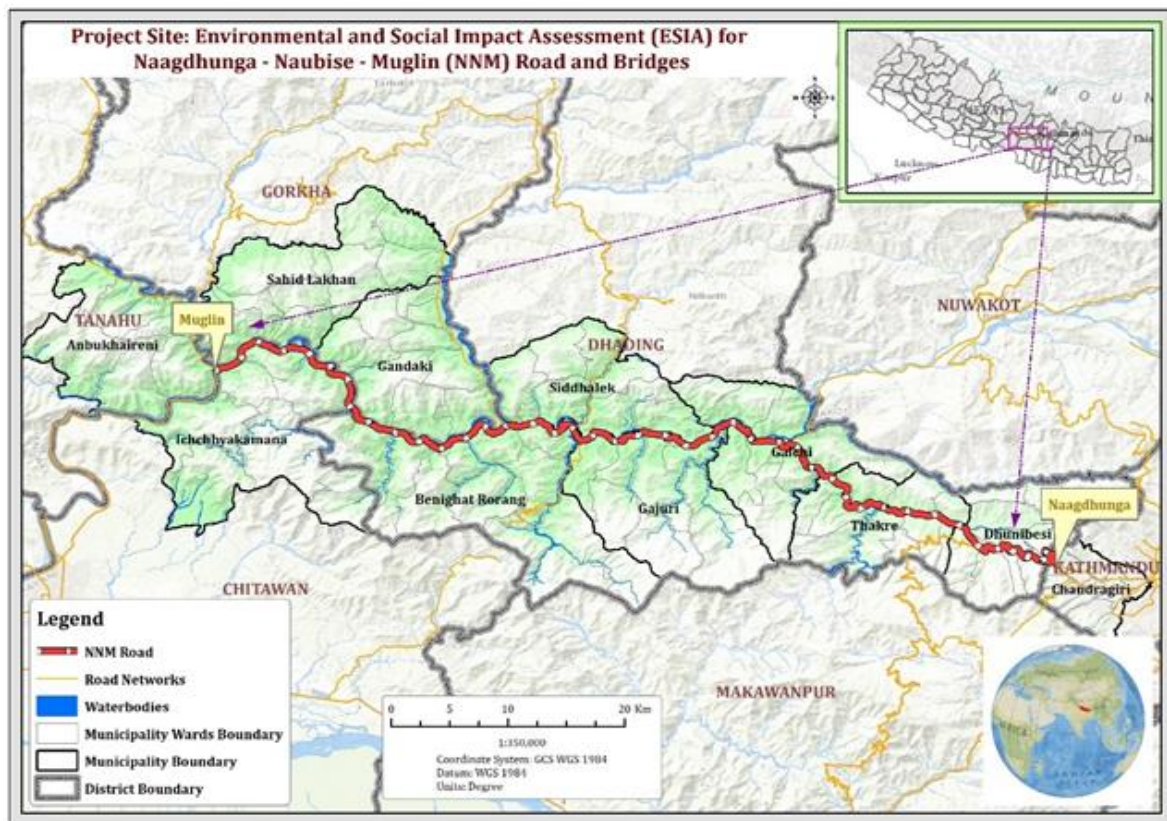
Project Description

The total length of the NNM Road is comprised of Nagdhunga-Naubise (12.3 km) (part of Tribhuvan Highway (TH) and Naubise-Mugling (82.4 km) (part of a Prithvi Highway (PH). The road is located in Kathmandu, Dhading and Chitwan districts of Province 3. The alignment begins at the Nagdhunga check-post and passes through Naubise, Khanikhola, Mahadevbesi, Galchhi, Baireni, Malekhu, Benighat, Kurintar, ending at Mugling. The road section has a junction with TH at Naubise. The highway also connects Nuwakot District via a newly constructed road in Galchhi and connects to the district headquarters of Dhading District at Phurke Khola, Malekhu. Similarly, at Mugling the highway has junction of Mugling-Narayanghat Road Section connecting this highway to Mahendra Highway (MH).

The existing NNM Road will have a carriageway width of 7 meters and shoulder width of 1 to 2.5 meters from its current carriageway of 5.5 to 6.5 m and existing shoulder of 0.5 to 1m. Improving road safety will also be a key feature of NNM Road improvement works and will include the installation of signages and imposition of speed limits.

The NNM Road is one of the key roads connecting Kathmandu to Terai Region on the way to Indian border and other major cities of Nepal such as Pokhara (a major tourist destination), Narayanghat and Birgunj. The improvement of the NNM Road will provide better accessibility and driving/riding quality, ensuring efficient transportation and better traffic and road safety. It will also facilitate the development of physical infrastructure, contributing to local and regional development, economic initiatives and improvement of local wellbeing. The original ESIA work was carried out in 2016-2018, in accordance with Environmental Protection Act

Map of Existing Road alignment



(EPA) 1997, Environmental Protection Regulations (EPR) 1997 and WB Operational Policies¹. The ESIA report was submitted to the WB as per the requirements. The WB issued the new Environment and Social Framework (ESF) in 2018, and accordingly this ESIA report has been updated to meet the requirements of the ESF.

Scope of ESIA

The scope of the ESIA is to: i) update the existing baseline status of the environment within the Corridor of Impact and Project Zone of Influence; ii) identify the additional probable adverse and positive environmental and social (E&S) risks and impacts due to the planned project during its entire cycle, that is, from preconstruction to construction, to operation and maintenance; iii) consider all Environment, Health and Safety (EHS) risks and impacts likely in the project to address as part of preparation of the Stakeholder Engagement Plan (SEP), Labour Management Procedure (LMP), Gender Based Violence (GBV) Risk Mitigation Action Plan for the NNM Road.

Legal and Institutional Framework

Nepal's national legislative framework, WB ESF and EHS guidelines form the legal and institutional framework for this ESIA at different stages, including the assessment and development of mitigation measures to be complied with during pre-construction, construction and operational stages.

¹(particularly Environmental Assessment EA (OP 4.01), Natural Habitats (OP 4.04), Indigenous People (OP 4.10), Physical Cultural Resources (OP 4.11), Physical Cultural Resources (OP 4.11), Involuntary Resettlement (OP 4.12), Forests (OP 4.36).

This section of the ESIA provides an overview of the applicable environmental and social policies, legislative and institutional frameworks, which the project will be required to comply during its implementation. The national legal and institutional framework is based on the Constitution of Nepal (2015), which provides the right of everybody to live in clean and healthy environment as well as to conserve, promote and make sustainable use of natural resources. A detailed analysis of the existing legislative framework in Nepal was undertaken, which included a review of all relevant documents such as development plans, strategies, policies, Acts and rules. The national directives, guidelines, manuals and standards help to fulfil the requirements of the regulatory framework, providing useful practical tools, applicable at the level of project implementation.

The existing regulatory framework was analysed and tabulated, highlighting relevant key provisions to the NNM Road ESIA. Some of the important laws and regulations reviewed included (but not limited to) the following: The Road Safety Action Plan (2013-2020), Nepal National Biodiversity Action Plan (2014-2020), Nepal National Environment Policy (2019), Forest Policy (2015), Labour Policy (2005), Land Acquisition, Resettlement and Rehabilitation Policy (2015), Environment Protection Act (2019), Forest Act (2019), Control of International Trade of Endangered Wild Fauna and Flora Act (2017), Labour Act (2017), Child Labour (Prohibition and Regulation) Act (2000), and Land Acquisition Act (1977) with amendments, Labour Rules (2018), Water Resources Regulation (1993), Industrial Policy (2010). Nepal, being a signatory party for many international conventions and other treaties, is bound to address the vital environmental and social issues transboundary or global in nature such as pollution, climate change and biodiversity conservation. The provisions of international treaties have been taken into account during ESIA process.

Baseline Environmental and Social Conditions

The baseline assessment from 2016-2018 and recent updates assessed key environmental attributes like physiography, drainage, geology, soil, hydrogeology, land use, flora, fauna, forest/vegetation cover, climate, ambient air quality, water quality, ambient noise levels, hazards and vulnerability. It also assessed social attributes such as private assets, cultural heritages, public utilities, Indigenous People (IPs), vulnerable groups, project-affected groups, GBV and OHS related to the proposed project.

Physical Environment: The highest point along the NNM Road is at Nagdhunga (1,500 m). The road alignment passes through a hilly area from Nagdhunga to Naubise. From Naubise, the road alignment goes along the river valley of the Mahesh Khola up to Galchhi. After Galchhi, road alignment follows the left bank of the Trishuli River valley upto Mugling, which is the lowest point of the road (265 m). Geologically, the project area belongs to the rocks of the Lesser Himalaya and falls in Central Nepal. The lithological units available within the project district are carbonaceous schist, limestone schist, dolomite and Gneiss schist and three types of soil namely, colluvium, residual and alluvium. Historically, the highway has been in very bad condition due to a number of slope failure sites and landslides. The entire section of the road from the Manakamana cable car station to Mugling from Km 90+1 00 to Km 92+500 presents an old landslide zone. However, only the road section from Km 91+900 to 92+500 for about 600 m is currently an active landslide zone. The rest of the section has been stabilized in

due course of time². The road section (125 m) at Jogimara 66+800 to 66+925 is also a potential rock fall zone.

The air quality, monitored in various locations, showed that all parameters were within the National Ambient Air Quality Standard (NAAQS) except for the PM₁₀ and PM_{2.5}. The observed equivalent noise pressure levels were found to exceed the National Noise Quality Standard Limit (NNQSL) and Occupational Safety and Health Association (OSHA) TLV guideline. In terms of water quality, fluoride level was found to be lower than the National Drinking Water Quality Standard (NDWQS)³ limit in all water samples. Iron was high in the water sample of Agra Khola, Majhimtar across Trishuli River and near Shree Chandrodaya H. S. School at Trishuli River. The water was found to be contaminated with Coliforms in all samples. Coliforms, iron and sediment content were found high in the water of Agra Khola and Trishuli river. Aggregate (sand, gravel, etc.) washing activities were found to be impacting the water quality in Trishuli river and its tributaries.

Biological environment: The biological environment along the NNM Road is represented by 5 forest types, 16 mammal species, 276 bird species, and around 10 amphibian and reptile species. Mostly, common species associated with anthropogenic environment and highly disturbed landscapes occur in the project area and were found during systematic surveys conducted along the road although some critically endangered and endangered species were also recorded along remaining forest patches in mountain streams and rivers within the 2-km radius indirect impact area of the project, but outside the 50-m ROW and 300-m direct impact area. The road was built in 1973 and the territory is heavily populated by human settlements. Wildlife is found only in small forest patches along rivers, mountain streams and in the remaining mountain forests, which provide habitats for animals, well adapted to live in such conditions. Many invasive plant species grow along the ROW, indicating the high degree of disturbance of natural habitats. The project area comprises 28 community forests, 7 government and 6 leasehold forests.

Socio-economic and Cultural environment: The project area covers Kathmandu, Dhading, and Chitwan districts and lies in Chandragiri and Dhunibeshi municipalities and Thakre, Galchhi, Gajuri, Ichchhakamana rural municipalities. The major settlements include Khanikhola, Naubise, Dharke, Mahadevbesi, Galchi, Gajuri, Baireni, Majhimatar, Malekhu, Benighat, Charaudi, Kurintar, Ramailo Danda, and Mugling. The caste and ethnic groups found in project area are Brahmin, Chhetri, Sanyashi, Dalit, Muslims, Madheshi and Janajatis/IPs. There are six IP communities namely Newar, Gurung, Magar, Tamang, Chepang and Bhujel, who have collective attachment to the land in the project area. The project area delineation of proposed road alignment is divided into Zone of Influence (ZoI), Indirect Impact Area (IIA) and Direct Impact Area (DIA). The project affected municipalities and rural municipalities are considered to be the ZoI of the project. The adjoining wards and adjacent area within 2 kilometres on either side of road alignment are considered as the IIA. DIA of the project includes all the areas, where construction-related activities will take place. The areas within 150 metres on either side from the centreline of the road (that is, a total width of 300 metres)

² The road alignment is considered starting from Nagdhunga

³ The NAAQS, NNQSL, OSHA and NDWQS guideline provided in chapter 4 (section 4.1)

has been considered as the DIA. The Corridor of Impact (CoI) is considered as 30 metres (15m on either side of the centreline), within the 50 metre (ROW). The total population within the DIA is 16,959. Out of this population, the number of males and females are 8,407 and 8,550 respectively. The total number of households affected by the project is 78. The population of the project-affected households is 407.

Stakeholder Engagement and Public Consultation

Stakeholder engagement is an inclusive process to engage stakeholders throughout the project lifecycle. ESS10 Stakeholder Engagement and Information Disclosure recognizes the voice of different stakeholders. Stakeholder consultations, carried out during ESIA preparation, addresses the issues of directly and indirectly affected groups, including local government rural municipalities (RM) and municipalities (M). Additional stakeholder consultations were carried out during updating of the ESIA to incorporate issues of project affected groups and other interested parties.

In addition to project-affected parties, other identified stakeholders are: local governments (2 M & 5 RM), local non-governmental organizations (NGOs), civil society, teachers, political leaders, women groups, local entrepreneurs, vulnerable and indigenous peoples (IPs), differently-abled people and marginalized groups, local business groups and suppliers (such as United Cement, Kepy Cement, gas bottling plants and stone crusher plants, etc.), local user groups (forest, water, irrigation etc.), local journalists, security personnel (traffic police and army), travel agencies, drivers and road users (including travellers).

Discussions during preliminary study (pre-feasibility) were organized to share information to the local people of project-affected wards of RM/M. Initial walkover surveys were carried out followed by individual interviews with local government officials. The tools such as Focus Group Discussions (FGD) and Key Informant Interviews (KII) were used to conduct discussions. Preliminary consultation held during the pre-feasibility stage were carried out at three different locations: Dhunibesi M, Gajuri RM and Benighat Rorang RM on 27-30 January, 2017. A total of 115 participants took part, comprising 104 males and 11 females. The participants were only from the indirectly affected groups. Public hearings were carried out at four different locations of Dhunibesi M, Galchi RM, Benighant Rorang RM and Ichhankamana RM with a total of 259 participants, comprising 228 males and 31 females.

Supplementary consultations were carried out at 22 different locations of the affected RM/M focusing on female groups (210 females and 86 males out of 296 participants) in June 2018. Additional consultations with the specific groups such as women, vulnerable/IPs, project affected parties, other interested parties were carried out during May-November, 2019 to fill gaps present in consultations with direct affected groups (project affected vulnerable groups and IPs), and other interested parties (broader and general groups) were still present after the public hearing and supplementary consultations. The total number of participants in the additional consultations were 252, comprising 171 females and 81 males.

During consultations, the key issues raised related largely to social aspects and included: compensation for impacted land; affected private and public structures and utilities; construction of footover bridges near schools and major market places; construction of

vegetable collection centres; gender-friendly public toilets with refreshment centres; landslide risks during construction of road; grievance redress mechanisms (GRM); gender-based violence (GBV) related issues; priority for local employment (including females); and stakeholder engagement during road upgrading works.

Analysis of Alternatives

An analysis of alternatives was based on safety considerations, geometric improvements with current traffic and future projections, and social and environmental impacts. Six alternatives were proposed in the ESIA:

- i) The first alternative considered the improvement of existing road to a 2-lane standard with curve improvement, an additional 2 bridges, and expansion to a 4-lane in urban areas;
- ii) The second alternative was to improve existing road to a 2-lane standard with curve improvement, a tunnel bypass and 4-lanes in selected urban areas
- iii) The third alternative included improvement of the existing road to a 2-lane standard with curve improvement, construction of a new 2-lane road alignment from Sisnekhola to Dharke, and expansion to a 4-lane in selected urban areas
- iv) The fourth alternative included minor improvements in the 2-lane standard, construction of new lane from Sisnekhola to Dharke, construction of 4-lane road from Dharke to Benighat, improvement of the existing road from Benighat to Mugling into two lanes, and a 2-lane new alignment on right bank of Trishuli River from Benighat to Kurintar
- v) The fifth alternative proposed the improvement of the existing road from Nagdhunga to Dharke into a 2-lane standard with curve improvement, a tunnel bypass and construction of a new 2-lane new alignment from Sisnekhola-Dharke, construction of a 4-lane road from Dharke to Benighat, improvement of the existing road from Benighat to Mugling into 2-lane, and 2-lane new alignment on the right bank of Trishuli River from Benighat to Kurintar.
- vi) The sixth alternative included improvement of the NNM Road into a 2-lane Asian Highway Standard including two bypass sections.

In assessing the six alternatives, the first three alternatives would have less impacts on the environment but would have more social impacts specifically on land acquisition in urban areas. They would also entail lower costs for construction, however, they would not adequately address the problems of road congestion. The fourth and fifth alternatives were recognized to pose more physical, biological and socio-economic impacts. Accordingly, the sixth alternative was chosen for the ESIA as it minimizes impacts on environment. In this updated ESIA, the sixth alternative has been studied without the two new bypass sections as the GoN has decided to drop the bypasses from the improvement works along NNM road to further reduce land acquisition and social impacts.

Environmental and Social Risks and Impacts

Beneficial impacts from the NNM Road improvement include facilitated economic development, covering generation of employment and arising opportunities for businesses, access to services and markets, improved road infrastructure contributing to safety issues and better transportation. Beneficial impacts are related to the improvement of road infrastructure

and its technical efficiency, economic development and livelihoods of the local people. Also, the project after completion will bring the carbon savings due to efficiency in road use. Extrapolation of the carbon savings shows that a net 146,938 tonnes of carbon emission will be saved between 2020 and 2042.

All impacts were categorized as per the ESF and ranked against risk assessment criteria as high, substantial, moderate or low. The following sections summarize the environmental and social risks and impacts likely due to the road improvement project by each relevant environmental and social standard.

Assessment and Management of Environmental and Social Risks and Impacts (ESS1): The improvement works of NNM road that will be carried out within the existing ROW, and with small land acquisition outside the ROW, and minimal tree cutting and habitat disturbance are assessed to have moderate to substantial risks and impacts that are largely construction-related and short-term. Impacts mainly relate to environmental degradation, increased risk to health and safety of workers and communities, increased traffic flow and traffic-related accidents and social issues related to increased labor influx such as gender-based violence (GBV) and child labor, all expected to take place during construction. The improvements of NNM Road is also assessed to have no significant cumulative impacts as works are mainly confined within the existing ROW and in an area that has already been altered, fragmented and highly disturbed for many decades as a result of human population growth, encroachment and establishment of new settlements along the highway, land transformation, agriculture development and other associated development. With or without improvement works in NNM Road, land use change and land transformation have already taken place and will continue to take place as a result of other factors such as decentralization, urbanization and development of rural areas on the way of shift to decentralization. In addition, the surrounding rural roads have been constructed in recent years, often without any environmental assessment and mitigation measures. Increased density of the road networks and lack of protective measures have aggravated the adverse impacts on environment that have already taken place such as siltation and sedimentation of river, increased barrier effect for wildlife movement, threat of poor water drainage and community health and safety. The impacts might be exacerbated by climate change and uncoordinated development of local communities, which may cause significant economic losses. The improvement of NNM Road will affect private structures of 6 HHs considered as vulnerable and disadvantaged, comprising four women-headed households and two Dalits households.

Labour and Working Conditions (ESS2): The NNM Road project will employ direct, contracted and primary supply workers who may be exposed to risks such as poor conditions in labor camps, non-payment of wages or other benefits, discrimination in employment, child labour or forced labour, occupational health and safety (OHS) issues which may arise include workplace accidents, grievances related to workers and GBV. The contracted workers are more susceptible to such risks.

Resource Efficiency and Pollution Prevention Management (ESS3): ESS3 refers to a number of risks and impacts including landscape aesthetic, air and noise pollution, potential hazards and solid waste management, and pollution of water sources. The project's impacts and risks

would be of significance on sensitive receptors due muck disposal; slope stability and erosion; blocking or filling of springs and seasonal streams; construction water demand; stressing water sources used by community (absence of perennial water sources); emission from construction vehicles, equipment and plants; dust from earth works, hill cutting, stock yard, transportation of materials, noise pollution and settlements along road; damage to structure vibration from movement of machine and equipment (structure on embankment); handling of hazardous and non-hazardous wastes, quarry and borrow area. All these impacts are more prominent during construction stage and can be managed through specific measures described in the mitigation chapter according to national standards for air, noise and water quality as well as through best practices applicable to road construction projects.

Community Health and Safety (ESS4): Transporting construction materials may cause nuisances to the local communities. Project activities such as hill cutting, road excavation, and the use of vibration equipment might result in landslides/mass wasting, and dust pollution. The stockpiling of construction materials, debris generated during construction may disturb the landscape and cultivated lands and contaminate the water bodies. Impacts to existing traffic is likely with the construction activities and plying of construction vehicle, and storage of construction materials in proximity to the existing highway. The presence of outside labour force in the project area may cause negative impacts on environment and local communities and should be managed to prevent conflict situations, including GBV. The project area lacks a well-defined and coordinated response mechanism. GBV risks associated with labour influx indicate a ‘substantial’ level of GBV risk⁴. Furthermore, a lack of institutional and infrastructural capacity of the GBV service providers may result in inefficient responses to GBV survivors. Further, risks associated with labour influx and increased mobility of outsiders may aggravate the spreading of communicable diseases including HIV/AIDS and STIs.

Land Acquisition, Restrictions of Land Use and Involuntary Resettlement (ESS5): In total, there are 78 project-affected households (HHs), comprising 68 HHs who are affected through impacts to private structures, and 10 HHs who are affected through the acquisition of private land for the project (0.20 hectares). The 68-project affected HHs will lose 76 private structures, and the 10 HHs will have impacts to 11 land parcels. Out of the 78 total project affected HHs, 23 HHs will lose residence only, 34 HHs will lose residence plus small business structures, and 11 HHs will lose business structures only. Of the 78 project-affected households, six HHs are vulnerable HHs, comprising four women-headed HHs (3 Brahmins HHs and 1 Chhetri HHs) and two Dalits HHs. The project will affect nine public structures (three temples, two public taps, two public toilets, one study center and one waiting shed). Further, 1,161 electric poles and drinking water supply (DWS) pipes⁵ will require relocation. Construction-related impacts during project implementation will be managed as per the procedures outlined in the Resettlement Action Plan (RAP) for the NNM Road project.

Biodiversity Conservation and Sustainable Management of Living Natural Resources (ESS6): The habitats in the ROW and in surrounding areas of the NNM Road is already fragmented

⁴ Adapted from WB GBV Action Plan for SRCTIP

⁵ (Water supply pipeline of diameter of 1 inch (0.64 km, GI; 34.7 km, PVC), 0.5 inch (2 km, PVC), 1.5 inches (2.3 km, PVC) and 2 inches diameter (5.62 km, PVC)) will require relocation

and anthropogenic pressure on the area is very much prevalent due its long history of development and human settlements. Based on a critical habitat screening conducted following the criteria for critical habitats under Environmental and Social Standard (ESS) 6 and IFC Performance Standard 6, the ESIA showed that the project zone of influence (i.e., within the 50-m ROW, 300-m Direct Impact Area from the center of the road and 2-km radius Indirect Impact Area) has the recorded presence of critically endangered and endangered species of animals and plants within the remaining forest patches along rivers and streams, but not within the ROW nor within the direct physical footprint of the project nor in the direct impact area. The ESIA further indicated that the improvement of the existing NNM road will only affect a total of 4 hectares scattered along the entire ROW out of 57 hectares of forest. The direct impact involves the cutting of a total of 52 trees and some poles. The physical works itself within the ROW will not adversely impact on habitats for critically endangered and endangered animals. Given the small forest clearance involving 52 trees and some poles along the ROW, it is assessed that the global population of critically endangered and endangered species will not be adversely affected. In addition, there are also no protected areas, wildlife reserves or wildlife migratory corridors along the NNM road. For every tree that will be cut, the project will replant 25 trees in an area designated by the Forest Department to meet the requirement of the GoN.

Indigenous People (ESS7): There are six indigenous peoples (IP) communities in the project area namely Newar, Gurung, Magar, Tamang, Chepang and Bhujel. These IP communities are located outside the ROW where the project interventions will take place. The project will not cause any direct impacts to their land, will not cause the relocation of any of the IP communities, and will not cause impacts to cultural heritage of the IP communities. The potential impacts and risks to these IP communities relate to labour influx, GBV, traffic safety, air and water quality deterioration during construction, etc. Therefore, according to the requirements of free, prior and informed consent (FPIC) under ESS7, FPIC is not required under this project component. An Indigenous Peoples Development Plan (IDPD) has been prepared to address any impacts to, and to promote project benefits for, the IP communities.

Cultural Heritage (ESS-8): ESS8 sets out general **provisions** on risks and impacts to tangible and intangible cultural heritage. During the ESIA, no archeologically and historically tangible heritages such as monasteries, or ancient monuments were found along the road alignment, and there will otherwise be no impacts to tangible or intangible cultural project under the NNM Project. There are three small temples/shrines within the ROW, however they are newly constructed by the families along the right of way, and as advised during stakeholder consultations, are not of cultural importance or significance. They will be relocated to the nearby public land in consultation with the respective families along the right of way, as outlined in the RAP. A Chance-finds procedures has been included in the NNM Road Environmental and Social Management Plan (ESMP) which will be followed if, during construction, there are any chance finds. Chance find procedures will also be included in the bidding documents, in the contractor contract and in the contractor's ESMP (C-ESMP).

Financial Intermediaries (ESS 9): Since no financial intermediary is involved in this project, ESS9 is not applicable.

Stakeholder Engagement and Information Disclosure (ESS 10): During stakeholder consultations, the issues raised by communities included: compensation for impacted land; affected private and public structures and utilities; construction of public structures such as footover bridges near schools and major market places; construction of vegetable collection centres; gender-friendly public toilets with refreshment centres; mitigation of landslide risks during construction of road; establishment of road safety measures; establishment of ward level GRM; and priority of employment to locals (including female).

Environmental and Social Management Measures

The major management measures in line with ESSs have been given below.

Cooperation and information dissemination about the project amongst interested stakeholders will help to execute all mitigation measures. The project will coordinate with local bodies and concerned stakeholders for planning of local development which will help mitigate cumulative impacts associated with uncoordinated development of road network.

An Environmental and Social Management Plan (ESMP) applying the mitigation hierarchy has been prepared to manage the project's environmental and social risks and impacts. It includes mitigation measures, a monitoring plan, capacity building, responsibilities and reporting system and environmental and social costs. In addition, the ESMP provides measures to address GBV issues at a project level. The key issues regarding labours will be managed in compliance with National Labour Act, 2017 and Labour Rules, 2018 and WB ESF, 2018 through comprehensive LMP and Occupational Health and Safety Plan (OHSP). A GRM will be provided for project workers to help workers to lodge grievances and to manage the resolution of worker-related grievances. A Worker Camp Operation Plan and Worker's Code of Conduct will be prepared, which will also discourage or minimize GBV.

A separate RAP has been prepared to address physical and economic displacement as a result of project activities. All losses (private and public assets) will be compensated with replacement costs as per the Entitlement Matrix. For any additional impacts occurring during project implementation, a resettlement framework has been prepared and will be applied for the additional losses. The ESMP obligates the contractor, upon mobilization, to prepare the Contractor's ESMP (C-ESMP), which shall be prepared prior to the commencement of construction activities. The C-ESMP shall include an OHS plan, Water and Waste Management Plan, Influx Management Plan, Workers camp management plan, Traffic management and road safety management plans, Quarry/borrow area management plan, and Site Restoration Plan among others in accordance with the GoN and IFC&WB workers' accommodation guidelines.

An Indigenous People's Development Plan (IPDP) has been prepared to address impacts to IP communities in the NNM Road area.

A Stakeholder Engagement Plan (SEP) has been developed for the project to identify stakeholders and to provide a plan for engaging with stakeholders throughout the project lifecycle. The SEP will provide materials for community awareness and sensitization with emphasis to women and young girls, promoting health seeking behaviour. The SEP includes details of a project level GRM for stakeholders to raise any questions and grievances.

Mitigation measures for general risks and impacts: Mitigation measures for general risks and impacts include: an erosion control plan with bioengineering and reinforcement structures; restoration of affected landscapes; development of a stockpiling and excavation management plan; recommendations for fuel efficient machinery and carbon offset by compensatory plantation; proper relocation and restoration of all affected utilities taking the community into confidence with meaningful consultation; enforcement and control of anti-poaching regulations; establishing speed limit signs in appropriate locations; providing awareness to drivers; establishing a grievance redress mechanisms (GRM) for complaints; providing workers transportation to and from the project sites; adopting safety measures for workers such as shinning jackets (aprons), boots, gloves, and helmets; compliance with the labour laws; establishment of Worker Camp Operations Guidelines; development of a Hazardous Materials Management Plan to manage hazardous material use, storage, transport, and disposal; development a Water Quality Management Plan; community awareness and sensitization with an emphasis on women and young girls; chemical management plan prior to construction including handling and disposal of hazardous chemical and waste. No tangible or intangible archaeologically important heritage will be impacted. In the case of chance finds, a Chance-Finds procedure outlined in the ESMF will be followed.

Site-specific mitigation measures: Site-specific mitigation measures include construction of slope stabilization and protection measures such as RCC modified wall, geo-grid wall, semi-flexible 3D galvanized steel mat, benching; avoidance of haphazard excavation of slopes, excavation in piece-meal applied along the steep slope area, management of existing natural drainage, re-plantation of 25 native trees for each felled tree; establishment of nurseries, relocation of electric poles, proper disposal of excavated spoil and other construction materials at identified spoil disposal sites, establishment of safety signage boards, and installation of noise barriers, covering of stockpile materials with tarpaulin, sprinkling of water carried out near and around the stockpile to avoid erosion; proper barricade and security guard for the area and construction of footbridge and foot-trails for local community.

Total cost for the ESMP, including RAP, is estimated to be at NPR 371,232,727 (USD 3.25 million).

Key Measures and Actions for the Environmental and Social Commitment Plan (ESCP)

The ESCP identifies measures and actions to meet ESS requirements. These include development of an ESIA, SEP, LMP, RAP, and IPDP identified to be required for the NNM Road project. The Ministry of Physical Infrastructure and Transport (MoPIT) is responsible for compliance with all requirements of the ESCP during implementation of specific measures and actions is conducted and implemented by the DoR-Development Cooperation Implementation Division (DCID).

Implementation of the material measures and actions set out in the ESCP, will be monitored and reported to the Bank by DoR as specified in the ESCP. The World Bank will monitor and assess progress and completion of the material measures and actions throughout implementation of the project. If required, the ESCP may be revised and updated during project implementation to reflect adaptive management of project changes and unforeseen

circumstances or in response to assessment of project performance conducted under the ESCP itself.

Institutional Arrangements

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

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

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

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

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

नागदुङ्गा-नौविसे-मुग्लिङ्ग सडकको

वातावरणीय तथा सामाजिक प्रभाव मूल्यांकन प्रतिवेदन (ई.एस.आई.ए.)

कार्यकारी सारांश

परिचय

नेपाल सरकारले मुलुकको अर्थतन्त्र तथा क्षेत्रीय व्यापार विस्तारको लागि रणनीतिक सडक कनेक्टिभिटी तथा व्यापारिक सुधार पूर्वाधार आयोजना (एस.आर.सि.टि.आई.पि.) अन्तर्गत हालको नागदुङ्गा-नौविसे-मुग्लिङ्ग सडकको स्तरोन्नतीका लागि विश्व बैंक समक्ष ऋण सहायताका लागि प्रस्ताव पेश गरेको छ । यस आयोजना अन्तर्गत (१) व्यापार सहजिकरण, (२) क्षेत्रीय सडक कनेक्टिभिटी, (३) संस्थागत सुदृढिकरण, (४) आकस्मिक आपतकालिन प्रतिक्रिया गरि चार कम्पोनेन्टहरू छन् । देशो कम्पोनेन्ट अन्तर्गत (क) नागदुङ्गा-नौविसे-मुग्लिङ्ग सडक खण्डलाई २ लेन स्टायाण्डर्डमा स्तरोन्नति (१४.७ कि.मी. लम्बाईको नागदुङ्गा-नौविसे-मुग्लिङ्ग सडकलाई २ लेन एशियन राजमार्ग स्तरमा स्तरोन्नति), (ख) महेन्द्र राजमार्ग अन्तर्गत १३० कि.मी. लम्बाईको कमला-ढल्केवर-पथलैया सडकखण्डलाई २ लेनबाट ४ लेनमा स्तरोन्नति गरिने छ । नागदुङ्गा-नौविसे-मुग्लिङ्ग सडकको विस्तृत डिजाईनका क्रममा नेपाल सरकारको आवश्यकता र विश्व बैंकको वातावरणीय र सामाजिक ढाँचा (ई.एस.एफ) अनुरूप नागदुङ्गा-नौविसे-मुग्लिङ्ग सडकको वातावरणीय र सामाजिक जोखिम आंकलन गर्न वातावरणीय र सामाजिक प्रभाव मूल्यांकन प्रतिवेदन (ई.एस.आई.ए.) तयार गरिएको थियो । कमला-ढल्केवर-पथलैया सडकको सम्भाव्यता अध्ययन भर्खरै शुरु भएको हुँदा पूर्व सम्भाव्यता जानकारीका आधारमा यस सडक खण्डलाई छुट्टै आपस्ट्रिम वातावरणीय र सामाजिक मूल्यांकन (ई.एस.ए.) मा समेटेको छ । कमला-ढल्केवर-पथलैया सडकको विस्तृत डिजाईनका समयमा ई.एस.ए. विस्तृत ई.एस.आई.ए. तयार गर्नका लागि आधार हुनेछ ।

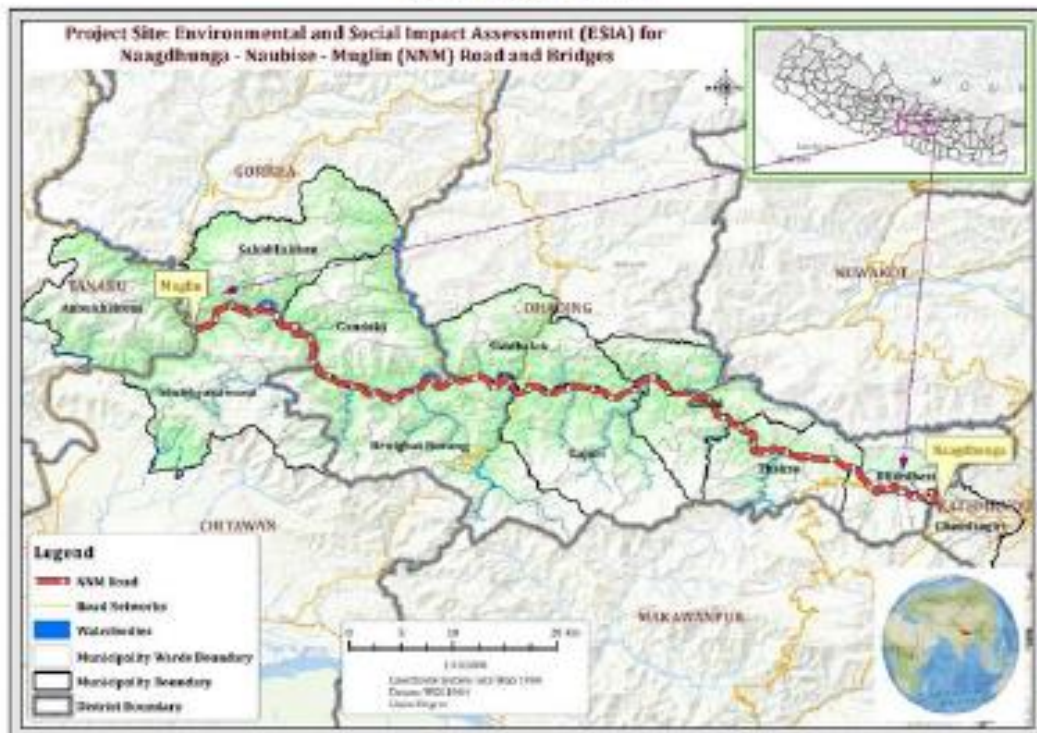
आयोजना विवरण

विभुवन राजपथ अन्तर्गत नागदुङ्गा देखि नौविसेसम्म १२.७ कि.मी. र पूर्वी राजमार्ग अन्तर्गत नौविसेदेखि मुग्लिङ्गसम्म ८२.४ कि.मी. गरी जम्मा ९५.७ कि.मी. रहेको छ । उक्त सडकखण्डमा प्रदेश ३ को काठमाडौं, धादिङ्ग तथा चितवन जिल्ला रहेका छन् । यो सडकखण्ड नागदुङ्गा चेकपोस्टबाट शुरु भई नौविसे, खानिखोला, महादववेँसी, गल्छी, वैरनी, मलेखु, बेनिघाट, कुरिनटार र मुग्लिङ्गमा गई अन्त्य हुन्छ । यस सडकखण्डको नौविसेमा एउटा चोकको निर्माण गर्ने योजना रहेको छ । यस राजमार्गले नव निर्मित गल्छि सडकखण्ड बाट तुवाकोट जिल्लालाई जोड्नुको साथै धादिङ्ग जिल्लालाको सदरमुकामलाई पुर्खै खोला, मलेखुबाट पनि जोड्छ । त्यसै, यस राजमार्गको मुग्लिङ्ग चोकको (जक्सन) मुग्लिङ्ग-नारायणगढ सडक खण्डले महेन्द्र राजमार्ग जोड्छ ।

विद्यमान नागदुङ्गा-नौविसे-मुग्लिङ्ग सडक हालको ५.५ मी. देखि ६.५ मी. क्यारिजवे र ०.५ मी. देखि १ मी. सोल्जर र ७ मिटर क्यारिजवे र १ देखि २.५ सोल्जर सहित स्तरोन्नति हुनेछ । सडक सुरक्षालाई नागदुङ्गा-नौविसे-मुग्लिङ्ग सडक सुधार कार्यक्रममा सडक सुरक्षा सुधारलाई पनि प्राथमिकता दिईने छ र सडक सुरक्षा सम्बन्धि संकेतका साथै गती सीमाका चिन्हहरूका जडान गरिने छ ।

काठमाडौँलाई तराई हुँदै इण्डिया र अन्य मुख्य शहरहरु जस्तै पोखरा (मुख्य पर्यटकिय सहर), नारायणगढ, जुटवल संग जोड्ने नागदुङ्गा-नौबिसे-मुग्लिङ्ग एक मुख्य सडक हो । नागदुङ्गा-नौबिसे-मुग्लिङ्ग सडक स्तरोन्नतीले राम्रो पहुँच, गुणस्तारिय ढाड्ढिङ्ग/सवारी, कृषाल यातायात, सुधारिएको ट्राफिक र सडक सुरक्षा प्रदान गर्नेछ । यसले भौतिक पूर्वाधार विकासमा सहजिकरण गर्नेछ जसले गर्दा स्थानिय र क्षेत्रीय विकासमा योगदान, आर्थिक उन्नती र स्थानिय जिवस्तरमा सुधार हुनेछ । पर्यावरण संरक्षण (ई.पि.ए.) १९९७, वातावरणीय संरक्षण नियम (ई.पि.आर.) १९९७ र विश्व बैंकका संचाल नीति अनुसार पहिलो ई.एस.आई.ए. सन् २०१६-२०१८ मा सम्पन्न गरिएको थियो । विश्व बैंकको आवश्यकता अनुरूप सो ई.एस.आई.ए. विश्व बैंकमा पेश गरिएको थियो । विश्व बैंकले २०१८ मा लागू गरेको नयाँ वातावरणीय र सामाजिक ढाँचा (ई.एस.एफ.) अनुरूप यस ई.एस.आई.ए. आई ई.एस.एफ.को आवश्यकता अनुरूप परिमार्जन गरिएको छ ।

हालको सडकको मानचित्र



ई.एस.आई.ए. को दायरा (स्कोप)

ई.एस.आई.ए. को दायरा (क) कोरिडोरको प्रभाव र परियोजना प्रभाव क्षेत्रको आमधारमा विद्यमान वातावरणीय बेसलाईन आई परिमार्जन गर्ने, (ख) परियोजना चक्र भरिको योजना जस्तै: पूर्व निर्माण देखि निर्माण, संचालन र मर्मतका कारण विभिन्न चरणमा आउन सक्ने थप वातावरणीय र सामाजिक सकारात्मक तथा नकारात्मक प्रभाव तथा जोखिम पहिचान गर्ने, (ग) नागदुङ्गा-नौबिसे-मुग्लिङ्ग सडकका लागि सरोकारवालाहरुको संलग्नता योजना (एस.ई.पि.), श्रमिक व्यवस्थापन कार्यविधी (एल.एम.पि.), लैंगिक हिंसा (जि.भि.पि.) जोखिम न्यूनीकरण कार्य योजना सम्बोधन गर्ने परियोजनामा सम्भावित सबै वातावरणीय, स्वास्थ्य तथा सुरक्षाको जोखिम र प्रभाव आंकलन गर्ने ।

कानूनी तथा संगठनात्मक रुपरेखा:

नेपालका कानूनी रुपरेखा विश्ववैकको वातावरणीय तथा सामाजिक रुपरेखा, वातावरणीय स्वास्थ्य तथा सुरक्षा सम्बन्धी निर्देशिका अनुरूप वातावरण तथा सामाजिक प्रभाव मूल्यांकन प्रतिवेदन (ई.इस.आई.ए) तयार पारिएको छ । यसै अनुरूप सामाजिक तथा वातावरणीय व्यवस्थापन विभिन्न चरणमा गरिने छ । यस वातावरणीय तथा सामाजिक प्रभाव मूल्यांकन अध्ययनमा आयोजना कार्यान्वयनको लागि आवश्यक सामाजिक क्षेत्र तथा वातावरणसंग सम्बन्धित नीतिनियम तथा संस्थागत रुपरेखा समावेश गरिनेछ । कानूनी तथा संस्थागत रुपरेखा नेपालको संविधान २०७२ मा आधारित रहेको छ । जसले सफा तथा स्वस्थ वातावरणमा बस्न पाउने अधिकारका साथै प्राकृतिक सम्पदाको संरक्षण उत्थान र दिगो उपयोगका बारेमा चर्चा गरेको छ । यसको अतिरिक्त विद्यमान संरक्षित नीति नियमको तथा विकास योजना तथा रणनीतिक नीति ऐन तथा नियमको विस्तृत विश्लेषण गरिएको छ ।

ई.इस.आई.एको यस खण्डले विद्यमान वातावरणीय र सामाजिक नीतिहरु, विज्ञायक र संस्थागत रुपरेखाहरुको अवलोकन प्रदान गर्नेछ जुन परियोजना कार्यान्वयनको समयमा अनुपालन गर्नुपर्ने छ । राष्ट्रिय कानून र संस्थागत रुपरेखा नेपालको संविधान २०१५ मा आधारित छ जसले सबैलाई स्वच्छ र स्वस्थ वातावरणमा बस्ने साथसाथै संरक्षण, प्रचार र प्राकृतिक साधनको दिगो उपयोग गर्ने अधिकार प्रदान गर्दछ । नेपालमा विद्यमान नियमहरुको विस्तृत विश्लेषण गरिएको छ जसमा सबै सम्बन्धित कागजातहरु जस्तै विकास योजना, रणनीति, नीति, ऐन र नियमहरुको समीक्षा गरिएको छ ।

राष्ट्रिय निर्देशिकाहरु, मार्गदर्शन (म्यानुअल) र मापदण्डहरुले परियोजना कार्यान्वयनको स्तरमा लागू हुने व्यवहारिक उपयोगी उपकरणहरु प्रदान गरी नियामक रुपरेखाहरुको आवश्यकताहरु पूरा गर्न सहयोग गर्छ ।

विद्यमान रुपरेखाको विश्लेषण तथा तालिका बनाई नागदुङ्गा-नीविसे-मुग्लिङ्ग सडकको वातावरणीय तथा सामाजिक प्रभाव मूल्यांकनको सन्दर्भमा निम्न प्रावधानहरुलाई समेत जोड दिईएको छ । यस संग सम्बन्धित केही महत्वपूर्ण कानून तथा नियमावलीहरु (तर सिमित नभएको) यसप्रकार छन्: सडक सुरक्षा कार्य योजना (२०१३-२०२०), नेपाल राष्ट्रिय जैविक विविधता कार्य योजना (२०१४-२०२०), नेपाल राष्ट्रिय वातावरण नीति (२०७६), वन नीति (२०७२), श्रम नीति (२०६३), जग्गा प्राप्ती, पुर्नवास तथा पुन:स्थापना नीति (२०७२), वातावरण संरक्षण ऐन (२०७६), वन ऐन (२०७६), लुप्तप्राय वन्य जीव तथा वनस्पतिको अन्तराष्ट्रिय व्यापारमा नियन्त्रणका लागि ऐन (२०१७), श्रम ऐन (२०७४), बाल श्रम निषेधाज्ञा तथा नियमावली (२०५७), जग्गा प्राप्ति ऐन (२०५४), (संसोधन सहित), जलश्रोत नियमाव (१९९३), औद्योगिक नीति । नेपालले विभिन्न अन्तराष्ट्रिय सम्मेलन र सन्धीहरुमा हस्ताक्षर गरेको हुँदा सिमावर्तिय वा विश्वव्यापि प्रकृतिका प्रदूषण, मीषम परिवर्तन र जैविय विविधता संरक्षण जस्ता महत्वपूर्ण वातावरणीय र सामाजिक मुद्दाहरु सम्बोधन गर्न बाध्य छ । ई.इस.आई.एको प्रक्रियामा अन्तराष्ट्रिय सन्धी/सम्मौताको प्रावधानहरुलाई ध्यानमा राखिएको छ ।

वातावरणीय र सामाजिक स्थितिको बेसलाईन:

२०१६-२०१८ को बेसलाईनको आकलन र हालै परिमार्जन गरिएको मुख्य वातावरणीय विषेशताहरु जस्तै फिजियोग्राफि, ट्रेनेज भूगोल, माटो, जलविज्ञान, भूमी प्रयोग, वनस्पति, जीव, वन/वनस्पती

आवरण, मौसम, परिवेशीय वायु गुणस्तर, पानीको गुणस्तर, परिवेशीय ध्वनीको स्तर, खतरा र जोखिमहरू विष्लेषण गरिएको छ । साथै प्रस्तावित परियोजना संग सम्बन्धित सामाजिक विप्रेषताहरू जस्तै तिजी सम्पत्ती, सांस्कृतिक सम्पदा, सार्वजनिक संसाधनहरू, आदिवासी जनजाती, पिछाडिएको समूह, परियोजना प्रभावित समूह, लैंगिक हिंसा तथा व्यवसायीक स्वास्थ्य सुरक्षाको पनि विश्लेषण गरिएको छ ।

भौतिक वातावरण: नागादुङ्गा-नीविसे-मुग्लिङ्ग सडकको सबैभन्दा उचाई नागादुङ्गा (१५०० मी.) हो । यो सडक खण्ड नागादुङ्गा देखि नीविसे सम्म पहाडी क्षेत्र हुदै गएको छ । नीविसे देखि गल्छी सम्म सडक खण्ड महेश खोलाको किनार बेसी भएर गएको छ । गल्छी देखि मुग्लिङ्ग सम्म सडक खण्ड विशुली नदीको किनार किनार जान्छ जुन सडकको सबैभन्दा कम उचाई (२६५ मी.) हो । भौगोलिक रुपमा परियोजना क्षेत्र नेपालको मध्य भागमा लेसर हिमालयको चट्टानी भागमा पर्दछ । परियोजना क्षेत्रमा उपलब्ध भिषिब्लोजिकल एकाईहरूमा कार्बनयुक्त चट्टान सिस्ट, चुनदुङ्गा, डोलोमाइट र नीस तथा पांगो, अवशिष्ट र बलौटे जस्ता तिन प्रकारको माटोले बनेको छ । विभिन्न कालखण्डमा गएका विस्तारी तथा पहिरो र तिनले थुपार्ने दुङ्गा माटोले सडकको अवस्था बिग्रदै गएको छ । मनकामना केवल कार स्टेशनदेखी मुग्लिङ्गछेउसम्मको ९०+१०० देखि ९२+५०० कि.मि. सम्मको खण्ड पहिले पहिरो गएको क्षेत्र हो । तथापि सडकखण्डको ९१+९०० देखि ९२+५०० कि.मि. सम्मको ६०० मिटरको भू-भाग पहिरोग्रस्त क्षेत्र हो र त्यो बाहेकको बाँकी भू-भागमा भने पहिरो रोकथाम गरि सुधार गरिएको छ । सडकखण्डको जोगिमारा आसपासको ६६+५०० देखि ६६+९२५ कि.मि. सम्मको (कि.मि.गणना गर्दा प्रस्थान बिन्दु नीविसेबाट मानिएको छ) १२५ मिटरको भू-भाग पनि दुङ्गा खस्नसक्ने संभावना भएको क्षेत्र हो ।

विभिन्न स्थानमा अनुगमन गरिएको वायुको गुणस्तर राष्ट्रिय परिवेश वायु गुणस्तर मानक (एन.ए.ए.क्यू.एस.) को प्यारामिटर भित्र देखिन्छ । अवलोकन गरिएको बराबर ध्वनी दबावको स्तर राष्ट्रिय ध्वनी गुणस्तर सीमा (एन.एन.क्यू.एस.एल.) र व्यवसायीक सुरक्षा र स्वास्थ्य संघ (ओ.एस.एच.ए.) टि.एल.भि. निर्देशिका भन्दा बढी पाईएको छ । पानीको गुणस्तरको हिसाबले सबै पानीको नमूनाहरू राष्ट्रिय खानेपानी गुणस्तर मानक भन्दा फ्लोराइडको स्तर कम रहेको पाईयो । आगरा खोला, विशुली नदी पारिको मझिमतार र विशुली नदी नजीकको श्री चन्द्रोदय एच.एस. स्कूल नजिक पानीको नमूनामा आइरनको मात्रा उच्च थियो । पानीका सबै नमूनामा क्लोरोफार्म दूषित थिए । आगरा खोला र विशुली नदीको पानीमा क्लोरोफार्म, आइरन र सेडिमेन्टको मात्रा उच्च पाईयो । बालुवा, गिट्टी उत्खनन कार्यले विशुली नदी र यसका साहायक नदीहरूको पानीको गुणस्तरमा असर पारेको पाईएको छ ।

जैविक वातावरण: नागादुङ्गा-नीविसे-मुग्लिङ्ग सडकको जैविक वातावरणमा ५ प्रकारका जंगल, १६ प्रजातिका स्तनधारी, २७६ प्रजातिका चराचुरुङ्गी र करिब १० प्रजातिका उभयचर पाईन्छ । सडकको व्यवस्थित सर्वेक्षणका क्रममा प्रायःजसो एन्थ्रोपोजेनिक वातावरण संग सम्बन्धित सामान्य प्रजातिहरू र परियोजना क्षेत्रमा अत्याधिक विचलित ल्याण्डस्केप पाईए तापनि पाहाडि क्षेत्रको बाँकी जंगल क्षेत्रमा र २ कि.मी रेडियस भित्रको परियोजनाको अप्रत्यक्ष प्रभाव क्षेत्र भित्र तर ५०० मी. आर.ओ.आर र ३०० मी. प्रत्यक्ष प्रभाव क्षेत्रमा केहि ओपोन्मुख प्रजातिहरू पनि रेकर्ड गरिएको थियो । सन् १९७३ मा निर्माण गरिएको सडक र वरपरको क्षेत्रमा घना जनसंख्या र मानव बस्ती छ । वन्यजन्तु वासस्थान अनुकुल नदी किनारको जंगल र पहाडी प्रवाह र बाँकी जंगलमा मात्र वन्यजन्तु पाईन्छ । धेरै जंगली

प्रजातिका विरुवाहरु आर.ओ.आर. संग संगी हुर्किन्छन् जसले प्राकृतिक वासस्थानको उच्च असन्तुलनको संकेत गर्छ ।

सामाजिक-आर्थिक र सांस्कृतिक वातावरण परियोजनाले काठमाडौं, धादिङ्ग र चितवन जिल्लाबाई समेटने र चन्द्रागिरी र धुनिवेशी नगरपालिकाहरुमा र थाके, गल्छि, इचछाकामना गाउँ पालिकामा अवस्थित छ । प्रमुख वस्तिहरुमा खानीखोला, नीबिसे, धार्के, महादेवबेसी, गल्छि, गजुरी, बेरेनी, मक्तिमटार, मलेखु, बेनीघाट, चरीदि, कुरिनटार, रमाइलो डाँडा र मुग्लिङ हुन् । परियोजना क्षेत्रमा ब्राम्हण, क्षेत्री, सन्ध्यासी, दलित, मुस्लिम, मधेसी, जनजाती/आदिवासी जनजाती समूह छन् । परियोजना क्षेत्रको भूमीमा नेवार, गुरुङ्ग, मगर, तामाङ्ग, चेपाङ्ग र भुजेल गरि ६ वटा आदिवासी समुदायको सामूहिक संलग्नता छ । परियोजनाको क्षेत्रको सडक खण्डहरुलाई प्रभाव क्षेत्र, अप्रत्यक्ष प्रभाव क्षेत्र र प्रत्यक्ष प्रभाव क्षेत्रमा विभाजित छ । परियोजनाले प्रभावित नगरपालिका र गाउँ पालिकाहरु परियोजनाको प्रभावित क्षेत्र हुन् । सडकको दुवै पट्टि २ कि.मी. भित्र जोडिएका वार्ड र नजिकका क्षेत्रहरु अप्रत्यक्ष प्रभाव क्षेत्र हुन् । परियोजना निर्माण सम्बन्धी गतिविधि हुने सबै क्षेत्र परियोजनाको प्रत्यक्ष प्रभाव क्षेत्र भित्र पर्दछ । सडकको बिचवाट दुवै छेउमा १५० मी. भित्रका क्षेत्रहरु (कुल ३०० मी. चौडाई) वार्ड प्रत्यक्ष प्रभाव क्षेत्र मानिन्छ । ३० मी. (केन्द्र रेखाको दुवैतिर १५ मी.), ५० मी. आर.ओ.आर. भित्रको क्षेत्रलाई प्रभाव कोरिडोरलाई (सि.ओ.आई.) मानिन्छ । प्रत्यक्ष प्रभाव क्षेत्र भित्र १६९५९ जनसंख्या छन् जसमा ८४०७ पुरुष र ८४५० महिला छन् । जम्मा ७८ घरधुरी र ४०७ जनसंख्या परियोजनाले प्रभावित हुनेछ ।

सरोकारवाला व्यक्तिहरुको सहभागिता तथा सार्वजनिक छलफल

सरोकारवाला व्यक्तिहरुको सहभागिता तथा सार्वजनिक छलफल आयोजनाको हरेक चक्रमा सरोकारवालाहरुको सहभागितामा गरिने समावेशी प्रकृया पनि हो । विश्व बैंकको ई.एस.ए १० ले विभिन्न सरोकारवाला व्यक्तिहरुको सुझावलाई समेट्छ । वातावरणीय तथा सामाजिक प्रभाव मूल्यांकनको क्रममा प्रत्यक्ष र अप्रत्यक्ष प्रभावित समूह लगायत गाउँपालिका र नगरपालिका प्रभावित समूहको मुद्दालाई सम्बोधन गर्न सरोकारवालाहरु संग परामर्श गरिएको थियो । ई.एस.आई.ए. परिमार्जन गर्ने क्रममा परियोजनाले प्रभाव पार्ने समूह र अन्य इच्छुक समूहका मुद्दाहरु समावेश गर्नका लागि सरोकारवालाहरु संग थप परामर्श गरिएको थियो ।

परियोजनाले प्रभाव पार्ने समूह बाहेक अन्य पहिचान गरिएका सरोकारवालाहरु स्थानिय सरकार (२ मी. र ५ आर.एम.), स्थानिय गैर सरकारी संस्थाहरु (एन.जि.ओ.), नागरिक समाज, शिक्षकहरु, राजनीतिक नेताहरु, महिला समूहहरु, स्थानिय उद्यमीहरु, बोपन्मुख र आदिवासी जनजातीहरु, फरक सक्षम व्यक्तिहरु र सिमान्तकृत समूहहरु, स्थानिय व्यापारि समूहहरु र आपूर्तिकर्ताहरु (जस्तै युनाईटेड सिमेन्ट, किपि सिमेन्ट, ग्यास बोटलिङ्ग प्लान्ट, कसर प्लान्ट आदि), स्थानिय उपभोक्ता समूहहरु (जंगल, पानी, सिंचाई आदि), स्थानिय पत्रकारहरु, सुरक्षा निकायहरु (ट्राफिक पुलिस र आर्मि), ट्राभल एजेन्सी, ड्राइभरहरु र सडक उपभोग गर्ने समूहहरु (स्थानिय यात्रुहरु सहित) हुन् ।

संभाव्यता अध्ययनभन्दा पहिले छलफल गरिएको विषयवस्तुहरुलाई एकीकृत गरी सम्बन्धित आयोजना प्रभावित नगरपालिका तथा गाउँपालिकाहरुमा जानकारी गराइएको थियो । सरकारी अधिकारीहरुसंग व्यक्तिगत साक्षात्कार पछि प्रारम्भिक वाकओभर सर्वेक्षणहरु गरिएको थियो । फोकस ग्रुप छलफल (एफ.जि.डि.) र मुख्य जानकार संग साक्षतकार (के.आई.आई.) जस्ता उपकरणहरु छलफलमा प्रयोग गरिएको थियो । पूर्व सम्भाव्यताको बखतमा आयोजित प्रारम्भिक परामर्श तिन फरक स्थानहरु

धुनीवेसी नगरपालिका, गजुरी गाउँ पालिका र बेनिघाट रोराङ्ग गाउँ पालिकामा जनवरी २७-३०, २०१७ मा गरिएको थियो । परामर्शमा जम्मा ११५ सहभागीहरूले भाग लिएका थिए जसमा १०४ पुरुष र ११ महिला सहभागी थिए । सहभागीहरू प्रत्यक्ष प्रभावित समूहका मानिए । सार्वजनिक सुनुवाई चार स्थानहरू, धुनीवेसी नगरपालिका, गजुरी गाउँ पालिका, बेनिघाट रोराङ्ग गाउँ पालिका र इच्छाकमना गाउँ पालिकामा भएको थियो जसमा २५९ जना (२२८ पुरुष र ३१ महिला) सहभागी थिए ।

पुरक महिला लक्षित (२१० महिला र ८६ पुरुष, जम्मा २९६) परामर्श प्रभावित नगरपालिका र गाउँ पालिकाका विभिन्न २२ स्थानमा जुन २०१८ मा सम्पन्न भयो । विशिष्ट समूहहरू जस्तै महिला, कमजोर/आदिवासी जनजाती, परियोजना प्रभावित पक्षहरू र अन्य इच्छुक समूहसंग २०१९ को मे महिना देखि नोभेम्बर महिना सम्म थप परामर्श गरिएको थियो । यस क्रममा प्रत्यक्ष प्रभावित समूहहरू संग परामर्शमा छुटेका समूह समावेश भए भने अन्य इच्छुक समूहहरू सार्वजनिक सुनुवाई र पुरक परामर्श पछि पनि उपस्थित थिए । पुरक परामर्शमा जम्मा २५२ जनाको सहभागिता थियो जसमा १७१ महिला र ८१ पुरुष सहभागी थिए ।

छलफल कार्यक्रममा उठेका मुख्य मुद्दाहरू मुख्यतया सामाजिक पक्षसंग सम्बन्धित थिए जसमा प्रभावित जग्गाको क्षतिपूर्ति, व्यक्तिगत र सार्वजनिक संरचना लाई असर, स्कूल र बजार क्षेत्र नजिक फुटभोभर पुलहरूको निर्माण, तरकारी संकलन केन्द्रको निर्माण, महिला मैत्री शौचालय र रिफ्रेसमेन्ट सेन्टर, निर्माणका क्रममा हुने पहिरोको जोखिम, गुनासो निवारण संयन्त्र (जि.आर.एम.) बैंगिक हिंसा (जि.वि.भि.), स्थानियलाई रोजगारमा प्राथमिकता (महिला सहित), र सडक स्तरोन्नति का दौरान सरोकारवालाहरूको सहभागिता थिए ।

वैकल्पिक विश्लेषण

Analysis of Alternatives

वातावरणीय तथा सामाजिक प्रभावलाई मध्यनजर राख्दै सुरक्षित सडक, मोड सुधार तथा हालको यातायात चापलाई ध्यानमा राखेर भविष्यको प्रक्षेपण सहित ६ वटा वैकल्पिक मार्ग यस वातावरणीय तथा सामाजिक अध्ययनमा समावेश गरिएको छ ।

१. पहिलो वैकल्पिक मार्ग हालको सडकलाई २ लेनको मापदण्ड अनुसार मोड समेत सुधार, दुईवटा पुलको निर्माण तथा बजार क्षेत्रमा ४ लेनको सडक बनाउने प्रस्ताव गरिएको छ ।

२. दोश्रो वैकल्पिक मार्गका रूपमा हालको सडकलाई २ लेनको मापदण्ड अनुसार मोड समेत सुधार गरेर सुरुङ्ग र बाईपासको निर्माण गरि बजार एरियामा ४ लेनको सडक बनाउने प्रस्ताव गरिएको छ ।

३. तेस्रो वैकल्पिक मार्ग हालको सडकलाई २ लेनको मापदण्ड अनुसार मोडसमेत सुधार गरि थप २ लेन मापदण्ड अनुसार को दायाँतिर विसुली नदीपारि नयाँ सडक सिस्ने खोलादेखि धार्के सडक बनाउने र बजार एरियामा ४ लेन मापदण्डको सडक बनाउने । पहिलो ३ वैकल्पिक मार्गमा सामाजिक तथा वातावरणीय प्रभाव न्यून देखिएतापनि यसले हालको यातायात चापलाई धेग्न नसक्ने देखिन्छ ।

४. चौथो वैकल्पिक मार्ग हालको २ लेन मापदण्ड सडकमा हल्का सुधार गरि खोला पारी नयाँ सडक सिस्ने-धार्के र ४ लेनको मापदण्डमा धार्केदेखि बेनिघाटसम्म हालको सडकलाई सुधार गर्ने र

वेनिघाटदेखि मुग्लिङसम्म २ लेन र अर्को नयाँ २ लेनको सडक दायाँतिर विशुली नदीपारि वेनिघाटदेखि कुरिनटारसम्म बनाउने ।

५. पाँचौँ बैकल्पिक मार्ग हालको सडक नागदुङ्गादेखि धार्केसम्म २ लेन मापदण्ड अनुसार मोड समेत सुधार गर्ने र सुरुङ्ग तथा वाईपास सहित नयाँ थप २ लेन मापदण्ड अनुसारको सिस्नेदेखि धार्के र ४ लेन मापदण्ड अनुसार धार्केदेखि वेनिघाटसम्म र वेनिघाटदेखि मुग्लिङसम्म २ लेन मापदण्ड अनुसारको हालको सडकलाई सुधार गर्ने र अर्को थप २ लेन मापदण्ड अनुसारको नयाँ सडक दायाँतिर विशुली नदीपारी वेनिघाटदेखि कुरिनटारसम्म बनाउने ।

६. छैटौँ बैकल्पिक अनुसार हालको नागदुङ्गा-नीबिसे-मुग्लिङ सडकलाई २ लेन सडकलाई एशियाली राजमार्ग मापदण्ड अनुसार सुधार गर्ने ।

विकल्पहरूको आकलन गर्दा पहिलो ३ विकल्पिक मार्गमा वातावरणमा कम प्रभाव पर्ने तर अधिक सामाजिक प्रभाव विशेषतः शहरी क्षेत्रको भूमी अधिकरण हुनेछ । तिनको निर्माण लागत पनि कम हुन्छ यद्यपि तिनले पर्याप्त मात्रामा सडकमा हुने भिड (कन्जेसन) लाई सम्बोधन गर्दैन । चौथो र पाँचौँ बैकल्पिक मार्ग अनुसार वातावरणीय, सामाजिक, जैविक तथा भौतिक बढी प्रभाव देखिन्छ । त्यस्तै छैटौँ बैकल्पिक मार्ग ले वातावरणीय प्रभाव कम गर्ने हुँदा ई.एस.आई.ए.का लागि छनौट गरिएको थियो । नेपाल सरकारले भूमी अधिकरण र सामाजिक प्रभाव न्यूनीकरण गर्न नागदुङ्गा-नीबिसे-मुग्लिङ सडक सुधार कार्यमा वाईपासहरू हटाउने निर्णय गरेको हुँदा हालको परिमार्जित इएसआईए मा २ वटा नयाँ वाईपास खण्डलाई समावेश नगरिकन नै अध्ययन गरिएको छ ।

वातावरणीय तथा सामाजिक जोखिम तथा असर

नागदुङ्गा-नीबिसे-मुग्लिङ सडक खण्डमा हुनसक्ने सकारात्मक परिवर्तनमा आर्थिक विकास, रोजगारी तथा व्यापार व्यवसायमा अवसर सृजना, बजारमा पहुँच, यातायातको छरितो सुविधा, सडक सुरक्षामा सुधार लगायतका विषयहरू छन् । सडकको भौतिक संरचना, प्राविधिक रूपमा छरितोपना र स्थानीयलाई रोजगारीको विकल्प लगायतका विषयहरू सडक स्तरोन्नतीले ल्याउन सक्ने थप सकारात्मक परिवर्तन हुन् । त्यसैगरी सडक स्तरोन्नति पश्चात सन् २०२० देखि २०४२ सम्मको अवधिमा करिब १४,९३८ टन कार्बनको उत्सर्जन घट्न गई वातावरण संरक्षणमा समेत टेवा पुग्नेछ ।

वातावरणीय र सामाजिक जोखिम तथा असरलाई विश्व बैंकको वातावरणीय तथा सामाजिक रुपरेखा-२०१८ अनुसार स्तरीकरण गरिएको छ । स्तरीकरण अति उच्च, उच्च, मध्यम र न्यून गरि चार प्रकारमा गरिएको छ । तलका अध्यायमा आयोजनाका कारण निम्तिन सक्ने जोखिम तथा असरलाई विश्व बैंकको वातावरणीय तथा सामाजिक रुपरेखा-२०१८ अन्तर्गतका विभिन्न मापदण्ड अनुरूप छोटकरीमा उल्लेख गरिएको छ ।

वातावरणीय र सामाजिक जोखिम तथा असरको मूल्याङ्कन र व्यवस्थापन (ई.एस.एस.-१) नागदुङ्गा-नीबिसे-मुग्लिङ सडकको सुधार कार्य आर.थो.आर. क्षेत्र भित्र गरिने छ । आर.थो.आर. क्षेत्र बाहिर सानो अनुपातमा भूमी अधिग्रहण, केहि रुख कटान र वासस्थानमा प्रभाव पर्ने हुँदा मुख्यतया निर्माण सम्बन्धी र अल्पकालिन वातावरणीय र सामाजिक जोखिम र प्रभाव मध्यम देखि पर्याप्त हुनेछ । निर्माणको समयमा मुख्यतया वातावरणीय, कामदार र समुदायको स्वास्थ्य र सुरक्षामा बाह्यो जोखिम, ट्राफिक प्रवाहमा वृद्धि र दुर्घटनाहरू, बाह्य कामदारहरूको ठूलो संख्यामा

आगमन संग सम्बन्धित सामाजिक मुद्दाहरु जस्तै लैभिक हिंसा, बाल श्रम जस्ता प्रभावहरु हुनसक्छन् । नागदुष्का-नीविसे-मुग्लिङ सडकको सुधार कार्य विद्यमान आर.ओ.आर. क्षेत्र भित्र सीमित हुने जुन जनसंख्या वृद्धिका कारण राजमार्ग वरिपरि अतिक्रमण र नयाँ वस्ती, भूमी परिवर्तन, कृषि विकास र अन्य सम्बन्धित विकासका कारण दशकौं देखि खण्डित र धेरै विचलित हुँदा कुनै महत्वपूर्ण संचित प्रभाव नपर्ने आंकलन गरिएको छ । नीविसे-मुग्लिङ सडकको सुधार कार्य भए वा नभए पनि विकेन्द्रिकरण, शहरीकरण र विकेन्द्रिकरण का कारण ग्रामिण क्षेत्रको विकासका परिणाम स्वरूप भूमी प्रयोग परिवर्तन र भूमी परिवर्तन पहिले नै भईसकेको र सो जारी रहने छ । साथै, हालै निर्माण गरिएका वरपरका ग्रामिण सडकहरु प्रायः कुनै वातावरणीय मूल्यांकन र शमन उपाय बिना नै निर्माण गरिएको छ । बढ्दो सडक संजाल र सुरक्षात्मक उपायको अभावले पहिले देखि हुँदै आएको माटो थिथिने तथा बालुवा, दुष्का, गिट्टी थुप्रिने समस्याहरु, वन्यजन्तुको दैनिक गतिविधिमा असर, ढल व्यवस्थापन कमजोर हुनसक्ने जस्ता वातावरणीय प्रतिकूल प्रभावहरु बढाउँछ । मौसम परिवर्तन र स्थानीय समुदायको आसमन्वयी विकास जसले महत्वपूर्ण आर्थिक क्षति निम्त्याउनुका साथै प्रभावहरु बढ्न सक्नेछन् । नागदुष्का-नीविसे-मुग्लिङ सडकको सुधार कार्यले कमजोर र विपन्न मानिएका ६ घरपरिवार (४ महिलाहरू नेतृत्व गरेका र २ दलित घरपरिवार) लाई असर पार्नेछ ।

श्रमिक तथा तिनीहरुको कार्यक्षेत्र (ई.एस.एस.-२) आयोजनाले प्रत्यक्ष, सम्झौता गरिएका र आयोजनालाई आवश्यक सामग्री विक्रेता रहनेछन् । तीनै किसिमका श्रमिकवर्गलाई विभिन्न किसिमका जोखिम जस्तै बसोबासको प्रबन्ध राम्रो नहुनु, काम गरेपश्चात ज्याला तथा न्यूनतम सुविधाबाट वञ्चित, ज्यालादर तथा रोजगारीको अवसरबाट वञ्चित, बालश्रम तथा बलजफ्ती काममा लगाउने, मानव बेचबिखन तथा ओसारपसार, स्वास्थ्य तथा सुरक्षा, कार्यस्थलमा हुने दुर्घटना तथा कार्यक्षेत्रभित्र फैलिन सक्ने सरुवा तथा यौनजन्य रोग र महिला हिंसा हुनसक्ने संभावना देखिन्छ । यी विभिन्न किसिमका श्रमिकहरुमध्ये सम्झौता गरिएका श्रमिकवर्गलाई बढी जोखिम निम्तिन सक्ने संभावना छ ।

स्रोत सद्दुपयोग, प्रदूषण नियन्त्रण तथा व्यवस्थापन (ई.एस.एस.-३) यस ई.एस.एस.ले साधारणतया ६ वटा जोखिम जस्तै भुगोलको अवस्थिती, सांस्कृतिक महत्वको सम्पदामा असर, वायु तथा ध्वनि प्रदूषण, संभाव्य जोखिम, फोहोरमैला व्यवस्थापन, पानीको स्रोतमा प्रदूषण वारेमा चर्चा गरेको छ । यस सडक खण्डको स्तरोन्नती गर्दा खहरे खोला, खोल्सी तथा पानीको मुहानमा अधिक दोहन हुन सक्ने देखिन्छ । हिलो तथा लेदो माटोको जथाभावी भण्डारण, भू-क्षय तथा पहिरो, पानीको मुहान धुल्ने, आयोजना स्थलमा प्रयोग गरिने सवारी तथा यान्त्रिक गतिविधिबाट निस्कने धुलो, धुवाँ, कटिङ्ग, फिलिङ्गको दौरान निस्कने धुलो, निर्माण सामग्रीको ढुवानी तथा भण्डारण, सडक छेउका वस्तीमा ध्वनि प्रदूषण, यान्त्रिक गतिविधिबाट निस्कने कम्पनको असर (किनाराका वस्तीमा), खतराजन्य तथा खतरामुक्त उत्खनन क्षेत्र र सामग्री निकाल्न खाडल खनेको क्षेत्र लगायतमा असर पुग्न सक्ने देखिन्छ । सडक खण्डको निर्माणको चरणमा उल्लेखित असर ज्यादा हुन सक्ने भएकोले ठाउँ विशेषको न्युनिकरणको उपाय अवलम्बन गर्नुपर्ने हुन्छ र यसलाई पछिल्लो अध्यायमा वायु, ध्वनि, पानीको राष्ट्रिय मापदण्ड र पहिलेका आयोजनामा लागू भएका राम्रा उदाहरणहरुलाई अवलम्बन गरिएको छ ।

समुदायको स्वास्थ्य तथा सुरक्षा(ई.एस.एस.-४) सडकखण्ड स्तरोन्नती गर्ने क्रममा निर्माण सामग्रीको ओसारपसारले स्थानीय वासिन्दाको स्वास्थ्यमा नकारात्मक असर पुऱ्याउनसक्छ । यसको साथै कटिङ्ग, फिलिङ्गको दौरान निस्कने धुलो, यान्त्रिक गतिविधिको कारण हुनेसक्ने कम्पनका कारण पहिरो, माटो खस्ने तथा वायु प्रदूषण निम्तिन सक्छ । निर्माण सामग्रीको भण्डारण तथा स्तरोन्नतिको क्रममा निस्कने फोहोरले वरिपरिको खेतीयोग्य जमीन तथा समग्र भू-उपयोगमा असर पुऱ्याउनुका साथै

पानीका श्रोत प्रदूषित पार्नसकछ । स्तरोन्नतिको कममा निर्माण सामग्री ओसारपसार गर्ने साधनको चाप बढ्नाले तथा सडक छेउमा निर्माण सामग्रीको भण्डारणले ट्राफिक व्यवस्थापनमा समस्या उत्पन्न गर्नसकछ । अर्को स्थानबाट आएका फिरन्ते श्रमिकका गतिविधिका कारण स्थानीय वासिन्दा र श्रमिकको बीचमा श्रोतको उपयोगमा (सार्वजनिक उपभोगका स्रोतहरु र सामाजिक सेवा सुविधा) पनि प्रतिस्पर्धा र द्वन्द्व बढ्न सकछ तथा श्रमिक र मानिसहरुको आवतजावतले आयोजना क्षेत्रमा लैङ्गिक हिंसा र जोखिमहरु बढ्न सकछन् । आयोजना क्षेत्रमा श्रमिकसंग सम्बन्धित, व्यवस्थित किसिमको लैङ्गिक हिंसा सुनुवाइ प्रभावकारी नहुनुले लैङ्गिक हिंसाको संभावित जोखिमलाई मध्यमस्तरमा आंकलन गरिएको छ^१ । साथै आवश्यक संगठनात्मक संरचना र पूर्वाधार क्षमताको अभावको कारणले पनि लैङ्गिक हिंसाको संभावित जोखिमलाई प्रभावकारी रुपमा सम्बोधन गर्न सकिएको छैन । साथसाथै फिरन्ते श्रमिकका कारण विभिन्न सरुवा रोग र यौनजन्य रोग जस्तै एचआइभी एड्स, फैलिन सक्ने संभावना पनि उत्तिकै रहेको छ ।

जग्गा अधिग्रहण, भूमि उपयोगमा बन्देज र अस्वेष्टिबल पुर्नवास (ई.एस.एस.-५): आयोजनाका प्रभावित ७८ घरधुरीमध्ये ६८ घरधुरीको निजी संरचना तथा बाँकी १० को जग्गा जमिनमा (०.२ हे.) क्षति पुग्नेछ । प्रभावित ६८ घरधुरीको ७६ वटा निजी संरचना तथा १० घरधुरीको ११ घडेरीमा क्षति पुग्नेछ । कूल प्रभावित घरधुरीमध्ये (७८), ५७ घरधुरीको वासस्थान तथा व्यापार/व्यवसायमा क्षति पुग्नेछ । त्यसैगरि ४८ घरधुरीको व्यापार/व्यवसायमा मात्र क्षति पुग्नेछ र १० आयोजनाका कारणले गर्दा जोखिमयुक्त घरधुरीका रुपमा छन् (४ चेपाङ्ग (आदिवासी/जनजाति), ४ महिला प्रमुख भएका घरधुरी (३ ब्राम्हण र १ क्षेत्री) र २ दलित) । आयोजनाका कारण ९ सार्वजनिक संरचनामा (तिनवटा मन्दिर, दुइवटा सार्वजनिक धारा, दुइवटा सार्वजनिक शौचालय, एक पुस्तकालय र एक प्रतिक्षालय)मा समेत क्षति पुग्नेछ । त्यसैगरि १,१६१ विद्युत पोल र खानेपानीका पाइपलाई अत्यन्त सुरक्षित सानुपर्ने देखिन्छ । यस सडकखण्ड स्तरोन्नतिका दौरान हुनसक्ने आकस्मिक क्षति जस्तै कटिङ्ग, फिलिङ्ग तथा यान्त्रिक गतिविधिका कारण हुनेसक्ने कम्पन आदिका कारण जग्गा, बाख्री तथा निवासमा पर्नसक्ने प्रतिकूल असरको लेखानोख गर्ने प्रक्या तय गरिएको छ । सो अनुसार सुची तयार गर्नुका साथै मुआब्जा निर्धारण समितिको बैठक बसी यसै आयोजनाका लागि तयार पारिएको पुर्नवास कार्ययोजना अनुरूप सम्बोधन गरिनेछ ।

जैविक विविधता संरक्षण र जीवित प्राकृतिक स्रोतको दीर्घो व्यवस्थापन (ई.एस.एस.-६): नागदुङ्गा-नीविसे-मुग्लिङ्ग सडकखण्ड आसपास र आर.ओ.आर क्षेत्रमा आवास विकास र मानव बस्तीको लामो इतिहासका कारण धेरै लामो समयदेखि खण्डित र एन्थ्रोपोजेनिक दबाव ज्यादा प्रचलित छ । ई.एस.एस. ६ र आई.एफ.सि. प्रदर्शन मानक ६ अनुरूप महत्वपूर्ण आवास स्किनिङ्ग गर्दा ई.एस.आई.एस. ले परियोजना प्रभाव क्षेत्र (५० मी. आर.ओ.आर. क्षेत्र भित्र, ३०० मी. सडकको बिच बाट प्रत्यक्ष प्रभाव क्षेत्र र २०० मी. रेडियसको अप्रत्यक्ष प्रभाव क्षेत्र) को नदी र खोला किनार बाँकी रहेको जंगल भित्र ओपोन्मुख र लुप्तप्राय प्रजातिको जनावर र बोटविशुवाहरु रहेको रेकर्ड देखाउँछ । तर आर.ओ.आर. वा परियोजनाको प्रत्यक्ष भौतिक पदचिह्न भित्र वा प्रत्यक्ष प्रभाव क्षेत्रमा भने ओपोन्मुख र लुप्तप्राय प्रजातिको जनावर र बोटविशुवाहरुको रेकर्ड छैन । ई.एस.आई.एस. ले नागदुङ्गा-नीविसे-मुग्लिङ्ग सडकखण्ड स्तरोन्नतिले सम्पूर्ण आर.ओ.आर.मा रहेको ५७ हेक्टर मध्ये छरिएर रहेको केवल ४ हेक्टर असर पर्ने संकेत गरेको छ । प्रत्यक्ष प्रभावमा जम्मा ५२ रुख काट्नुपर्ने र केहि पोलाहरु

^१विश्व बैंकको GBV Action Plan को प्रारम्भिक नतिजाबाट साधार गरिएको

पर्दछन् । आर.ओ.आर. क्षेत्र भित्रको भीतिक कामले संकटग्रस्त र जोखिममा परेका जनावरहरुको वासस्थानमा प्रतिकूल प्रभाव पार्ने छैन । आर.ओ.आर. संगैका केहि सानो जंगल फडानि जसमा ५२ रुख र खम्बाहरु समावेश हुंदा संकटग्रस्त र जोषीमुख प्रजातिहरुको कुल संख्यामा प्रतिकूल प्रभाव पर्ने छैन । साथै नीविसे-मुग्लिङ सडकखण्डमा कुनै संरक्षित क्षेत्र, वन्यजन्तु भण्डार वा वन्यजन्तु प्रवासी कोरिडोर छैनन् । नेपाल सरकारको आवश्यकता पुरा गर्न प्रत्येक रुख कटानीमा परियोजनाले वन विभागले तोकेको क्षेत्रमा २५ रुख रोप्ने छ ।

आदिवासी जनजाति (ई.एस.एस.-७): परियोजना क्षेत्रमा नेवार, गुरुङ, मगर, तामाङ, चेपाङ र भुजेल् गरि ६ आदिवासी जनजाती समूहहरु छन् । यि ६ आदिवासी जनजाती समूहहरु परियोजनाको हस्तक्षेप नहुने आर.ओ.आर बाहिर अवस्थित छन् । परियोजनाले कुनैपनि आदिवासी जनजातिको भूमीमा प्रत्यक्ष प्रभाव, पुनर्वास वा सांस्कृतिक सम्पदामा असर पार्ने छैन । बाढी मात्रामा बाहिरि आउने बाहिरि श्रमिक, बैज्ञिक हिसा, ट्राफिक सुरक्षा, निर्माण समयमा वायु र पानीको गुणस्तरमा झस आदि आदिवासी जनजनतामा पर्ने सम्भावित प्रत्यक्ष प्रभाव र जोखिमहरु हुन् । त्यसैले, ई.एस.एस.-७ अन्तर्गत स्वतन्त्र अग्रिम जानकारी सहितको मन्जुरी (एफ.पि.आई.सि.) अनुसार यस कम्पोनेन्टमा एफ.पि.आई.सि.को आवश्यक छैन । परियोजना बाट आदिवासी जनजाति समुदायमा पर्ने प्रभावलाई सम्बोधन गर्न र सो समुदायलाई परियोजना बाट हुने लाभ प्रचार गर्न आदिवासी जनजाती विकास योजना (आई.डि.पि.डि.) तयार पारिएको छ ।

पुरातात्विक र सांस्कृतिक सम्पदा (ई.एस.एस.-८): ई.एस.एस.-८ ले प्रत्यक्ष वा अप्रत्यक्ष सांस्कृतिक सम्पदामा पर्ने जोखिम र प्रभावको सामान्य प्रावधान विस्तार गर्दछ । ई.एस.आई.ए. का दौरान नागदुङ्गा-नीविसे-मुग्लिङ सडकखण्डको आसपासका क्षेत्रमा कुनैपनि पुरातात्विक र सांस्कृतिक महत्वका धरोहरहरु जस्तै गुम्बा वा प्राचिन स्मारकहरु फेला परेनन् । तथापी आर.ओ.आर. क्षेत्र भित्र त्यहाँका परिवारहरुले नयाँ निर्माण गरेका तीनवा ससाना मन्दिरहरु छन् जुन सांस्कृतिक महत्वको नभएको सुझाव सरोकारवालाहरु संगको परामर्शका समयमा प्राप्त भयो । सम्बन्धित आर.ओ.आर क्षेत्रका परिवार संगको परामर्शमा उक्त मन्दिरहरुलाई आर.ए.पि. मा उल्लेख गरे बमोजिम नजिकको सार्वजनिक जग्गामा स्थानान्तरण गरिने छ । नागदुङ्गा-नीविसे-मुग्लिङको ई.एस.एम.पि.मा अकस्मात फेला प्रकिया समावेश गरिएको छ जुन निर्माणका कममा यदि आकस्मात फेला परेमा अनुसरण गरिने छ । अकस्मात फेला प्रकिया बोलपत्र, ठेकेदार संगको सम्झौता र सि-ई.एस.एम.पि. मा पनि समावेश गरिने छ ।

वित्तीय मध्यस्थता (ई.एस.एस.-९): आयोजनाको लागि कुनैपनि वित्तीय मध्यस्थता आवश्यक नपर्ने भएकोले (ई.एस.एस.-९) आवश्यक छैन ।

सरोकारवालाहरुको सहभागिता र सार्वजनिक परामर्श तथा छलफल (ई.एस.एस.-१०): नागदुङ्गा-नीविसे-मुग्लिङ सडक खण्डका मुख्य सरोकारवालासंगको छलफलका कममा मुआब्जा, सार्वजनिक संरचनामा पर्न सक्ने असर, सार्वजनिक संरचना जस्तै विद्यालय तथा मुख्य बजार क्षेत्रमा फरक तरिकाले सक्षम व्यक्ति मैत्री आकाशो पुलको निर्माण, तरकारी संकलन केन्द्र, महिला मैत्री शौचालय तथा रिफ्रेस केन्द्रको निर्माण, फुटपाथ नियन्त्रण, सडक स्तरोन्नतिको दौरान निम्तिन सक्ने पहिरो नियन्त्रण, सुरक्षा मैत्री सडक तथा बडा स्तरमा गुनासो सुनुवाइ सम्बन्धी व्यवस्था र स्थानीय रोजगारी विशेषतः महिला रोजगारी सम्बन्धि विषय उठाइएका थिए ।

वातावरणीय र सामाजिक व्यवस्थापनका उपायहरु

ई.एस.एस.को आधारमा अपनाइने व्यवस्थापनका उपायहरू यसप्रकार रहेका छन् ।

सरोकारवाला समक्ष समन्वय गर्ने तथा आवश्यक सुचना उपलब्ध गराउने प्रक्रियाले आयोजनाका कारण निम्तिने असरहरू न्यूनीकरण गर्न मद्दत पुऱ्याउँदछ । आयोजनाले स्थानीय निकाय तथा सरोकारवालासंग आवश्यक समन्वय गरेर स्तरोन्नतीको कार्य गर्नेछ जसले गर्दा स्थानीय स्तरमा योजना तर्जुमा गर्दा निम्तिन सक्ने अव्यवस्थित विकासका गतिविधिका थप असरहरूलाई न्यूनीकरण गर्न मद्दत गर्छ ।

यस वातावरणीय तथा सामाजिक व्यवस्थापनमा आयोजनाबाट पर्नसक्ने प्रतिकूल जोखिम तथा असर न्यूनीकरणको स्तर बमोजिम तयार पारिएको छ । उक्त व्यवस्थापनमा न्यूनीकरणको उपायहरू अनुगमन तालिका क्षमता अभिवृद्धि तथा प्रतिवेदन तथा वातावरणीय तथा सामाजिक मूल्य समेत समावेश गरिएको छ । साथै यस व्यवस्थापनले आयोजना क्षेत्रभित्र हुने लैंगिक हिंसा न्यूनीकरणका उपाय समेत समावेश गरिएको छ । यस व्यवस्थापनले आयोजनाबाट हुनसक्ने मुख्य रूपमा श्रमिकसंग सम्बन्धित समस्याहरू श्रम ऐन २०७४, श्रम नियमावली २०६५ र विश्व बैंकको वातावरणीय तथा सामाजिक मापदण्ड ईएसएस-२ मा उल्लेख भएअनुरूप श्रमिकको व्यवस्थापन प्रक्रिया तथा पेशागत स्वास्थ्य तथा सुरक्षाको संरचना समेत समावेश गरिएको छ । यसको अलावा गुनासो सुनुवाइ सम्बन्धी व्यवस्थाको स्थापना गरी श्रमिकसंग सम्बन्धित गुनासोहरू समेत दर्ता तथा सुनुवाइ गर्ने व्यवस्था यस योजना अनुरूप समेटिएका छन् । त्यसैगरी श्रमिकले पालना गर्नुपर्ने अनुशासन तथा नियम बनाउनुको साथै लैंगिक हिंसा घटाउने एवं निरुत्साहित गर्न यस व्यवस्थापन योजनामा समेटिएको छ ।

आयोजनाबाट पर्नसक्ने सामाजिक जोखिम तथा असरलाई सम्बोधन गर्न छुट्टै पुर्नवास कार्ययोजना तयार गरिएको छ । सबै क्षतिहरू (निजी र सार्वजनिक सम्पत्ति) लाई अधिकार मेट्रिक्स (इन्टाइटलमेन्ट मेट्रिक्स) अनुरूप प्रतिस्थापन आगत सहित क्षतिपूर्ती दिइने छ । आयोजना कार्यान्वयनको बेला हुने कुनैपनि थप प्रभावहरू हुने थप क्षतीमा लाग्नु हुनेगरी पुर्नवास रुपरेखा तयार पारिएको छ । ई.एस.एम.पि. ले ठेकेदार परिचालन भए पश्चात र निर्माण कार्य थालनि गर्नु अगाडि ठेकेदारलाई ठेकेदारको ई.एस.एम.पि. (सि.- ई.एस.एम.पि.) तयार पार्न बाध्य गर्छ । सि.- ई.एस.एम.पि.मा नेपाल सरकार र आई.एफ.सि. तथा विश्व बैंकको कामदार आवाश निर्देशिका अनुरूप अरु मध्ये व्यवसाय र स्वास्थ्य सुरक्षा योजना, पानी र फोहर व्यवस्थापन योजना, वाह्य कामदारहरूको ठूलो संख्यामा आगमनको व्यवस्थापन योजना, श्रम शिविर व्यवस्थापन योजना, ट्राफिक र सडक सुरक्षा व्यवस्थापन योजना, क्वेरी व्यवस्थापन योजना र साईट पुनस्थापना योजना समावेश हुनुपर्ने छ ।

नागदुइ-नीविसे-मुग्लिङ सडक खण्डमा रहेका आदिवासी जनजाती समुदायमा पर्ने असरहरू सम्बोधन गर्न आदिवासी जनजाती विकाय योजना तयार पारिएको छ ।

परियोजनाले सरोकारवाला पहिचान र परियोजना चक्र भरि सरोकारवालाहरूको संलग्नताका लागि सरोकारवाला संलग्नता योजना तयार पारिएको छ । सरोकारवाला संलग्नता योजनाले समुदाय जागरुकता र महिला तथा जवान बालिका केन्द्रित स्वस्थता खोज व्यवहारलाई बढावा दिने सामग्री प्रदान गर्दछ । सरोकारवाला संलग्नता योजनाले सरोकारवालाहरूको कुनै प्रश्न वा गुनासा भएमा व्यक्त गर्न परियोजना स्तरको गुनासो सम्बोधन संयन्त्रको विस्तार समावेश गर्दछ ।

सामान्य जोखिम र प्रभाव निवारण उपग्रह सामान्य जोखिम र प्रभाव निवारण उपग्रहमा बायोइन्जिनियरिङ र सुदृढीकरण संरचनाहरू सहितको ईरोजन नियन्त्रण योजना, प्रभावित त्याइस्केपको जिर्णोद्धार, स्टर्कपिङ र उत्खनन व्यवस्थापन योजनाको विकास, क्षतिपूर्ती रोपन, दक्ष मैसिन र कार्बन अफसेट का लागि सिफारिस, अर्थपूर्ण परामर्शका साथ समुदायलाई विश्वासमा लिएर सबै प्रभावित उपयोगहरूको उचित स्थान परिवर्तन र पुनर्स्थापन, सबै शिकार दुरुत्साहित गर्ने नियमहरूको कार्यान्वयन र नियन्त्रण, उपयुक्त स्थानमा गति सीमा संकेत स्थापना, चालकहरूलाई जागरुकता प्रदान गर्ने, उजुरीका लागि गुनासो निवारण संयन्त्र (जि.आर.एम.) स्थापना, परियोजना साइट सम्म र बाट श्रमिकलाई यातायात सुविधा, कामदारहरूको सुरक्षा उपायहरू अपनाउने जस्तै चम्किने ज्याकेट (एप्रोन), जुता, पन्जा र हेल्मेटहरू, श्रम कानूनको पालना, कामदार शिविर संचालन निर्देशिकाको स्थापना, खतरनाक सामग्री प्रयोग, भण्डारण, यातायात र व्यवस्थापन गर्न खतरनाक सामग्री व्यवस्थापन योजना विकास, जल गुणस्तर व्यवस्थापन योजनाको विकास, महिला र जवान बालिकाहरूलाई जोड दिएर समुदाय जागरुकता र संवेदनशीलता, निर्माण भन्दा पहिला खतरनाक रासायनिक फोहरसहितको रासायनिक व्यवस्थापन योजना पर्दछन् । कुनैपनि प्रत्यक्ष वा अप्रत्यक्ष पुरातात्विक महत्वको सम्पदामा असर पर्ने छैन । आकस्मिक प्राप्त सम्बन्धमा ई.एस.एम.एफ.मा उल्लेखित आकस्मिक प्राप्त कार्यविधि अनुसरण गरिने छ ।

स्थान विशेषका असर न्यूनीकरणका उपायहरू स्थान विशेषका असर न्यूनीकरणका उपायहरूमा जथाभावी भिर कटान तथा उत्खननमा रोक लगाउँदै स्लोपको बेन्चिङ्ग कार्य गरिनेछ एवं छाडो र भिरालो जमिनमा विस्तारै र न्यून कटान गरिनेछ । यसका साथै हाल रहेका प्राकृतिक जल निकास व्यवस्थापन, बायोइन्जिनियरिङ तथा स्लोप नियन्त्रण कार्य, एक रुख काटेवापत २५ रुख रोप्नुपर्ने प्रावधान, रोप्दा स्थानीय प्रजातीको छनौट, नर्सरीको स्थापना, विद्युतका पोल्को स्थानान्तरण, सडक सुरक्षा चिन्ह तथा बोर्डको स्थापना, ध्वनिका अवरोध क्षेत्रको स्थापना, निर्माणजन्य सामग्री भण्डारण स्थललाई विपालले ढाक्ने, भण्डारण गरिएको निर्माणजन्य सामग्री धुलोले उडाउनबाट रोक्न पानी छर्कने, उक्त क्षेत्र सुरक्षाको लागि बारबेरा तथा सुरक्षा गार्डको प्रबन्ध र स्थानीय वासिन्दाको लागि फुटपाथ तथा आकाशो पुलको निर्माण लगायतका उपाय अवलम्बन गरिनेछ ।

यी उल्लेखित न्यूनीकरणका उपायहरू अवलम्बन गर्न लाग्ने वातावरणीय व्यवस्थापनको अनुमानित खर्च रु. १४२,३०६,६४९ (करिब १,२५४,२४७ अमेरिकी डलर) रहेको छ ।

वातावरणीय तथा सामाजिक प्रतिवद्धता योजनाका लागि आवश्यक उपाय तथा कार्य

यस प्रतिवद्धता योजनाभित्र आयोजनामा वर्णन गरिए अनुरूप वातावरणीय तथा सामाजिक प्रभाव मुल्याङ्कन प्रतिवेदन एवं पुर्नवास नीतिको रूपरेखा तथा जोखिमयुक्त समुदाय विकास रूपरेखा अन्तर्गतको पुर्नवास कार्ययोजना तथा जोखिमयुक्त समुदाय विकास योजना, श्रमिक व्यवस्थापन योजना, सरोकारवालाहरूको सहभागिता योजना लागु गर्ने समय तालिका उल्लेख छ । भौतिक पूर्वाधार तथा यातायात मन्त्रालय, सडक विभाग अन्तर्गतको विकास सहायता कार्यान्वयन महाशाखा यस प्रतिवद्धता योजना लागु गर्ने जिम्मेवार निकाय छन् ।

सडक विभाग, यस प्रतिवद्धता योजना मुताविकका विषयवस्तु कार्यान्वयन गर्न आवश्यक उपाय तथा कार्य गर्ने र सोको विस्तृत जानकारी विश्व बैंकलाई उपलब्ध गराउने निकाय हो । विश्व बैंकले आयोजना अवधिभर प्रतिवद्धता योजनाभित्रका विषय कार्यान्वयन भए/नभएको अनुगमन गर्नेछ । यदि

आवश्यक परेको खण्डमा वा आयोजनामा केही आकस्मिक घटनाक्रम देखिएमा त्यसलाई उपयुक्त निराकरण गर्न वातावरणीय तथा सामाजिक प्रतिवद्धता योजनालाई आयोजना अवधिभर सिमित परिधिभित्र रही परिमार्जन तथा अध्यावधिक गर्न सकिन्छ । प्रस्तावकले संभावित वातावरणीय तथा सामाजिक जोखिमको व्यवस्थापन विश्व बैंकको वातावरणीय तथा सामाजिक व्यवस्थापन रुपरेखा अनुरूप गर्नेछ र वातावरणीय तथा सामाजिक सुरक्षणका क्रियाकलापमा जोखिम न्यूनीकरण गर्दै परिणाममा ध्यान पुऱ्याउनेछ ।

संगठनात्मक व्यवस्थापन

भौतिक पूर्वाधार तथा यातायात मन्त्रालय अन्तर्गतको सडक विभाग, सडक संजालको योजना तर्जुमा तथा निर्माणमा नेपालको छाता संस्था हो । सडक विभाग अन्तर्गत पाँचवटा महाशाखामा एक एक जना उपमहानिर्देशक रहने व्यवस्था छ जो आफ्नो निकाय अन्तर्गतको आयोजना तयार तथा लागू गर्न जिम्मेवार रहन्छन् । आयोजना कार्यान्वयन हुने विभिन्न स्थानमा ३३ वटा डिभिजन कार्यालय (हाल १९ वटा) रहेका छन् । पाँच महाशाखामध्ये, विकास सहायता कार्यान्वयन महाशाखा दातृ निकायले आर्थिक सहयोग गर्ने योजना कार्यान्वयन गर्ने प्रमुख निकाय हो । विकास सहायता कार्यान्वयन महाशाखा अन्तर्गतको आयोजना समन्वय इकाइले प्रारम्भिक वातावरणीय परिक्षण प्रतिवेदन, वातावरणीय तथा सामाजिक प्रभाव मूल्याङ्कन प्रतिवेदन, पुर्नवास कार्ययोजना तथा जोखिमयुक्त समुदाय विकास योजना र अन्य वातावरणीय तथा सामाजिक जोखिमको व्यवस्थापन सम्बन्धि प्रतिवेदन तयार तथा लागू गर्ने गरेको छ । परियोजना व्यवस्थापन गर्न आयोजना समन्वय इकाइ स्थापना गरिने छ ।

सडक विभाग अन्तर्गतको भू-वातावरण तथा सामाजिक इकाई, वातावरणीय तथा सामाजिक जोखिमको व्यवस्थापन तथा अनुगमन गर्न तोकिएको निकाय हो । यस इकाईले योजना अनुरूप आयोजना कार्यान्वयन भए/नभएको अनुगमन र नेपाल सरकार तथा दातृ निकायको सहयोग रहने आयोजनाका प्रारम्भिक वातावरणीय परिक्षण प्रतिवेदन, वातावरणीय तथा सामाजिक प्रभाव मूल्याङ्कन प्रतिवेदन, पुर्नवास कार्ययोजना तथा जोखिमयुक्त समुदाय विकास योजनाको समिक्षा पनि गर्ने गरेको छ । वातावरण संरक्षण ऐनले तोकेबमोजिम भौतिक पूर्वाधार तथा यातायात मन्त्रालय यातायात क्षेत्रको प्रारम्भिक वातावरणीय परिक्षण प्रतिवेदन स्वीकृत गर्ने निकाय हो । त्यसैगरी यस मन्त्रालयले वन तथा वातावरण मन्त्रालयले स्वीकृत गर्ने वातावरणीय तथा सामाजिक प्रभाव मूल्याङ्कन प्रतिवेदनलाई समिक्षा तथा लागू गर्दछ । वन तथा वातावरण मन्त्रालय अन्तर्गतको वातावरण प्रभाव मूल्याङ्कन शाखाले वातावरणीय तथा सामाजिक प्रभाव मूल्याङ्कन प्रतिवेदनलाई समीक्षा तथा स्वीकृत गर्दछ ।

अन्य निकायहरु जस्तै वन तथा भू-संरक्षण विभाग, राष्ट्रिय निकुञ्ज तथा वन्यजन्तु संरक्षण विभाग, श्रम तथा व्यवसायजन्य सुरक्षा विभाग र आयोजनाबाट प्रभावित गाउँपालिका/नगरपालिकाहरुको पनि आयोजना कार्यान्वयनका दौरान समन्वयकारी भूमिका रहने छ ।

ठेकेदार र उप-ठेकेदारहरुले बोलपत्र, सम्झौता र सडक विभागको ई.एस.सि.पि.मा उल्लेखित ई.एस.एम.पि. र सम्बन्धित योजनाहरु पालना गर्नुपर्ने छ ।

वातावरणीय र सामाजिक जोखिम र प्रभावहरु व्यवस्थापन गर्न परियोजना कार्यान्वयनमा संलग्न सडक विभाग र निकायहरुको तालिम र क्षमता अभिवृद्धि परियोजनाको संस्थागत सुदृढिकरण कम्पोनेन्टले गर्नेछ ।

Table of Contents

CHAPTER 1: Project Description	1
1.1 The Project Background	1
1.2 NNM Road General Characteristics	2
1.3 Salient Features	3
1.4 Project Design	6
1.5 Construction Approach and Methods	6
1.6 Four-Laning in the Built-Up Areas	7
1.7 Plan for Footbridge.....	7
1.8 Procedure of Operation.....	8
1.9 Project Implementation Time Schedule	9
1.10 Labour and Working Conditions	9
1.11 Construction Materials	9
1.11.1 Sources of Rock Aggregates and Natural Sand	9
1.11.2 Source of Construction Water	12
1.12 Use of Energy and Energy Saving Measures during Project Implementation	12
1.13 Road Traffic Analysis.....	13
1.13.1 Traffic Demand.....	13
1.13.2 Traffic Growth.....	13
1.13.3 Diverted and Generated Traffic	14
1.14 Delineation of the Project Area	14
1.14.1 Zone of Influence (ZOI)	14
1.14.2 Direct Impact Area (DIA).....	14
1.14.3 Indirect Impact Area (IIA).....	16
CHAPTER 2: Legal and Institutional Framework	17
2.1 The Environmental Assessment Process in Nepal	17
2.2 Environmental and Social Legislation of Nepal.....	17
2.2.1 The Constitution of Nepal	17
2.2.2 National Plans, Strategies and Policies.....	18
2.2.3 National Directive, Guidelines, Manuals and Standards	26
2.3 International Policy Framework.....	27
2.3.1 Relevant International Conventions.....	27
CHAPTER 3: Methodology.....	32
3.1 Approach	32
3.2 Consultative Meeting within Study Team.....	34
3.3 Consultative Meetings with the Project Proponent	34
3.4 Desk Study	34
3.5 Field Study and Survey	34
3.6 Analysis of Alternatives	35
3.7 Public Consultation/Stakeholder Engagement	35
3.8 Compilation of Field Data and Triangulation with Secondary Information.....	35
3.9 Data Analysis and Interpretation	35
CHAPTER 4: Baseline Environmental and Social Conditions.....	36
4.1 Physical Environment.....	36

4.1.1 Topography and Geomorphology.....	36
4.1.2 Climate and Hydrology.....	37
4.1.3 Regional Geology	40
4.1.4 Engineering Geological Condition	44
4.1.5 Seismicity	46
4.1.6 Landslide and Slope Stability	48
4.1.7 Landslide Hazard Mapping and Active landslide area	51
4.1.8 Air Quality	51
4.1.9 Noise Level.....	52
4.1.10 Water Quality	53
4.1.11 Land Use.....	53
4.1.12 Solid Waste Management	56
4.2 Biological Environment.....	57
4.2.1 Forests in the Project Area.....	57
4.2.2 Types of Forest by Vegetation.....	57
4.2.3 Types of Forest by Ownerships and Area Being Affected	60
4.2.4 Estimated Number of Trees Along the Road Alignment.....	61
4.2.5 Wood Volume, Biomass, and Carbon Conversion of the Trees Affected in the Project Area	62
4.2.6 Tree Species Diversity in CF.....	62
4.2.7 Tree Species Diversity in Leasehold Forest	62
4.2.8 Fauna in the Project Area	63
4.2.9 Herpetofauna and Aquatic Fauna	67
4.2.10 Protected, Rare or Endangered Flora and Fauna Speciesin ZOI	70
4.3 Socio-economic and Cultural Environment (Baseline)	71
4.3.1 General Profile of Project Area	71
4.3.2 Profile of Project Affected People	79
4.3.3 Indigenous Peoples in the project area	81
Chapter 5: Stakeholder Engagement and Public Consultations.....	82
5.1 Introduction	82
5.1.1 Mapping of Stakeholders.....	82
5.1.2 Affected Parties	82
5.1.3 Other Interested Parties.....	83
5.2 Methods of Stakeholder Engagement and Public Consultations.....	83
5.3 Stakeholder Consultation.....	83
5.4 Grievance Redress Mechanism	86
5.4.1 Project-Related Grievances	87
5.4.2 Grievance related Project workers.....	87
5.4.3 Gender Based Violence (GBV) Related Grievances	87
5.4.4 Implementation of GRM in the Project Cycle	87
Chapter 6: Environmental and Social Risks and Impacts	91
6.1 Beneficial Impacts of NNM Road Improvement	91
6.1.1 Improved Road Infrastructure.....	92
6.1.2 Employment Generation.....	93
6.1.3 New Income Generation (Trade, Agriculture, Business, Industry)	93
6.1.4 Increase in Land and Property Value.....	94
6.1.5 Carbon Emission Savings/Reduction in GHG Emissions	94

6.2 Adverse Impacts	94
6.2.1 General Impacts	94
6.3 Assessment and Management of Environmental and Social Risks and Impacts (ESS 1)	100
6.3.1 Cumulative Impacts	100
6.4 Labour and Working Conditions (ESS-2)	102
6.5 Resource Efficiency and Pollution Prevention Management (ESS-3)	103
6.5.1 Construction stage	103
6.5.2 Impacts at the Operation Stage	105
6.6 Community Health and Safety (ESS-4)	105
6.7 Land Acquisition, Restrictions of Land Use and Involuntary Resettlement (ESS5)	110
6.7.1 Impacts at Construction Stage	110
6.8 Biodiversity Conservation and Sustainable Management of Living Natural Resources (ESS-6)	112
6.8.1 Impacts at the Construction Stage	112
6.8.2 Impact at the Operation Stage	113
6.9 Indigenous People (ESS-7)	113
6.10 Cultural Heritage (ESS8)	113
Chapter 7: Environmental and Social Management Measures	115
7.1 Application of the Mitigation Hierarchy in the NNM road	115
7.2 Plan for Beneficial Impact Augmentation Measures:	115
7.3 Plan for Adverse Impact Mitigation Measures	116
7.3.1 Construction Stage Activities by Contractor	130
7.3.2 Operation Stage Activities by PIU	131
Chapter 8: Analysis of Alternatives	140
8.1 Introduction	140
8.2 Basis of Selection of the Road Alignments	140
8.2.1 Comparative Assessment of Alternative Alignments	143
8.3 Alternative Time Schedule for Construction	145
Chapter 9: Key Measures and Actions for the Environmental and Social Commitment Plan	146
9.1 Environment and Social Commitment Plan (ESCP) Monitoring and Reporting	146
9.2 Environment and Social Standards (ESS) Standards and Compliance	147
Chapter 10: Institutional Arrangements	150
10.1 Institutions and their Roles in E&S Risk Management of Roads and Bridges Project	150
10.1.1 Department of Roads	150
10.1.2 Project Office/Project Management Office (PO/PMU)	150
10.1.3 Geo-Environment and Social Unit (GESU)	151
10.1.4 Divisional Offices of DoR	151
10.1.5 Ministry of Physical Infrastructure and Transport (MoPIT)	151
10.1.6 EIA Unit under Ministry of Forest and Environment (MoFE)	151
10.1.7 Environmental Impact and Compliance Monitoring Unit under Department of Environment's Environmental (DoE)	151
10.1.8 Department of Forestry and Soil Conservation (DoFSC)	152
10.1.9 Department of National Parks and Wildlife Conservation (DNPWC)	152
10.1.10 Department of Labour and Occupational Safety (DoLOS)	152
10.1.11 Ministry of Federal Affairs and General Administration	152

10.1.12 District Coordination Committees (DCC)	152
10.1.13 Municipalities and Rural Municipalities (Gaunpalikas)	152
10.1.14 Department of Local Infrastructure (DoLI)	153
10.1.15 Department of Archaeology	153
10.2 Implementation Arrangement of ESMP	155
10.3 Acquisition of Permits and Clearances.....	157
10.4 Safeguard Capacity and Staffing Techniques.....	159
References.....	161
Annexes.....	163
Annex 1: Project Description	163
Annex 1.1: Flood Estimation for Drainage Structures	163
Annex 2: Baseline Information	164
Annex 2.1: Annual, Spring, Monsoon, Autumn and Winter Patterns of Temperature.....	164
Annex 2.2: Annual, spring, monsoon, autumn and winter patterns of rainfall in the study area	165
Annex-2.3: Trishuli River, Discharge in cumecs	166
Annex-2.4: Trishuli River, Maximum Instantaneous Discharge in cumecs.....	167
Annex 2.5: Lithostratigraphy of Lesser Himalaya, Central Nepal	167
Annex 2.6: Conversion of the maximum acceleration of the earthquake motion into the design seismic coefficient	168
Annex 2.7: National Ambient Air Quality Standards for Nepal, 2012.....	168
Annex 2.8: Water Quality Test Results	169
Annex 2.9: National Drinking Water Quality Standard 2006.....	171
Annex 2.10: Water and Effluent Quality Guidelines of the Country Are as Follows:	172
Annex 2.11: Bird Species Recorded from Field Study and Literature Review	172
Annex 2.12: Fish Fauna of the Study Area (based on literature sources and survey)	180
Annex 2.13: Critical Habitat Criteria.....	183
Annex 2.14: Results of Critical Habitat Assessment.....	184
Annex 2.15: Critical Habitat Screening Assessment (Criterion 1.1 and Criterion 1.3).....	185
Annex 2.16: Distribution of Caste/Social Groups in Project Municipals.....	194
Annex 2.17: Literacy Rate of Project Municipalities/Rural municipalities.....	194
Annex 2.18: Human Poverty Index of Project Districts	194
Annex 2.19: Distribution of HHs Headed by Females in Project Districts	194
Annex 2.20: Absentee Population and Household	195
Annex 2.21: Distribution of Project Affected HHs By Social /Caste Groups	195
Annex 2.22: Sex of Household Heads of Project Affected Surveyed Households	195
Annex 2.23: Household and Population of Project Affected Surveyed Households.....	195
Annex 2.24: Distribution of Project Affected Surveyed Households by Caste and Ethnic Groups	195
Annex 2.25: Distribution of Project Affected Surveyed Households By Ips And Vcs Category	196
Annex 2.26: Educational Status of Affected Population	196
Annex 2.27: Occupational Status of Affected Population	196
Annex 2.28: Annual Household Income of Project Affected Household (NRs.)	196
Annex 2.29: List of tracks that are existed along the existing highway connecting different villages.....	196
Annex 3: Stakeholder Engagement and Public Consultation	199

Annex 3.1: Public Consultation during ESIA Scoping (22 Aug- 6 Sep 2016):.....	199
Annex 3.2: Public Consultation during ESIA phase (26-30 Jan 2017)	202
Annex 3.3: Consultations with Community Forest Groups for Flora and Fauna in the Project Area (15-21 March 2017)	202
Annex 3.4: Public Hearing (9-12 April 2019)	203
Annex 3.5: Consultation for Footbridge and Public Toilet (26-31 June 2018)	205
Annex 3.6: First Supplementary Public Consultation (16 June -11 Aug 2019)	210
Annex 3.6: Second Complimentary Consultation (December 2019)	212

List of Tables

Table 1-1: Proposed standards with comparison	4
Table 1-2: Salient Features of the Existing Highway	4
Table 1-3: Location of Built up areas for four-laning.....	7
Table 1-4: Locations of Pedestrian Overhead Bridges	7
Table 1-5: Construction material availability and estimated volume	10
Table 1-6: Estimates of Normal Traffic in 2018 by Sub-sections (AADT)	13
Table 1-7: Registered Vehicles in Nepal, 1997–2017	14
Table 1-8: Economic Growth in Nepal, 2000–2018.....	14
Table 1-9: Traffic Growth Forecasts by Vehicle Class	14
Table 1-10: Affected Location with Wards of DIA.....	15
Table 2-1: Environmental and social rights of citizens declared in the Constitution of Nepal	17
Table 2-2: Key Provisions and Relevance of National Plans, Strategies, Policies, Acts/Rules and Regulations to NNM ESIA	18
Table 2-3: WB Environmental and Social Framework and Environmental and Social Standards in the infrastructure projects in Nepal.....	28
Table 4-1: Elevation with chainage of locations.....	36
Table 4-2: Rivers/rivulets along NNM roadside.....	37
Table 4-3: Design flood estimation for existing bridges in the existing road alignment (cumecs).....	39
Table 4-4: Geological Characteristic of the Road Corridor area (explanation of following Geological Map: Fig. 4-3)	42
Table 4-5: Geomorphology and Geology of road alignment of Existing Road alignment.....	44
Table 4-6: Soil Types and their distribution	45
Table 4-7: Distribution of the soils and terrain along the road alignment	45
Table 4-8: Section wise Hazard Category	46
Table 4-9: Instrumentally Recorded Earthquake	48
Table 4-10: Active landslide areas in the proposed road alignment.....	51
Table 4-11: Air Quality of Project Area	51
Table 4-12: Noise Quality Level of Project Area	52
Table 4-13: National Ambient Sound Quality Standard, 2012.....	52
Table 4-14: Noise exposure limits for the work environment (adopted from Occupational Safety and Health Administration (OSHA)).....	52
Table 4-15: Land use within the ROW, DIA and IIA of NNM and (area in Ha.)	53

Table 4-16: Impact of NNM on forest, trees, wood volume, biomass and carbon.....	61
Table 4-17: List of Protected, Rare or Endangered Plant species.....	63
Table 4-18: Global and national status of Mammal species reported in the ZOI of the road..	64
Table 4-19: : Herpetofauna Species Observed During the Field Survey	69
Table 4-20: Some Macroinvertebrates of the Study Area	69
Table 4-21: Globally and nationally threatened birds found in the project area	70
Table 4-22: Electric Poles within the direct impact zone (in Nos.)	78
Table 4-23: Water Supply Pipe Lines existing within the direct impact zone (in km).....	79
Table 5-1: Summary of the raised issues during stakeholder consultation.....	84
Table 6-1: Risk Screening Criteria	91
Table 6-2: Beneficial Impacts of NNM section improvement.....	91
Table 6-3: Estimate of Carbon Emission (2019 – 2042)	94
Table 6-4: Generic Adverse Impact Assessment Matrix along NNM.....	95
Table 6-5: Highly Landslide Prone Area	103
Table 6-6: Estimated volume of spoil for the disposal	104
Table 6-7: List of existing bridges along the NNM highway	107
Table 6-8: Quarry along NNM	108
Table 7-1: Benefits augmentation and enhancement measures	115
Table 7-2: Matrix of generic impacts and mitigation measures along NNM road and its management in accordance with WB ESF	118
Table 7-3: Site-specific impacts and mitigation measures along NNM road and its management in accordance with WB ESF	124
Table 7-4: Environmental and Social Management Plan	132
Table 7-5: Environmental and Social Monitoring Plan	137
Table 7-6: Estimated cost for ESMP and RAP	139
Table 8-1: Alternative Alignments Considered	141
Table 8-2: Road Improvement Options	142
Table 10-1: Environmental and social management responsibilities	155
Table 10-2: Status of permits and clearances	157
Table 10-3: Institutional Mandate and Responsibility in Road Development Projects.....	158
Table 10-4: Staffing Plan for DoR GESU and PMU.....	160
Table 11-1: Design flood estimation for existing bridges in the existing road alignment (cumecs).....	163

List of Figures

Figure 1-1: Map of NNM road Alignment	2
Figure 1-2: Current Road condition of NNM road section.....	3
Figure 1-3: Typical elevation of FB (road width 30m).....	8
Figure 1-4: Project implementation Schedule of NNM Road Project	9
Figure 1-5: Soil from project impacted area and water from Trishuli river will be used for construction.	10
Figure 1-6: Ongoing Practices of River material extraction.....	12
Figure 1-7: Direct impact area along the NNM	15
Figure 1-8: Direct impact area along existing road	16
Figure 3-1: Approach for ESIA	32
Figure 4-1: Temperature variation map in the road corridor from Birgunj to Kathmandu	38
Figure 4-2: Relief along NNM road.....	41
Figure 4-3: Geological Map of the Road corridor	43
Figure 4-4: Alluvial and residual soil types in the open deposit area along existing Highway	45
Figure 4-5: Soil types along NNM Road: Source: Data analysis, 2019	46
Figure 4-6: Seismic Map of Nepal.....	47
Figure 4-7: Peak Ground Acceleration Map of the Nepal Himalaya (Thapa and Wang, 2012)	47
Figure 4-8: Landslide and instable slopes along NNM section.	50
Figure 4-9: Landslide Hazard map along NNM Road in the project area.	50
Figure 4-10: Settlements surrounded by forests and agricultural fields	54
Figure 4-11: Land Use and Land Cover Map in the IIA along NNM Section	54
Figure 4-12: Road alignment showing Rural Municipalities and Municipalities.....	55
Figure 4-13: Land use map of NNM road (Direct Impact Area).....	56
Figure 4-14: Solid wastes dumped along the road (Near Naubise)	56
Figure 4-15: Forest Cover Map of NNM Road	58
Figure 4-16: Spots with wildlife species presence along NNM road	58
Figure 4-17: Schima-Castanopsis forest in Kathmandu district	59
Figure 4-18: Hill-Sal Forest along NNM section	59
Figure 4-19: Riverine forest in the Trishuli River Valley.....	59
Figure 4-20: Pine forest in NNM section.....	60
Figure 4-21: Highly disturbed and fragmented landscape along NNM road; monkey attracted to road.....	64
Figure 4-22: Migration status of birds found along road alignments	65
Figure 4-23: Globally threatened Steppe Eagle stopped for night in the woods near the road during migration in April (left); Common Myna – one of the most abundant species along the road, inhabiting human settlements (right).	65
Figure 4-24: Black Kite is one of the most common scavengers, found near the road	66
Figure 4-25: Fish harvest from the Trishuli River	67
Figure 4-26: Himalayan Vulture	70
Figure 4-27: Clustered settlements along existing highway.	71

Figure 4-28: Bananaproduction along NNM.	73
Figure 4-29: Markets along the road.....	75
Figure 4-30: Pilgrimage and touristic places along NNM.....	77
Figure 5-1: Consultant team meeting and stakeholder interview	82
Figure 5-2: Stakeholder consultations and key informant interview	83
Figure 5-3: Grievance Redress Mechanism structure in the project cycle	90
Figure 6-1: Deforestation trends along Birgung to Kathmandu Trade Corridor in Mid-Hill region.	102
Figure 7-1: Mitigation Hierarchy and its application principles (adapted from BBOP, 2009)	115
Figure 10-1: Organizational Chart of the Department of Roads and the embedding of the Geo-Environment & Social Unit	154

Acronyms

amsl	Above mean sea level
AP	Affected peoples
BCDP	Building Code Development Project
BOD	Biological Oxygen Demand
CBOs	Community Based Organizations
CDC	Compensation Determination Committee
CC	Construction Contractor
C-ESMP	Contractor's Environmental and Social Management Plan
CF	Community Forests
CITES	Convention on International Trade of Endangered Species
CoI	Corridor of Impact
CSC	Construction Supervision Consultant
cums	Cubic meters
DAO	District Administration Office
DBST	Double Bituminous Surface Treatment
DCC	District Coordination Committee
DCID	Development Cooperation Implementation Division
DFO	District Forest Office
DIA	Direct Impact Area
DLR	District Land Revenue Office
DNPWC	Department of National Parks and Wildlife Conservation
DO	Dissolved Oxygen
DoLOS	Department of Labour and Occupational Safety
DoMG	Department of Mines and Geology
DoR	Department of Roads
DoTM	Department of Transport Management
DPHO	District Public Health Office
DRO	Divisional Road Offices
EA	Environmental Assessment
EHS	Environment Health and Safety
EPA	Environmental Protection Act
ESCP	Environmental and Social Commitment Plan
ESIA	Environment and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESF	Environment and Social Framework
ESS	Environmental and Social Standard
FB	Footbridges
FGD	Focus Group Discussions
FPIC	Free Prior Informed Consent
GBV	Gender Based Violence
GESU	Geo-Environment and Social Unit
GF	Governmental Forest
GHG	Green House Gas
GoN	Government of Nepal

GPN	Good Practice Note
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
ha	Hectare
HHs	Households
IPDP	Indigenous Peoples Development Plan
IPPF	Indigenous Peoples Planning Framework
IFC	International Finance Corporation
IIA	Indirect Impact Area
IP	Indigenous People
KDP	Kamala-Dhalkebar-Pathlaiya
KII	Key Informant Interviews
LHF	Leasehold Forest
LLR	Land and Land Resources
LMP	Labour Management Procedure
M	Municipality
MBT	Main Boundary Thrust (MBT),
MCT	Main Central Thrust
MFT	Main Frontal Thrust (MFT).
MoFE	Ministry of Forest and Environment
MoPIT	Ministry of Physical Infrastructure and Transport
MT	Mahabharat Thrust
NDWQS	National Drinking Water Quality Standard
NEFIN	Nepal Federation of Indigenous Nationalities
NEIC	National Earthquake Information Centre
NGDC	National Geological Data Centre
NGO	Non-Government Organization
NNM	Nagdhunga-Naubise-Mugling
NNQSL	National Noise Quality Standard Limit
NOAA	National Oceanic and Atmospheric Administration
NTFP	Non-Timber Forest Products
OHSMF	Occupational Health and Safety Management Framework
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Association
PA	Project Area
PAF	Project Affected Families
PAP	Project Affected Persons
PCU	Project coordination Units
PGA	Peak Gravitational Acceleration
PH	Prithvi Highway
PIU	Project Implementation Unit
RAP	Resettlement Action Plan
RM	Rural Municipality
RoW	Right of Way
SC	Supervision Consultant

SDGs	Sustainable Development Goals
SEP	Stakeholder Engagement Plan
SPAF	Severely Project Affected Families
SRCTIP	Strategic Road Connectivity and Trade Improvement Project
SRN	Strategic Road Network
STI	Sexually Transmitted Infections
TH	Tribhuvan Highway
IPPF	Indigenous People’s Planning Framework
IPDP	Indigenous People’s Development Plan
WB	World Bank
ZOI	Zone of Influence

CHAPTER 1: Project Description

1.1 The Project Background

The Government of Nepal (GoN) is preparing the Strategic Road Connectivity and Trade Improvement Project (SRCTIP) for World Bank financing (IDA credit). The project has the following three components:

Component 1: Trade Facilitation: This component will cover issues relevant to trade development and support: (a) augmentation of physical infrastructure, equipment, inspection and related border transit management systems that are required to absorb increasing traffic and trade volumes at key border crossing points at Birgunj, Bhairahawa and Biratnagar; (b) augmentation of equipment and training, and construction and/or renovation of lab buildings at key border locations; and; and (c) knowledge and capacity building for: continuous improvement of the trade policy environment; monitoring of trade performance; and development and implementation, and monitoring and evaluation, of targeted trade promotion measures.

The component is also expected to generate employment opportunities for women in the construction/renovation and in laboratories and their capacity development.

Component 2: Regional Road Connectivity: This component will finance (i) capital expenditures pertaining to the construction phase of NNM and KDP roads, and associated consultancy services for design, supervision of works and safety assessment activities; and (ii) works, goods, equipment and consultancy services for implementation of SCDP. Both road improvement and upgrade works will cover engineering measures to improve climate resilience and road safety. The works will also include traditional item-rate contracts and new contracting approaches with provisions of road maintenance over a 5 to 8-year period after completion of the construction activity and receiving the project completion certificate. The component is consisted of 3 subcomponents:

- a) Improvement of the existing Nagdhunga-Naubise-Mugling (NNM) Road to a 2-lane with 1 m paved shoulders, including adoption of engineering measures to improve climate resilience, road safety, citizens' engagement and beneficiary feedback mechanisms;
- b) Upgrading of the Kamala-Dhalkebar-Pathlaiya (KDP) Road from 2-lane to 4-lane, including adoption of engineering measures to improve climate resilience, road safety and involvement of citizens and beneficiary feedback mechanisms; and
- c) Implementation of a safe corridor demonstration program (SCDP), covering a length of about 250 km of Strategic Road Network (SRN) including the NNM and KDP roads, which will include support for enhanced enforcement of traffic rules and post-crash response.

Component 3: Institutional Strengthening: This component will support (a) for the National Road Safety Council, through establishment of an interim secretariat with seed funding for staffing and equipment, and support for prioritized activities from the National Road Safety Action Plan (RSAP), including coordinating, monitoring and evaluating measures under

SCDP; monitoring of IT-MIS' work and the equipment service providers; supporting nation-wide role-out of the web-based Road Accident Information Management System (RAIMS); and supporting training and peer-exchange programs; (b) capacity enhancement of DoR for improved management of SRN, with particular focus on development and mainstreaming of road asset management system, support for training facilities and training in selected priority areas (covering also training and employment of local women for skilled employment opportunities in non-traditional transport sector), including network-level safety assessments, quality, procurement, design of advanced structures, management of environmental and social risks and impacts, and mobilization of additional resources to expand the sector revenue-base through direct and/or indirect user charges; and (c) support for periodic maintenance of the Core Highway Network (CHN).

Component 4: Contingency Emergency Response: Following an adverse natural event that causes a major natural disaster, the government may request the Bank to re-allocate project funds to support response and reconstruction. This component would draw resources from the unallocated expenditure category and/or allow the Government of Nepal to request the Bank to re-categorize and reallocate financing from other project components to partially cover emergency response and recovery costs. This component could also be used to channel additional funds should they become available as a result of an emergency.

1.2 NNM Road General Characteristics

The existing NNM Road section is a part of the Tribhuvan and Prithvi Highway (North – South Highway). It starts at Nagdhunga check-post of Kathmandu district and ends at Mugling Bazaar of the Chitwan district covering a total length of 94.7km (Fig. 1-1). The alignment passes

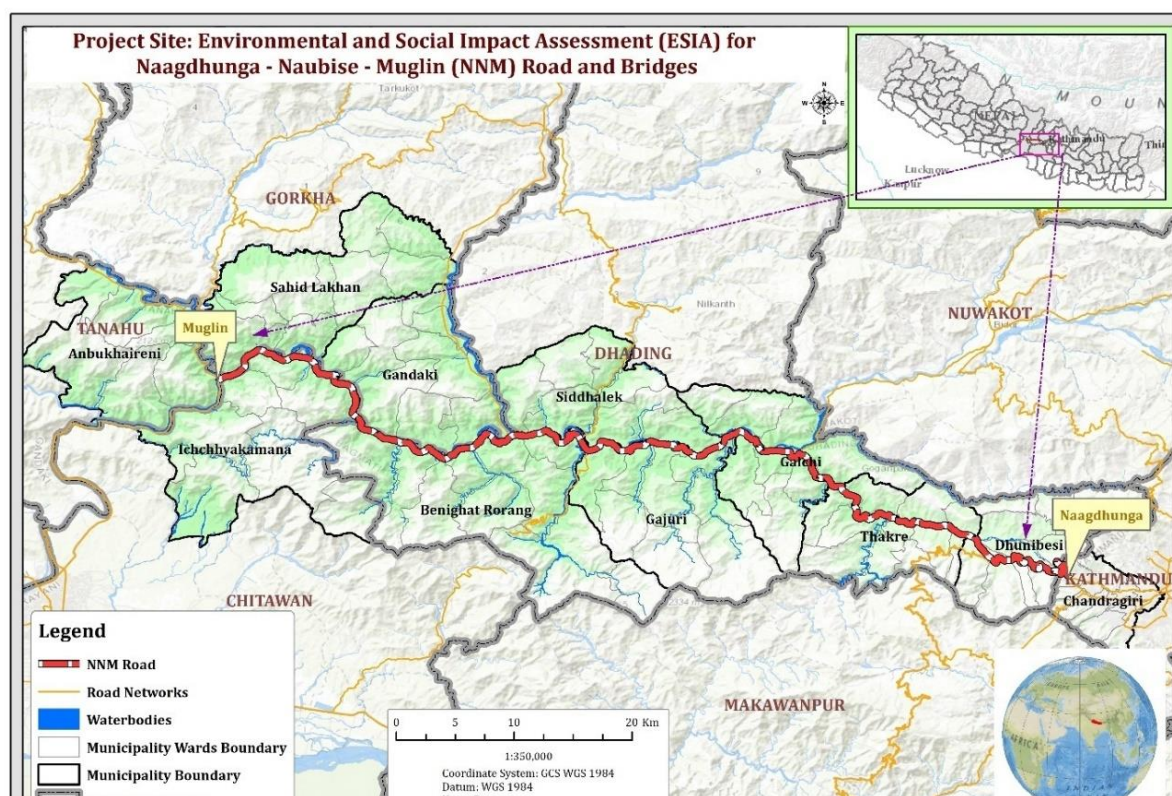


Figure 0-1: Map of NNM road Alignment

through Nagdhunga, Naubise, Khanikhola, Mahadevbesi, Galchhi, Baireni, Malekhu, Benighat, Kurintar settlements to reach Mugling. The project consists of the present 2-lane road proposed for improvement to a 2-lane carriageway configurations with shoulders and side drains. The highway has a junction with Tribhuvan Highway (TH) at Naubise. The highway also connects Nukawot District via a recently constructed road from Galchhi and connects to the district headquarter of Dhading District at Phurke Khola, Malekhu. Similarly, at Mugling the highway has junction of Mugling-Narayanghat Road Section connecting this highway to Mahendra Highway.

The present condition of the Prithvi Highway (PH), including the NNM Road section, does not respond to needs of increased traffic flow and requires improvement (Fig. 1-2). The PH, because of the terrain it follows, the loading on the roads and amount of traffic it carries, has varied road conditions from Kathmandu Valley to Mugling. The existing highway is a two-lane single carriageway road with high grade and narrow intersections, sealed with 2-Bituminous Surface Treatment (DBST) in almost all areas, except where regular maintenance is done. There is no traffic signage even in major intersections such as Naubise, Galchi, Malekhu, including no traffic lights. No passing lanes are being provided. Speed limits have not been applied on most sections, except some warning signs are placed near urban and town areas and a few sharp bends. There are many areas to be treated for high grades, sharp bends and visibility for all road users. Accidents due to sharp bending and narrow width are high. The passing lanes along the proposed section are lacking and not sufficient, although some are being implemented in the Naubise-Nagdhunga section.

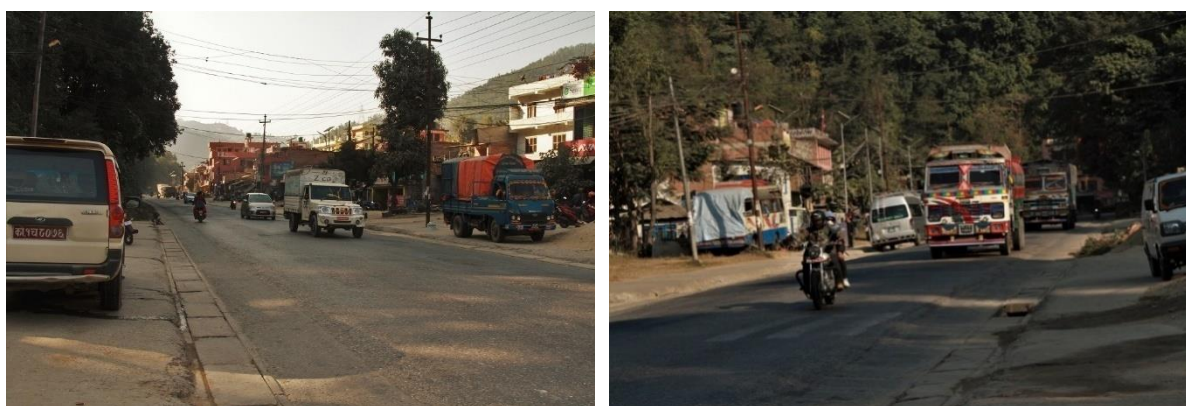


Figure 0-2: Current Road condition of NNM road section

Safety issues are increasing with population growth on both sides of the highway, however, there are no road crossing structures established at the populated settlement areas all along the alignment. The local intersections constructed by local residents should be addressed, before they become critical for road safety. Proper signage and other roadside furniture are required to be installed.

1.3 Salient Features

The existing 2-lane NNM Road has been proposed to be improved into the 2-lane Asian Highway Standard (**Table 1-1**). Existing NNM alignments will be upgraded with the standard carriageway width of 7 meters with shoulder width 1 to 2.5 meters in accordance with the terrain (plain (P), rolling (R), mountainous (M), and steep (S)).

Table 0-1: Proposed standards with comparison

Design Parameters	Nepal Road Standards (Class-II Road)				Asian Highway Standards				Proposed Standards			
	P	R	M	S	P	R	M	S	P	R	M	S
Design Speed (Kmph)	100	80	60	40	80	60	50	40	100	80	50	35
Vertical Gradient (%)	5	6	7	9	4	5	6	7	5	6	6	7
Maximum Length of Gradient (m)	450	400	300	200	700	600	500	400	450	400	400	200
Radius of Horizontal Curve (m)	370	210	110	40	210	115	80	50	370	210	80	30
Super Elevation (%)	7 – 10				10				Max. 8%			
Carriageway Width (m)	7.0				7.0				7.0			
Shoulder Width (m)	2.5				2.0 – 2.5				1.0 - 2.5			
Camber (%)	2.5				2.0				2.5			
Stopping Sight Distance (m)	190	130	80	50					190	130	80	50
Minimum Transition Curve Length (m)	400	250	40	35	70	50	40	35	400	250	40	35
Right of Way (m)	30 – 50				40				30 - 50			

The salient features of the existing highway are provided in the **Table 0-2**.

Table 0-2: Salient Features of the Existing Highway

S.N.	Salient features	Descriptions
1	Name of the Project Road	Nagdhunga-Naubise-Mugling Road
2	Length	96 Km
3	Terrain	Steep Hilly and Mountainous
4	Existing bituminous carriageway width	5.50 m to 6.50 m
5	Existing shoulders widths	0.50 m to 1.00 m
6	Number of major horizontal curves	107
7	Location of steep vertical gradients	46
8	Number of hairpin bends/blind curves	6
9	Number of major villages/bazaars	12
10	Length of existing side drains	102 Km
11	Number of existing bridges	26
12	Number of existing culverts	445
13	Length of existing retaining walls	14985 m
14	Length of existing breast walls	6701 m
15	Length of existing gabion walls	5135 m
16	Number of major junctions	6
17	Number of minor junctions	64
18	Length of existing median	Nil
19	Length of existing footpath	Nil
20	Right of Way	50 m

Source: Detailed Design Report, 2019

Nagdhunga — Naubise Road: The Nagdhunga- Naubise Road is part of TH, which is a national highway as per DoR classification with road reference No. H 02. This road was initially constructed in 1956 and then rehabilitated in 1997. The salient features of this existing section of road are mentioned below:

• Name of Road	:	Nagdhunga — Naubise Road
• Road Reference No	:	H 02
• Link Code		
○ Nagdhunga to Peepalmod	:	H 0214
○ Peepalmod to Naubise	:	H0213
• Length	:	12.5 Km
• Carriageway Width	:	5.5 to 7.5 m
• Shoulder Width	:	0.5 m
• Formation Width	:	7.5 — 9.5 m
• Minimum Radius of Horizontal Curve	:	17 m
• Number of Horizontal Curves	:	169
• Number Curves with R=or<25m	:	33
• Maximum Gradient	:	10.19% at Km 0+289; 10.34% at Km 1+512; 10.31% at 2+451
• Grade more than 7 %	:	At 20 locations
• Pavement Composition	:	Sub-base 20 cm Base 18-25 cm and Bituminous Layer 5 - 10 cm
• Condition of Road Pavement	:	Fair to Poor; IRI >7; SDI 1.7— 3.
• Number of Bridges	:	2 Nos, Total Length: 45 m
• Number of Culverts		
○ Hume Pipe	:	52
○ Slab Culvert	:	8

Naubise — Mugling Road: The Naubise-Mugling Road is a part of PH, a national highway as per DoR classification with road reference No. H 04. The road was constructed in 1973 and rehabilitated/upgraded in 1995. Some of the existing features of this road are depicted below:

• Name of Road	:	Naubise - Mugling Road (Part of PH)
• Length	:	82+850Km
• Road Reference No	:	H 04
• Link Code		
○ Naubise to Galchhi	:	H 0401
○ Galchhi to Trishuli Bridge	:	H 0402
○ Trishuli Bridge to Mawa Khola	:	H 0403
○ Mawa Khola to Mugling	:	H 0404
• Carriageway Width	:	6.5 m
• Shoulder Width	:	1.0 m
• Formation Width	:	8.5 m
• Minimum Radius of Horizontal Curve	:	20 m at Km 12+324 and Km 79+786
• Number of Horizontal Curves	:	577 Nos.
• Maximum Gradient	:	8.21 % at Km 38+324
• Gradient more than 7%	:	At 30 places
• Pavement Composition	:	Wearing Course 40 mm Binder Course 60 mm

		Wet mix Base/ESB	150-200 mm
		Granular Sub-base	200-250 mm
• Condition of Road Pavement	:	Fair to Good; IRI <6, SDI <3	
• Number of Bridges	:	24 Nos. Total Length 766.5 m	
• Number of Culverts			
○ Hume Pipe	:	50	
○ Box Culvert	:	2	
○ Slab Culvert	:	333	
• Major Landslide Areas			
○ Krishnabhir at Km 58			
○ Jogimara at Km 64			
• Major Junctions			
○ Naubise at Km 0+000	:	Junction to Hetauda (TH)	
○ Galchhi at Km 22+400	:	Junction to Nuwakot	
○ Malekhu at Km 42+200	:	Junction to Dhadingbesi	
○ Benighatat Km 50+900	:	Junction to Gorkha District	
○ Darechaur at Km 78+100	:	Junction to Manakamana Cable Car Gate	
○ Mugling at Km 82+000	:	Junction to Narayanghat and Pokhara	

Bridges: Out of the 20 existing bridges, 18 will be rehabilitated, whilst 2 will be newly constructed. The list of the existing bridges along the NNM highway is presented in the **Annex 1**.

1.4 Project Design

The improvement of existing highway will enhance movement of traffic from Kathmandu, not only to Mugling, but also to Birgunj, connecting the Indian border and Pokhara. This section of highway is important, especially for the freight transportation and export of goods and commodities. Several alternatives have been studied along the proposed section in order to achieve a 4-lane Asian Highway Standard. However, due to the fragile geology, topography, and undulations, the alternative of improving existing NNM highway into 2-lane standards with significant improvement at urban areas, situated along the highway has been considered.

The project involves upgrading the road to 2-lane Asian Highway standard and therefore does not require for opening of tracks, and hence no blasting will be employed. All the road upgrading works will be done with the use of mechanical equipment. The same will apply for the quarry works.

1.5 Construction Approach and Methods

Crusher plants and borrow pits will be established in several proposed locations to obtain sand, soil and aggregates. It is suggested that the general construction method of highway construction will be mechanical. Machines and excavators will be used throughout the length for the formation of road width and site clearance. There will be no blasting to be employed under the project. Disposal of spoil will be carried out using loader and trucks for haulage from excavated road alignment to proposed tipping site for safe disposal. Appropriate environmental safeguards will be adopted during the time of construction. Required safety and personal protection equipment such as helmets, visibility vests, gumboots, masks, gloves and other equipment will be provided to all labour workers during the time of construction. Prevention of landslides along the proposed new alignment will be carried out with the adoption of new

technologies such as installation of rock bolts and application of shotcrete in order to avoid installation of heavy structures, like gabion boxes along the new cut slopes, cutting of hill slopes with stable benching, etc.

Construction activities will be carried out in piecemeal approach for the improvement of existing PH. Construction contractor will not be allowed to stop or complete halt of existing traffic movement along the highway during the time of construction. Traffic mobilization will be maintained during construction within under construction section with one-way movement of traffic as applicable to site condition. However, construction contractors for each package will prepare traffic management plans and will seek approval from the construction supervision consultant prior to implementation.

1.6 Four-Laning in the Built-Up Areas

Table 0-3: Location of Built up areas for four-laning

S.N.	Location of the Bazars	From	To	Length (m)
1	Khanikhola	10+670	11+110	440
2	Dharke	2+550	2+970	420
3	Mahadevbesi	10+500	10+850	350
4	Simle	14+100	14+370	270
5	Galchhi- Baireni	23+530	23+900	370
6	Gajuri	37+400	38+130	730
7	Malekhu	43+310	43+520	210
		43+650	45+220	1,570
8	Sital Bazar	46+900	47+360	460
9	Benighat	50+770	51+170	400
10	Bishaltar	53+000	53+510	510
11	Majhimtar	60+670	61+150	480
12	Phisling	68+120	68+540	420
13	Kurintar	74+000	75+320	1,320
14	Lewatar to Ramailo Danda	75+840	77+380	1,540
15	Mugling	82+050	82+403	350
	Total Length			9,840

1.7 Plan for Footbridge

Safety aspects along the project corridor have been identified by the Safety Expert and reported separately. In line with the recommendations, pedestrian safety aspects have also been considered. The requirement of providing Footbridges (FB) for pedestrian to cross the road are planned and designed accordingly. Siting of the foot bridges identified are primarily located in the market and town area where schools, colleges, hospitals and other public facilities are used by pedestrians. There are 19 pedestrian bridges proposed for construction.

Table 0-4: Locations of Pedestrian Overhead Bridges

S.N.	Locations	Chainage	Pedestrian Bridge (Foot-over Bridge)	
			No of Pedestrian Bridges	Span (m)
1	Khanikhola	10+775	1	21
2	Dharke	2+775	1	30
3	Mahadevbesi	10+680	1	30
4	Simle	14+250	1	30
5	Galchhi - Baireni	23+650	1	21
6	Gajuri	37+600	2	30

S.N.	Locations	Chainage	Pedestrian Bridge (Foot-over Bridge)	
			No of Pedestrian Bridges	Span (m)
		37+850		
7	Malekhu	43+400	3	30
		44+350		
		44+700		
		44+700		
8	Sital Bazar	47+100	1	21
9	Benighat	50+915	1	30
14	Bishaltar	53+325	1	21
15	Majhimtar	61+000	1	21
16	Phisling	68+300	1	21
17	Lewatar	76+200	1	21
18	Ramailo Danda	77+100	1	21
19	Kurintar	74+800	1	21
20	Mugling	82+300	1	30
	TOTAL		19	

Source: Detailed Design Report, 2019

Span arrangement conforms to the width available for highway design. There are two types of cross sections proposed in road design. Accordingly, two types of FB have been designed. These FBs have two equal spans with a central pier to be constructed in median. Typical elevation displaying the arrangement of FB with respect to road cross-section has been shown in **Figure 0-3**.

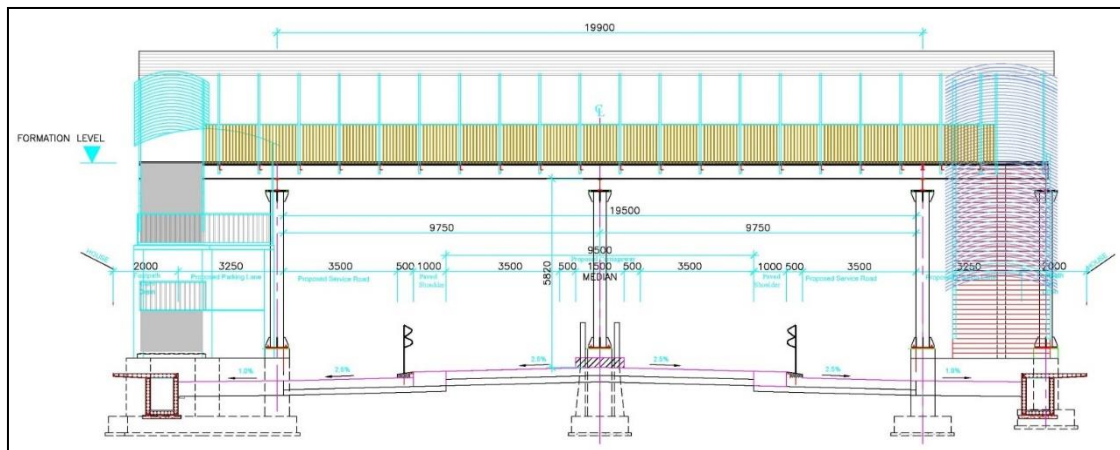


Figure 0-3: Typical elevation of FB (road width 30m)

All FBs have been provided with access by stair for the abled users whereas disabled users have facilities of ramp, so that wheelchairs can be moved on the FB to cross the roads. The stairs and ramps are easily accessible from the footpath and service road. The FBs are also provided with roof cover to protect pedestrians from heat and rain. Safety barriers are provided to keep items and users from falling onto the roads. Anti-skidding textured deck tiles have been recommended for safety and slipping of the users.

1.8 Procedure of Operation

The road comes under the Strategic Road Network of PH. DCID-DoR will be the responsible organization for the operation and maintenance of project. The mode of operation will be similar to other Strategic Roads of the country. Other local bodies shall not be responsible to operate and to collect any sort of direct benefits from its operation.

1.9 Project Implementation Time Schedule

The project implementation time schedule is presented below, including 2-3 years allocated to construction work:

Implementation Schedule of KNM Road Project						
Sl. No.	DESCRIPTION OF ACTIVITIES	Period of Implementation				
		Year 1	Year 2	Year 3	Year 4	Year 5
1	PRE-CONSTRUCTION ACTIVITIES					
A	Submission of Draft DPR and Approval of DPR					
B	Invitation of Bids including Receipt of Bids					
C	Evaluation of Bids including approval from World Bank					
D	Award of Contract / Signing of Contract					
2	CONSTRUCTION ACTIVITIES (ALL PACKAGES)					
A	General					
B	Earthworks					
C	Pavement Works					
D	Bridge Structures					
E	Other Structures					
F	Road Furniture and Traffic Safety Measures					
G	Environmental Mitigation and Bio-Engineering Works					
H	Miscellaneous Works					
3	DEFECT LIABILITY PERIOD FOR ALL CONTRACT PACKAG					

Figure 0-4: Project implementation Schedule of NNM Road Project

1.10 Labour and Working Conditions

Consultations with the local municipality and other project parties in the project vicinity informed that there have not been practices of standard operating systems (hiring, payment and management) for labours, who have been employed through mutual agreement. In the project vicinity there are industries and commercial activities, where labours are engaged, but the status of comply with Labour Act provisions appears inadequate. Also, no specific types of employment have been identified as per the Labour Law and WB ESS2 for the engagement of direct workers, contracted workers, primary supply workers and community workers. RM/MS have committed to introducing labour management into their core functions. The current project is estimated to have employment of 741,635 person-days of skilled labour, and 3,711,633 person-days of unskilled workers⁶ under three different types, except community workers. The timing of the employment differs according to the nature and volume of the project activities. The workers will be hired based on the set criteria developed in accordance with the national law. Also, written agreement and condition of contract will be developed and registered for each employment.

1.11 Construction Materials

1.11.1 Sources of Rock Aggregates and Natural Sand

Most of the borrowed soil suitable for embankment and subgrade will be used within the project area. Average distance for most of the borrow area sources from the nearest point on the project road is less than 5 km. These deposits are accessible from the project road with little or no improvement of existing accesses. Quantities of soil material for use in the embankment and

⁶ Number of workers based on Detailed Design Report, 2019

sub-grade construction of the project road is adequate from the project area. All the proposed bypasses will be constructed balancing cut and fill balance consideration. Therefore, alignment soil at cut locations will be used for filling valley side. Aggregate and sand required for the construction will be collected from the project influence area. The details of the construction material are presented in table below.



Figure0-5: Soil from project impacted area and water from Trishuli river will be used for construction.

Naturally occurring construction material like sand, gravel and aggregates are found in sufficient quantity with suitable quality within the vicinity of the road alignment. More than 861,000 m³ of sand and aggregates will be required for the construction. **Table 0-5** shows location of the construction material site together with available quantity and distance from the road.

Table 0-5: Construction material availability and estimated volume

S.N.	Coordinate	Location	Available Quantity (m ³)	Distance/ Reference	Remarks
1	27°49'35.43"N, 85° 1'8.48"E	Trishuli River at Galchi- Trishuli Road, Keureni	238,000	4/22+600	River bed/Crusher
2	27°44'39.21"N, 85° 6'22.12"E	Dharke	As per Demand	0.2/6+100	Crusher
3	27°48'57.05"N, 84°40'7.24"E	Jabang Khola	288,000	2/66+100	Quarry
4	27°48'8.71"N, 84°50'5.31"E	Malekhu Khola, Malekhu	45,000	1.5/43+400	River bed
5	27°49'3.84"N, 84°46'2.85"E	Trishuli River at Bishaltar, Siurenitar	42,000	2/51+300	
6	27°44'38.68"N, 85° 3'41.49"E	Agra Khola, Mahadev Besi	As per Demand	2/11+200	River bed + Quarry
7	27°55'2.53"N, 84°32'15.36"E	Marsyangdi River, Anbu Khaireni	84,000	11/82+400	River bed
8	27°48'17.72"N, 84°44'49.52"E	Trishuli River, Charaundi	90,000	0.3/55+500	River Bed
9	27°48'18.13"N, 84°50'50.90"E	Trishuli River, Malekhu	74,000	1/42+300	River Bed

Source: Field survey, 2017

A significant number of sand mining activities exist along the Trishuli River and several sand cleaners are established along the existing PH. Numerous sand and soil excavation activities

(quarry/borrow) are being carried out on the southern side along the highway particularly in the Dhading district at Galchi, Baireni, Gajuri, Malekhu, Benighat and Majhimtar for commercial purpose affecting existing land use, landscape, and topography. These sand and soil are sold as construction material and the excavated area has been developed land plots for residential or commercial purposes. Moreover, such excavation activities also exist at Dharke area and direct disposal of muddy waste is still under practice along the Mahesh Khola (a tributary of Trishuli River) from Dharke area which also has significant contribution in polluting Trishuli River. The confluence of Mahesh Khola and Trishuli River is at Galchi. Some of the ongoing practices are presented in the following pictures.



Sand cleaners established along the Trishuli River bank; Dhading district.



Illegal sand mining activities along the Trishuli River within Dhading district



Sand cleaners are established between highway and Trishuli



Direct disposal of waste from sand cleaning and mining activities along the Trishuli River banks



Polluted and muddy Trishuli river due to direct disposal



Quarry along the Trishuli River Right Bank at Bishaltar



Roadside sand mining close to the highway along NNM near Gajuri



Roadside sand and soil mining close to the highway



Crusher plant established close to highway at Galchi



Sand cleaning and crusher close to the highway at Ghatbeshi, Dhading

Figure 0-6: Ongoing Practices of River material extraction

1.11.2 Source of Construction Water

Water from the Trishuli River and its tributaries are likely to be used by the construction contractor during the time of construction. Manufactured materials such as cement, steel and bitumen will be mostly sourced from local suppliers.

1.12 Use of Energy and Energy Saving Measures during Project Implementation

During project implementation, the construction contractor should provide the alternative sources of energy for workers, such as gas or kerosene stoves to prevent pressure on natural forests in the project area. Contractor will avoid using fuelwood for the construction purpose and for cooking purpose in labour camps. Contractor will establish fuel storage yard near the proposed campsites to manage and control the sustainable use of diesel and other energy resources required during construction. Other measures will include economy of energy and resources, when possible in the project cycle to minimize energy use and avoid pressure on natural resources.

1.13 Road Traffic Analysis

1.13.1 Traffic Demand

Traffic levels in the project road section are determined based on the results of traffic counts carried out by DoR in 2017 supplemented by the results of a series of traffic counts along the road section in the beginning of 2018. The counts reflected different levels of traffic volumes in different sub-sections particularly in the following four sub-sections:

- Nagdhunga-Naubise – 12.40 km
- Naubise-Galchhi – 22.41 km
- Galchhi-Malekhu – 19.88 km
- Malekhu-Mugling – 40.19 km

Estimated traffic volumes by vehicle type in terms of annual average daily traffic for 2018 in the four homogenous sub-sections are presented in **Table 0-6**.

Table 0-6: Estimates of Normal Traffic in 2018 by Sub-sections (AADT)

Vehicle	AADT 2018			
	Nagdhunga-Naubise Section	Naubise-Galchhi Section	Galchhi-Malekhu Section	Malekhu-Mugling Section
MC	2,384	1,857	935	1,807
Car	1,299	1,136	816	907
B	1,086	1,340	1,220	1,214
MB	434	414	242	179
MiB	1,071	858	670	710
4WD	552	609	332	487
Utility	468	461	260	300
MAT	620	800	626	627
HT	2,996	2,867	1,841	1,436
LT	319	467	375	277
Total	11,231	10,809	7,317	7,944

Source: Consultants' surveys and estimates, 2018

1.13.2 Traffic Growth

Traffic growth forecasts are based on economic and population growth outlook for future years, on economic growth elasticity of registered vehicles growth, and on historical traffic growth trends on the project road corridor. Available historical traffic data was obtained from annual traffic counts carried out by DoR. Owing to low vehicle ownership rates, with only 0.08 vehicles per capita as of FY2017, vehicle sales have increased at an average annual growth rate of 17.5% between FY2007 and FY2017 (**Table 0-7**)⁷.

Economic parameters, including GDP and per capita income (Annex 1, Economic analysis) were analysed to estimate vehicle growth elasticity. The elasticity is adopted for traffic projection. The traffic growth rates by vehicle classes forecasted for the analysis are summarized in **Table 0-9**.

⁷Government of Nepal, Department of Transport Management. 2018. *Vehicle Registration Details up to Fiscal Year 2073-74*. Kathmandu. Compared to 0.42 vehicles per capita in India and 0.80 in the United States.

1.13.3 Diverted and Generated Traffic

As the project road is an already established traffic corridor for regional and domestic trade, the analysis did not assume a diversion of traffic from other corridors. The magnitude of generated traffic depends on the estimated level of benefits accrued to the project by the improvement of road conditions. Based on the extent of VOC and travel time savings, generated traffic is not considered in the analysis.

Table 0-7: Registered Vehicles in Nepal, 1997–2017

Year	Annual Sales					Total Registered Vehicles
	Car	Motorcycle	Bus	Commercial	Total	
1997	4,521	15,739	968	2,537	23,765	203,445
2002	4,379	36,117	1,591	5,073	47,160	364,444
2007	6,030	72,568	2,520	7,617	88,735	626,174
2012	11,84	145,135	3,420	9,682	170,08	1,348,995
2017	32,80	354,071	25,973	31,407	444,25	2,783,428
Growth p.a. 2007–2017 (%)	18.5	17.2	26.3	15.2	17.5	16.1

Source: Department of Transport Management (DoTM), 2018.

Table 0-8: Economic Growth in Nepal, 2000–2018

Parameters	2000	2008	2015	Growth p.a. 2000–2015 (%)	2018 Growth Rate Forecast (%)
GDP (million NRs)	379,488	815,658	2,120,470	12.2	4.9
Population (million)	21.0	25.5	28.0	2.0	1.0
GDP per capita (NRs)	18,036	31,946	75,855	10.0	-

Source: Nepal Rastra Bank, 2018.

Table 0-9: Traffic Growth Forecasts by Vehicle Class

Vehicle	2018-2021	2022-2032	2033 Onwards
2-Wheelers	6.8%	6.1%	5.0%
Car/Jeep/Van	5.4%	5.2%	4.5%
Buses	5.0%	4.8%	4.1%
Trucks	4.5%	4.3%	4.1%

Source: Consultants' estimates

1.14 Delineation of the Project Area

1.14.1 Zone of Influence (ZOI)

The project area delineation of proposed road alignment will be the area that will have both beneficial as well as adverse impacts due to construction and implementation. The project affected municipalities and rural municipalities are considered to be ZoI of the project. The ZoI of the project area has been categorized as Direct Impact Area (DIA) and Indirect Impact Area (IIA), which is described below:

1.14.2 Direct Impact Area (DIA)

The DIA of the project includes all the areas where activities related to the construction will take place. The areas within the 150 m on either side from the center of the road (300m corridor) will be considered as the DIA, because land use change will occur there and land and

property acquisition will take place within this area. During operation stage this area will be impacted by increased level of traffic volume, which can have repercussions on safety of people. This area will have a greater likelihood of impact on human population, private land and resources and impacts on physical, biological as well as socio-economic and cultural environment and, thus, it is considered as high impact area. The direct impact zone has been calculated as extent of direct road effect on environment (chemical pollution, traffic noise, road lights, direct animal distribution), which is from 100 to 200 m from the road (each side)⁸, we took an average 150 m each side, because the NNM road passes mostly through mountainous area with steep and abrupt slopes and dense vegetation. Dense vegetation itself mitigate negative impacts of dust, noise and disturbances.



Figure 0-7: Direct impact area along the NNM

The DIA has been increased in some locations based on topography and stakeholder consultations/feedback during scoping stage. As operation of burrow sites, quarry sites, spoils management sites, campsites, etc. will be included within the area. In addition, labour related issues affect the socio-economic and cultural environment of the project area. The following table presents affected locations and wards within the DIA along the highway alignment.

Table 0-10: Affected Location with Wards of DIA

District	Former VDCs	Earlier Wards		New Municipality/RMs	New Wards
		Along the alignment	Indirect influence wards		
Kathmandu	Chandragiri Municipality	3		Chandragiri Municipality	2
Dhading	Chhatredeurali VDC	1		Dhunibeshi Municipality	2
	Naubise VDC	3, 5, 6, 4, 7, 8, 1		Dhunibeshi Municipality	6, 7, 8, 9
	Thakre VDC	2, 8, 5, 4, 3	6	Thakre RM	6, 7, 8
	Bhumisthan VDC	4, 6, 7, 8, 9		Thakre RM	1, 2
	Baireni VDC	8, 9, 7		Galchi RM	4, 6, 7
	Pida VDC	1, 3, 2		Gajuri RM	5, 6
	Gajuri VDC	1, 2		Gajuri RM	1, 2
	Benighat VDC	1, 9, 8, 7	2	Benighat Rorang RM	3, 5
	Dhusa VDC	1, 3		Benighat Rorang RM	7, 8
	Jogimara VDC	8,9,1,2		Benighat Rorang RM	9,10
Chitwan	Darechok VDC	9, 1, 2, 7, 3, 4	5	Ichakamana RM	3, 5

Source: Field Survey, 2017

⁸Transportation Research Board and National Research Council. 2005. *Assessing and Managing the Ecological Impacts of Paved Roads*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/11535>

1.14.3 Indirect Impact Area (IIA)

The adjacent areas within 2 kilometres either side of road alignment are considered as the Indirect Impact Area (IIA). In this area, physical and biological environment will experience



Figure 0-8: Direct impact area along existing road

impacts during the time of construction. The IIA is evaluated as area of avoidance of the road by wildlife, which varies from 1,000 m for deer to 5,000 m for some large predators, such as bears. The bird density and wetland species richness also have been evaluated to be impacted in the indirect impact zone (Transportation Research Board and National Research Council, 2005).

Besides, indirect impacts will appear as cumulative effects during operation stage in the form of adverse impacts linked to better access to the area such as increased poaching, fodder collection, deforestation, unplanned human encroachment along the road and other similar activities. Impacts inadvertently during construction phase are likely in these areas due to various construction activities.

CHAPTER 2: Legal and Institutional Framework

Relevant legal and institutional frameworks are of paramount importance to the realization of the right to environmental and social security. This section of the ESIA provides an overview of the applicable environmental and social policies, legislative and institutional frameworks, national and international legal instruments with which the project will be required to comply. The policy, legal and institutional framework applicable to the project is outlined below.

2.1 The Environmental Assessment Process in Nepal

The integration of environmental conservation with development endeavors is reinforced through mandatory provisions of the Environment Protection Act, 1997 (EPA) and Environmental Protection Rules, 1997 (first amendment, 1999), (EPR-rule 3). Also, the Policy Document of DoR on Environmental Assessment in the Road Sector of Nepal (January 2000) requires an Environmental Impact Assessment for national highways and main feeder roads for any kind of interventions such as rehabilitation, upgrading etc. As per Schedule 2 (pertaining to Rule 3) Clause D Road Sector – No. 1 (a) of EPR (1997), EIA report shall take approval from Ministry of Forests and Environment (MoFE), prior to its implementation. This report will be the integral part of the bidding document and the prospective contractor shall abide by the mitigation measures prescribed in the ESMP document. The scoping document and Terms of Reference (ToR) have already been approved on February 23, 2018. Currently, the EIA is in the process of approval and is anticipated to be cleared from MoFE within six months.

2.2 Environmental and Social Legislation of Nepal

2.2.1 The Constitution of Nepal

Environmental and social sustainability has been covered explicitly in the Constitution of Nepal 2015. The Constitution of Nepal 2015 states that everybody has the right to live in clean and healthy environment as well as to conserve, promote and make sustainable use of natural resources during construction and operations of the NNM Road which is highlighted in following table.

Table 0-1: Environmental and social rights of citizens declared in the Constitution of Nepal

Article	Rights guaranteed
18	Right relating equality not to discriminate citizens on grounds of origin, religion, race, caste, tribe, sex, economic condition, language, region, ideology or on similar other grounds.
25	Right relating to property and provides the basis for compensation and procedures relevant to requisition
30	The right to a clean and healthy environment and a right to obtain compensation in accordance with law
34	Rights to fair labour practice including appropriate remuneration, facilities and contributory social security
37	The right to housing and claims that citizens cannot be evicted from the residence, except in accordance with law
38	The right to housing and claims that citizens cannot be evicted from the residence, except in accordance with law
40	The Rights of Dalit, their health and social security, the rights to use, protect and develop their traditional occupation, knowledge, skills and technology

Article	Rights guaranteed
18	Right relating equality not to discriminate citizens on grounds of origin, religion, race, caste, tribe, sex, economic condition, language, region, ideology or on similar other grounds.
42	The right to social justice relevant to minorities, indigenous and marginalized communities
43	The Right to social security of different categories of marginalized communities and individuals, who cannot take care of themselves and citizens belonging to the tribes on the verge of extinction, in accordance with law

Apart from above mentioned Articles, Article 51 (Entry g, h and l) covers policies relating to protection, promotion and sustainable use of natural resources (forests, wildlife, birds, vegetation and other biodiversity) by mitigating possible risks to environment from industrial and physical development and adopting appropriate measures to abolish or mitigate existing or possible adverse environmental impacts on the nature, environment or biological diversity.

2.2.2 National Plans, Strategies and Policies

The project will be required to comply with relevant existing and environmental and social laws and regulations in Nepal throughout the life of the project. The policy, legal and institutional framework under which the project will be undertaken is outlined below.

Table 0-2: Key Provisions and Relevance of National Plans, Strategies, Policies, Acts/Rules and Regulations to NNM ESIA

S.N.	Plans, Policies, Strategies Rules/Regulations	Key provisions	Relevance to NNM ESIA
Plans			
1.	15th 5 years' Development Plan of Nepal (2019-2024)	Enhancement in socio-economy with fast alleviation of poverty by high economic growth in next 5 years based on growth in agriculture, industrial and services sector with a slogan of "Generating Prosperity and Happiness"	Road development and connectivity is vital for the economic growth and overall development.
2.	20 Year Road Plan, 2002-2022	The objective of the plan being the development of Strategic Road Networks (SRN), aligns with the priorities set out in the Tenth Five Year Plan (2002-2007) as that plan gives priority to constructing feeder and strategic roads connecting North to South encompassing all road development works.	This Act has been established to carry out regular, occasional, periodic and casual repair and maintenance works of roads and levy tolls on, and collect tolls from motor vehicles plying on the road.

S.N.	Plans, Policies, Strategies Rules/Regulations	Key provisions	Relevance to NNM ESIA
3.	Nepal National Biodiversity Action Plan, (2014-2020)	The overall goal is to significantly enhance the integrity of Nepal's ecological systems by 2020, thereby contributing to human well-being and sustainable development of the country. This is to be achieved through implementation of a number of sector specific and cross-sectoral strategies and priority actions	The Action Plan emphasizes that governance and legal/regulatory implementation is a major underlying factor behind deforestation and forest degradation.
4.	The Road Safety Action Plan (2013-2020)	The action plan suggests amendments that are required in the existing transport related laws and rules to accommodate issues such as harmonization with UN and international agreements, pedestrian regulations, safe practices for commercial vehicles, delegate more power to the traffic police, promotion of ISO traffic safety management standard -ISO 3900, safe vehicle guideline and better route permit procedures aligned with safety provisions	The policy of document suggests five types of environmental assessment activities: Screening, Initial Environmental Examination, Scoping, Environmental Impact Assessment and Monitoring.
Strategies			
5.	Nature Conservational Natural Strategic Framework for Sustainable Development (2015-2030)	The Strategy stresses out the needs to mitigate the current and potential future effects of the pressure of transportation and other infrastructure development on the habitats of endangered flora and fauna based on the landscape concept.	The Strategy identifies legal and regulatory issues applicable for nature conservation, sustainable development and bio-diversity protection.
6.	MoPIT's Five Year Strategic Plan for Prosperous Nepal through Roads, Rail and Transport Development, 2016/17-2021/22	Lays out map for Prosperous Nepal through Roads, Rails and Transport Development.	The strategy aims to reduce the number of casualties and road accidents on the highways and strategic roads

S.N.	Plans, Policies, Strategies Rules/Regulations	Key provisions	Relevance to NNM ESIA
7.	Sustainable Development Goals, (SDG) 2016-2030	SDG-9 aims for resilient infrastructure including roads, SDG 11- aims for inclusive, safe, resilient and sustainable human settlements SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss SDG17:to protect women and girls from violence	The SDG provisions for safer roads, biodiversity conservation and reduce gender disparity.
Policies			
8.	Nepal National Environment Policy, 2076 (2019)	The policy established the framework for the protection, control, and minimization of pollution, environmental mainstreaming, environmental justice, participation, sustainable development, good governance, and capacity development.	The Policy is aimed to ensure rights of the people to live in clean and healthy environment controlling pollution, managing solid waste, and enhancing greenery.
8.	Forest Policy, (2015)	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.	The policy stresses conservation of endangered species and emphasizes to avoid forest destruction or chopping down the tree while constructing infrastructures during implementation of project other than forest sector.
9.	National Transport Policy, 2058 (2001)	The principal objective of this Policy is to develop a reliable, cost effective, safe facility oriented and sustainable transport system that promotes and sustains the economic, social, cultural and tourism development of Nepal as a whole	The policy puts high priority in completing the construction of roads connecting all 77 District Headquarters of the Country to the main road network

S.N.	Plans, Policies, Strategies Rules/Regulations	Key provisions	Relevance to NNM ESIA
10.	Land Use Policy, 2072 (2015)	The objectives of the policy are to categorize or classify entire lands of the country into various Land Use Zones (LUZs), level wise division (Federal, Provincial and Local), and to ensure the use of Land and Land Resources(LLRs) on the basis of land use plans (LUPs) for protection of agricultural land and maintain beautiful, well-facilitated settlement and sustainable urbanization, forests areas including natural heritages, biodiversity and historical, cultural and religious, archaeological and areas of strategic importance	It ensures the participation of government and public agencies as well as the private sector by linking productivity, environmental balance and conservation, social and economic prosperity and poverty alleviation.
11.	Labour Policy, 2062 (2005)	Labour Policy stresses out guaranteeing out the minimum social and professional security by for all citizens of the country without discrimination	The Policy encouraged investments in labour-intensive employment sectors with economic development potentials, road development is one of such sectors.
12.	Land Acquisition, Resettlement and Rehabilitation Policy, 2071 (2015)	The policy requires that expenses related to land acquisition, compensation and the implementation of resettlement and rehabilitation plans should be considered as project costs, underlining that compensation amount should be calculated on the market rate.	Policy outlines the needs to conduct an economic and social impact assessment of the development projects.
13.	Public-Private Partnership Policy, 2072 (2015)	The objectives of this policy are focused on serving to public interests in developing of infrastructures at the same time creating environment for private investment and use of private sector experience, managerial skills, competencies and technical skills for infrastructure development	The policy covers 6 development areas for partnerships including infrastructure and transport.

S.N.	Plans, Policies, Strategies Rules/Regulations	Key provisions	Relevance to NNM ESIA
14.	Draft National Occupational Safety and Health Policy, 2073 (2017/18) The Policy was publicly available since 2073 B.S. (around 2017/18).	Occupational health and safety have been addressed in professional manner to avoid potential casualties within working space and including construction sites and to reduce risk and hazardous activities that may affect to project site workers.	The goal of the policy is to make workplace and working environment less risky and occupation safety standard and to ensure to safety to the workers.
15.	National Health Policy, 2076 (2019)	Universal health coverage including prevention, promotion, treatment, rehabilitation and palliation,	All kinds of pollution to be reduced that may impact general public and program to be implemented and developed along with relevant agencies in the basis of scientific planning.
Acts			
16.	Environment Protection Act, 2076 (2019)	The law contains several provisions to internalize environmental assessment system and to maintain a clean and healthy environment by minimizing the adverse impacts on human beings and other life forms and physical objects.	The act highlights that any development project, before its implementation has to pass through environmental assessment, which will be either BES, IEE or EIA depending upon the location, type and size of the projects. The Act has included three tiers of provisions (Section 3.2.a) on conducting 'environmental study as brief environmental study (BES), IEE and EIA.
17.	Public Road Act, 2031 (1974)	The Public Road Act is the governing legislation for construction and operation of roads in Nepal.	The Act prohibits the construction of permanent structures (buildings) in a defined distance from the road, i.e. the road agency has the authority over everything within the right-of-way
18.	Forest Act, 2076 (2019)	Section 49 of the Act prohibits reclaiming lands, setting fires, grazing, removing or damaging forest products, felling trees or plants, wild animals hunting and extracting boulders, sand and soil from the National forest without the prior approval.	Section 42 of the act has made three provisions for using of forest areas: (i) the project should be of national priority sub-Section (1), (ii) there is no alternative other than to use the forest area sub-Section (1/2), and (iii) the project should not have significant impact on environment sub-Section (1)

S.N.	Plans, Policies, Strategies Rules/Regulations	Key provisions	Relevance to NNM ESIA
19.	Local Government Operation Act, 2074 (2017)	The Act provides the functions, rights and duties of local government such as Municipalities, rural municipalities and their wards.	This act empowers the local bodies for the conservation of soil, forest, and other natural resources and implements environmental conservation activities.
20.	Soil and Water Conservation Act, 2039 (1982)	Provisions to construct and maintain dams, embankment, terrace improvements, diversion channels and retaining walls, protect vegetation in landslide-prone areas and undertake a deforestation programs, and Regulate agricultural practices pertinent to soil and watershed conservations	Section 13 of the act empowers the authority to prohibit the commission of any acts that may cause soil-erosion or soil cutting in a land where any of the acts has been done under Section 4 and in vicinity of such land.
21.	Plant Protection Act 2064 (2007)	legal provisions for preventing the introduction, establishment, prevalence and spread of pests while importing and exporting plants and plant products, promoting trade in plants and plant products by adopting appropriate measures for their effective control	the act may impose the prohibitions/restrictions in the import of plant or plant product, transport from one district to another district of any plant or plant product.
22.	Aquatic Life Protection Act, 2017 (1960)	recognition of the value of wetlands and aquatic animals.	Section 3 of the act renders no person shall knowingly use any kind of electric current, explosive substance or poisonous substance with intention of catching and killing any aquatic animal in any water.
23.	Control of International Trade of Endangered Wild Fauna and Flora Act, 2074 (2017)	The act prohibits on Trade or Transaction of Threatened or Vulnerable wild fauna or flora or specimen thereof	<i>The act ensues that no person shall purchase, sell, possess, use, plant, rear, captive breed, transport, import, export, or cause to be done so a threatened or vulnerable wild fauna or flora or a specimen, except of the cases when a license obtained</i>

S.N.	Plans, Policies, Strategies Rules/Regulations	Key provisions	Relevance to NNM ESIA
24.	Water Resources Act, 2049 (1992)	to make legal arrangements for determining beneficial uses of water resources, preventing environmental and other hazardous effects thereof and also keeping water resources free from pollutions.	Section 19 of the act clearly mentions that no one shall pollute water resource by way of using or putting any litter, industrial wastes, poison, chemical or toxic to the effect that the pollution tolerance limit of the water resource as prescribed pursuant to Sub-section (1) is exceeded.
25.	Land Acquisition Act, 2034 (1977)	The Act is the main legislation to guide the involuntary acquisition of land in the country.	Government can acquire land at any place in any quantity by giving the compensation pursuant to the Act for the land required for any public purpose or for the operation of any development project initiated by government, authorized institution (sections 3 and 4).
26.	Land Use Act, 2076 (2019)	Section 4.1 of the act classifies lands into 10 categories such as agricultural, residential, industrial, commercial, mining and mineral, forest, river, stream, pond and wetland, public use, cultural and archaeological, and others.	The act provisions for the need for economic development and infrastructure building, among others to ensure that land is properly used and managed and that land set aside for one purpose is not used for other.
27.	Labour Act, 2074 (2017)	The Act has been passed for provisions for the rights, interest, facilities and safety of workers and employees working in various sectors and thus ensures the good working conditions and welfare of the workers.	Section 11 (3) of the Labour Act provides for the employment contract and the matters to be covered under the employment contract <i>and the Act</i> requires the employment contract to include (a) remuneration, (b) benefits, and (c) terms of the employments of the Employee and such other matters as prescribed. Section 64 (1) states that the main employer must obtain the employees from licensed labour supplier.

S.N.	Plans, Policies, Strategies Rules/Regulations	Key provisions	Relevance to NNM ESIA
28.	Child Labour (Prohibition and Regulation) Act, 2056 (2000)	The Child Labour (Prohibition and Regulation) Act 2000 is the main legal expedient to prohibit engaging children in factories, mines or similar risky activities and to make necessary provisions with regard to their health, security, services and facilities while engaging them in other activities.	Under the Section 3 of the Act, child having not attained the age of 14 years is strictly prohibited to be engaged in works as a labourer. Equally, under Section 4, engagement of child in works as a labourer against his/her will by way of persuasion, misrepresentation or by subjecting him/her to any influence or fear or threat or coercion or by any other means is prohibited. Under Section 6, in case any Enterprise, engaging a child in works, must get an approval from the concerned labour office or any authority or official prescribed by that office and form the fathers, mother or guardian of the child.
29.	Act related to Children, 2075 (2018)	The act provisions the children's fundamental rights provided in the constitution, into a legislative provision, which then allows children to exercise their rights legally.	any child under the age of 14 are not allowed working in hazardous labour or the worst form of child labour
30.	Road Board Act, 2058 (2002)	The act makes necessary provisions on having the roads repaired and maintained, making cost effective the expenditures to be incurred in repairing and maintaining the roads and making transparent and effective the repairing and maintenance works of the roads	The Act aims on providing sustainable fund for planned maintenance of the roads. The aim of planned maintenance is to keep existing maintainable roads in serviceable condition, reduce vehicle operating cost and provide more comfort to the road users.

S.N.	Plans, Policies, Strategies Rules/Regulations	Key provisions	Relevance to NNM ESIA
Rules/Regulations			
31.	Labour Rules, 2075 (2018)	The Labour Rules demands the Employment Contract to cover (a) nature of employment, (b) primary work of the Employee and his/her position, (c) statement that the Employees' Service Rule will be integral part, (d) date, time, place of contract and its effective date, (e) Other important terms and conditions related to the work or service of the Employee	The Labour Rules regulate the Employee work schedule, providing rest period for certain female employees with submitting of certain certificates, determining the percentage of disability, associated with accident in the workplace, other issues relevant to sickness or accident while working, associated with occupational safety and health, etc.
32.	Water Resources Regulation, 2050 (1993)	Measures are to be taken for the conservation of aquatic life and water-environment and for mitigating social and economic effects of the project in the concerned area.	It is mandatory under Rule 17(e) that appropriate measures should be taken to lessen the adverse effects due to the project on the overall environment

2.2.3 National Directive, Guidelines, Manuals and Standards

The Environmental Management Guideline for roads and bridges (DoR, 1999) consists of environmental mitigation measures to be incorporated into DoR projects, procedures for public participation, and socio-economic consideration. The guideline also suggests considering the various socio-economic issues like land acquisition and compensation, economic impacts and cultural heritage. It includes also the various implementation strategies. The National EIA Guidelines (1993) provide several mechanisms for identification of projects requiring EIA, processes selecting alternatives, and mitigation measures including monitoring and evaluation. The Environmental Assessment in Road Sector (2000) explains, in general, and basically to DoR engineers and environmental managers the environmental assessment procedures. The document lists five main types of environmental assessment activities and the different criteria, required for a particular type of EA. The Reference Manual for Environmental and Social Aspects of Integrated Road Development (MoPPW/DoR, 2003) help to integrate social and environmental considerations in road development, including public involvement strategies with technical road construction practices. The Manual is based on the experiences of Nepal and incorporates the national (EPA, 1997; EPR, 1997/1999) and international “best practice”. It suggests process of environmental and social assessment process, roles and responsibilities of stakeholders at various stages of the project, advises on impact mitigation action plan, and process for involving the public. The Environmental and Social Management Framework (ESMF) of DoR (2007) with amendment (2013) compiles various safeguard and compliance aspects of environmental and social issues related to road programs in Nepal, providing guidance into the design of the strategic roads. The Occupational Safety and Health Guidelines,

2074 (2017) provide a valuable framework for discussions and concrete actions in order to improve the safety and health of workers. The Use of Forest Land for National Priority Infrastructure Guidelines (2017) provide directives on compensatory plantation to be carried in the equivalent area as directed by respective forest office and that to be maintained for 5 years by the proponent and handover to the district forest office. The Gender Equality and Social Inclusion Operational Guidelines, 2074 (2017) formulate the policies to protect women, poor, vulnerable and excluded people, recognizing their rights. Nepal Planning Commission Standard on Distribution and Classification of Project Development for Federal, Province and Local level, 2076 (2019) has elaborated federal mandate on SRN development, maintenance (k), SRN bridges and tunnel roads. Federal government is responsible for women rescue programme, children policy and integrated social protection as well as for labour employment and social security, forest and environment such as health related issue, health related standard and regulation, coordination, and migration analysis.

Based on all national documents stated above, this ESIA aligns and complies with the aforesaid national policy framework, indicating across various sectors and fields of expertise, the requirement for the assessment and effective management of environmental and social impacts related to the construction of the NNM highway.

2.3 International Policy Framework

2.3.1 Relevant International Conventions

Nepal is a signatory party for many international conventions and other treaties. In the current review only those relevant to sustainable development were analysed and have importance, because they address vital environmental and social issues, which are transboundary or global in nature such as pollution, climate change, biodiversity conservation, address social inequality and provide principles of environmental justice. The table below provides the brief review of international treaties and their provisions, relevant to environmental and social issues during road construction process and applicable in the case of ESIA of the NNM road.

As international policies, numbers of protocols and conventions have guided this study. These protocols and conventions are as mentioned in Table below.

Selected International Conventions/Protocols
Convention on Biological Diversity (CBD), 1992
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), (1973 amended 1979)
Plant Protection Convention, 1952 (Second Amendment, 1997)
World Heritage Convention, 1975
United Nations Framework Convention on Climate change (UNFCCC), 1992.
UN Paris Agreement, 2015
United Nations Convention to Combat Desertification (UNCCD), 1994.
Strategic Approach to International Chemicals Management, 2006
Concerning Indigenous and Tribal Peoples in Independent Countries, 1991 Convention (No.169)
Convention on the Rights of the Child, 1989
International Labour Organization Convention, 1998
The United Nations Declaration on the Rights of Indigenous Peoples, UNDRIP, 2007
Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), 1979.
UN Declaration on the Elimination of Violence against Women, 1993

The above international protocols and conventions provide guidance on international best practice and focus on the conservation of natural resources and biological diversity, protecting and promoting environment as well as social issues including the group of conventions of the International Labour Organization and Gender Based Violence (GBV).

2.2.2 World Bank Environmental and Social Framework and Standards

The main objectives of the WB are to eliminate extreme poverty and promote shared prosperity. The WB ESF sets out the WB's commitment to sustainable development and mandatory requirements for the bank finance projects. The Bank's ESF is used to assess and manage the environmental and social risks and impacts of the projects. To this end, the Bank has defined specific ESSs which are designed to avoid, minimize, or reduce, mitigate and compensate/offset the adverse environmental and social risks and impacts. The projects supported by the WB are required to meet the 10 ESSs as relevant to the project.

Table 0-3 provides a comparison of the ESSs with national legislative framework and requirements. ESSs create mechanisms for the integration of environmental and social issues into decision making. They provide a set of specialized tools to support development. No financial intermediaries are involved in the NNM Road project so ESS9 is not applicable. The comparative analysis of national regulatory frameworks with ESS1 to ESS8, and ESS10, found that the requirements in regulatory frameworks were aligned with ESSs, however the issues of GHG emission calculation, resource efficiency, community health and safety, and workers GRM have not been adequately addressed. These aspects are considered in different themes of impact assessment in line with international best practices, but not mandatory under existing regulatory frameworks. Currently, the Nepal National Environmental Policy – 2076 (2018) established framework for the protection, control, and minimization of pollution, environmental mainstreaming, environmental justice, participation, sustainable development, good governance, and capacity development. The strategy set the standards and guidelines for the prevention of pollution on water, air, land, noise and due to electric and magnetic field, chemical and radioactive. It also facilitates creation and operation of quality measurement centres in major cities and industrial states; implementation of standards for the control of pollution, preparation of emission field mapping. The other strategies established to fulfil the policy are safe disposal of non-recyclable waste and hazardous waste; incentive to use of clean energy vehicle; special attention for the construction of physical structures and pollution control.

Table 0-3: WB Environmental and Social Framework and Environmental and Social Standards in the infrastructure projects in Nepal

World Bank ESS	Relevant Nepal Laws, Regulations and Policy Issuances	Gaps vis-à-vis WB ESS
1. Assessment and Management of Environmental and Social Risks and Impacts	National Environmental Impact Assessment Guidelines (1993) Environment Protection Act (EPA) (2019) Environment Protection Regulations (EPR) (1997)/(obsolete)	• Scope of EIA may not cover all WB ESS. • EPA/EPR does not allow use of other types/forms of assessments.

World Bank ESS	Relevant Nepal Laws, Regulations and Policy Issuances	Gaps vis-à-vis WB ESS
		Does not emphasize hierarchy of measures in ES risk management planning
2. Labour and Working Conditions	Labour Act (2017)	Current OHS provisions are not adequate (No separate legislation on OHS. Current OHS mandate is provided only in Chapter 12 of the Labour Act)
	Child Labour Act (2001)	Lack of industry-specific standards DoLOS⁹ has so far issued only one directive: OHS Directive for Brick Workers)
3. Resource Efficiency and Pollution Prevention and Management	EPA (2019) Section 7. EPR (1997) (obsolete)	Lack of legislations on resource use efficiency in projects
	National Ambient Air Quality Standards (2003), Water Resources Act (1992)	Need guidance for integration relevant to resource efficiency
	Water Resources Rules (1993)	
	Drinking Water Regulation (1998), Drinking Water Quality Standards	
	Water Quality Guidelines for the Protection of Aquatic Ecosystem	Need instructions for incorporation in infrastructure projects
4. Community Health and Safety	The EPA/EPR identifies the direct and indirect human health impact as one of the components in assessing the effect of development projects.	There is limited coverage as scope of ESIA's do not necessarily include community safety issues.
	EPA Section 13 and 15: Nobody shall create pollution in such a manner as to cause significant adverse impacts on the environment or likely to be hazardous to public life and people's health. Labour Act (2017)	Public health legislations do not specifically impose requirements for development and infrastructure projects.
5. Land Acquisition, Restriction on Land Uses and Involuntary Resettlement	Public Road Act (1974)	Does not require preparation of RAP
	Land Acquisition Act (1977) Guthi Corporation Act (1976)	Does not allow for PAP consultation in the compensation options
	Land Reform Act (1964) Land Revenue Act (1977)	- Priority in employment - Valuation of lost assets considers depreciation and hence not at replacement cost - Leasing of land is not allowed for temporary easements. Compensation for any temporary use of land is limited to damage compensation.

⁹Department of Labour and Occupational Safety

World Bank ESS	Relevant Nepal Laws, Regulations and Policy Issuances	Gaps vis-à-vis WB ESS
6. Biodiversity Conservation and Sustainable Management of Living Natural Resources	The Aquatic Animal Protection Act (1960) National Park and Wildlife Conservation Act (1973)	• Natural habitats are not specifically required to be assessed in the EIA
	Forest Act (2019) and Forest Regulation (1995) (obsolete)	• Does not specifically require Biodiversity Management Plan even where biodiversity impact is found significant in the EIA
7. Indigenous Peoples	National Foundation for the Development of Indigenous Nationalities Act (2002) Local Government Operation Act (2017) ILO Convention 169 (2007) Forest Act (1993) and Forest Regulation (1995)	• Does not require —Free, Prior and Informed Consent for projects in IP territories • Does not require focus social assessment on IP Population • Does not require preparation of IP Plan
8. Cultural Heritage	EPA (2019) Section 9-10	• Does not include intangible cultural heritage
	EPR (1997) Chapter 5 (obsolete)	• Does not provide guidance for the development of Cultural Heritage Plan
	Ancient Monument Act (1956)	• Does not provide guidance for the application of globally recognized practices in the study, documentation and protection of cultural heritage • Does not provide instruction for adoption of chance find procedures
9. Financial Intermediaries	Not applicable. Projects undertaken through financial intermediaries are subject to the same processes and procedures as any other projects.	

WBG General EHS Guidelines, 2007

The WBG General EHS Guidelines 2007 guides users on common EHS issues potentially applicable to all industry sectors. This guideline provides an approach to the management of significant sources of emissions, including specific guidance for assessment and monitoring of impacts. The EHS guidelines also provide guidance on prevention and control of community health and safety impacts that may occur during new project development, at the end of the project life-cycle, or due to expansion or modification of existing project facilities. The guideline highlights general approach to the management of EHS issues at the facility or project level. The guideline entails the inclusion of EHS considerations into corporate and facility-level business processes in an organized, hierarchical approach highlighting with the identification of EHS project hazards and associated risks. Further, the risk management strategies will incorporate engineering and management controls to reduce or minimize the possibility and magnitude of undesired consequences when impact avoidance is not feasible.

Environmental Health, and Safety Guidelines for Toll Roads, 2007

The EHS guidelines for Toll Roads include information relevant to construction, operation and maintenance of large, sealed road projects including associated bridges and overpasses. The guideline highlights the environmental issues specific to construction and operation of roads include the habitat alteration and fragmentation, storm-water, waste, noise, air emissions, and wastewater. The guidelines also highlight occupational and community health and safety and performance indicator monitoring of environment and occupational health and safety. The issues associated with the construction and operation of roads primarily include physical hazards, chemical hazards, and noise.

Workers' accommodation: processes and standards. A guidance note by IFC and the EBRD, 2009

In the lack of universally applicable international regulations on workers' accommodation standards, there are some international standards/guidance on food safety, water sanitation, and waste management. Appropriate standards to the construction and operation of worker housing falls within the performance requirements on labour issues expected of clients. The Standard comprises planning and assessing the requirements for workers' accommodation in accordance with international, national, and local regulatory framework. The guideline also provides the principles and standards applicable to the construction of workers' accommodation, including the transport systems provided, the general living facilities, rooms/ dormitories facilities, sanitary and cooking facilities, food safety, medical and leisure/social facilities. Finally, the document consists checklist in order to access general regulatory framework of established accommodation, to assess the need for and impact of workers' accommodation on communities, standards provided for workers' accommodation, managing worker accommodation, etc.

CHAPTER 3: Methodology

The environmental and social assessment was proportionate to the potential risks and impacts of the project, and assessed, in an integrated way, all relevant direct, indirect and cumulative environmental and social risks and impacts throughout the project life cycle, including those specifically identified in WB ESSs 2–10 and with respect to prevailing institutional and legislative setup of the GoN. The approach and methodology adopted for the assignment have been described below.

3.1 Approach

The environmental and social assessment has been based on a detailed ESIA conducted in 2016-2018 following the World Bank safeguard policies and additional information collected recently, including an accurate description and delineation of the project and associated aspects, and environmental and social baseline data at an appropriate level of detail sufficient to inform characterization and identification of risks and impacts and mitigation measures. The assessment evaluated the project's potential environmental and social risks and impacts; examined project alternatives; identified ways of improving project selection, siting, planning, design and implementation. The mitigation hierarchy was applied for adverse environmental and social impacts and seek opportunities to enhance the positive impacts of the project. The environmental and social assessment also included stakeholder engagement as an integral part of the assessment, in accordance with ESS10. The ESIA was retrofitted with outcomes from different components namely, Stakeholder Engagement Plan (SEP), Gender Based Violence (GBV) Risk Mitigation Action Plan, Labour Management Procedures (LMP), Resettlement Action Plan (RAP), Indigenous People's Development Plan (IPDP), Environmental and Social Commitment Plan (ESCP) and Borrower's Capacity Assessment made by WB. The approach, used for ESIA, is illustrated in **Figure 0-1**.

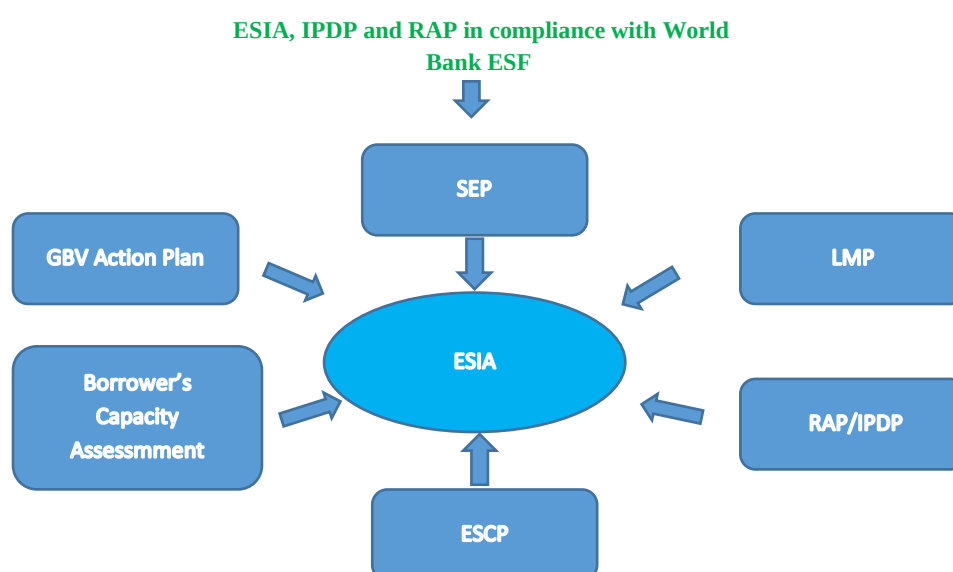
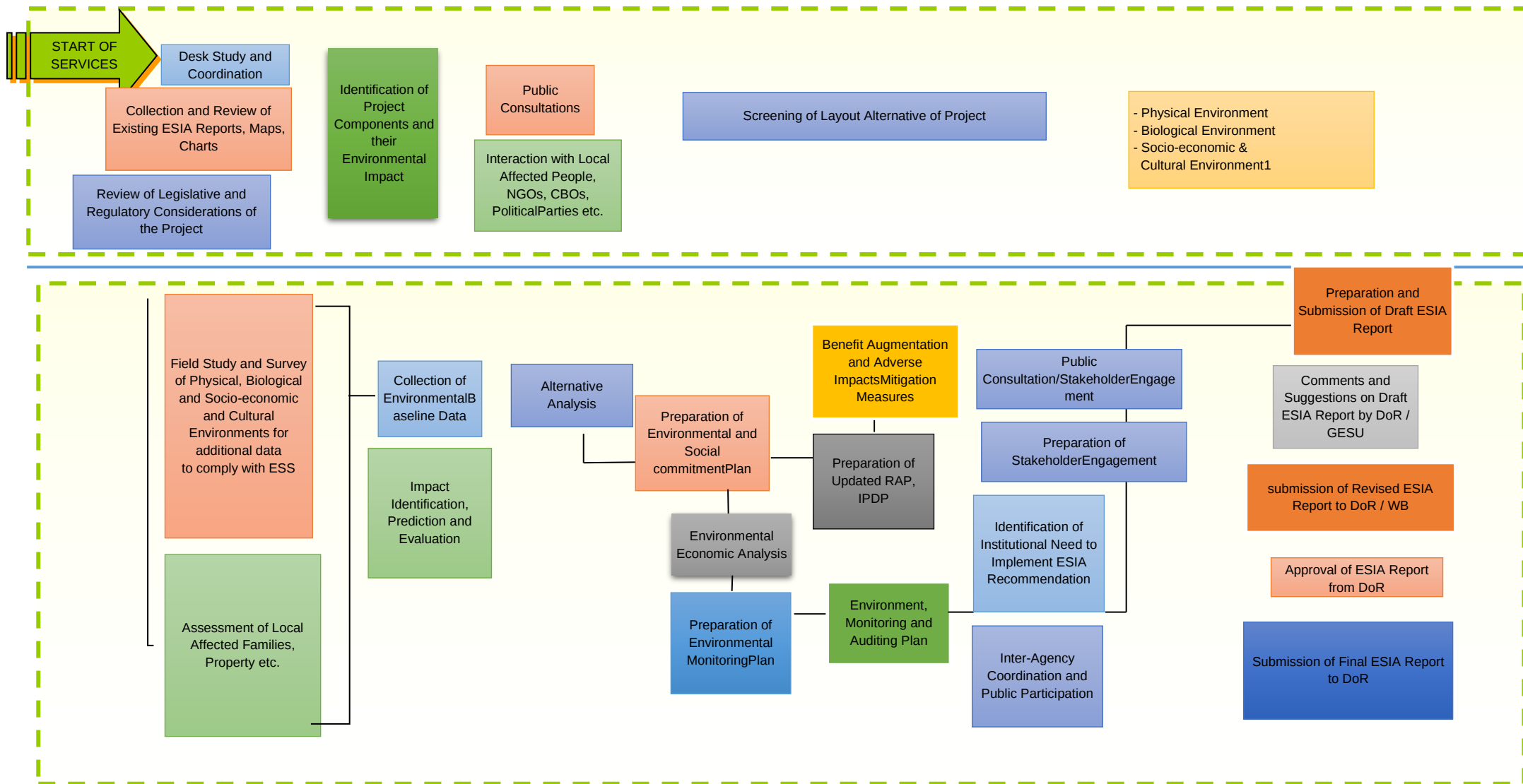


Figure 0-1: Approach for ESIA

The major set of activities and methods undertaken are described below.

General Workflow



3.2 Consultative Meeting within Study Team

A start-up meeting was held for all the team members to be deputed for the study. The main purpose of this meeting was to acquaint the team members about the objectives, scope of the work (SoW) and the working modality of the study towards timely completion and quality performance of the assessment. Furthermore, the internal study team meetings were held intermittently as required.

3.3 Consultative Meetings with the Project Proponent

Before outset of the study, a consultative meeting with the client was held by the study team members. The meeting was organized with two objectives:

- To introduce the team personnel with the client and vice versa and to have an overview of the assignment and share about how to conduct the assessment in an effective and efficient manner, and
- To share and discuss the ESIA updating/retrofitting methodology and tools and solicit their comments and suggestions.

This consultative meeting was envisaged to be instrumental to aware the study team about the approach and methodology of the study and prepare a solid background for charting out the future course of action. Above all, this served as a milestone in creating ownership among the client and the team of experts about the assignment.

3.4 Desk Study

Desk study is an essential part of the investigation process. Review is invaluable in assessing the requirements of a ground investigation. A well-executed desk study can help to formulate investigation work, culminating in a cost effective and targeted investigation. The purpose of the desk study is to determine the requirements of the project in terms of all relevant legislation, as well as reference the assessment on similar projects and good practices elsewhere, to gain insight into the current state of the area. The assessment team of experts made intensive desk review of the collected documents, literature, reports, publications and data in order to arrive at in-depth understanding of the assessment.

The team also reviewed the legislative and regulatory provisions of the project. The documents included: existing ESIA report, tables, maps, charts and other relevant like WB ESF, policies, national and international policies and national laws and so forth. The existing RAP and IPDP were also reviewed where relevant, to further inform the updating/retrofitting of the existing ESIA. Through desk reviews, the project components and their environmental and social impacts were duly identified. The important information gathered from the desk study were incorporated/integrated/supplemented in the updated/retrofitted ESIA for the final preparation of report.

3.5 Field Study and Survey

Extensive primary data were gathered in 2016-2017 following the preparation of a detailed ESIA for the NNM road to meet World Bank safeguard policies. In view of the shift from safeguards to the ESF, the ESIA was updated and additional information and data were collected. For the updating, the team of experts carried out field study and survey for additional

data collection to comply with WB ESSs as outlined in ESF. The study was concentrated on physical, biological socio-economic and cultural environment, local affected families, properties etc of the project. While undertaking field surveys and studies, baseline data on environmental and social aspects were collected through public consultations and interactions with local affected peoples (APs), NGOs, CBOs, local government bodies, representatives of major political parties and other relevant stakeholders. The data and information previously collected were also verified for their validation. For this check lists for activities and environmental and social impact evaluation were prepared by the concerted efforts of the relevant team of experts.

3.6 Analysis of Alternatives

Alternative analysis is formulation of a well-implemented plans, policies, and procedures taking into account the unique political, strategic, and operational issues. It supports the inclusion of independent, critical thought and alternative perspectives to support decision-making. In this regard, the team of experts developed various plans. They included: Environmental and Social Commitment Plan (ESCP), Environmental Economic Analysis, Environmental and Social Monitoring Plan (ESMP), Benefit Augmentation and Adverse Impacts Mitigation Measures, updating of existing RAP and IPDP, Development of GBV AP, Labour Management Procedure (LMP), Environment, Monitoring and Auditing Plan etc.

3.7 Public Consultation/Stakeholder Engagement

Stakeholder mapping and analysis were done as part of development of the Stakeholder Engagement Plan (SEP). The institutional need to implement ESIA recommendation and inter-agency coordination and public participation mechanisms were identified.

3.8 Compilation of Field Data and Triangulation with Secondary Information

Following the collection of data and information of additional data from the field, they were duly compiled having brought into the office of the consulting organization. The required data and information collected from the field were triangulated with the secondary information collected through desk review for data entry and processing and supplemented in the updated report.

3.9 Data Analysis and Interpretation

All the completed checklists were thoroughly examined and edited in the field, they were further rechecked and verified. Data analysis is the process of evaluating data using analytical and logical reasoning to examine each component of the data provided. The additional data and information collected from the field for updating/retrofitting the existing ESIA were duly analysed and interpreted. The study will be implied different processes in analysing the qualitative and quantitative data. Descriptive analyses were used for the assessment process. The study team read and reread the transcripts, sentences and phrases highlighting the verbatim.

CHAPTER 4: Baseline Environmental and Social Conditions

The baseline conditions are the standard against which projected future conditions are compared with project alternatives. This chapter portrays the baseline data and information on socio-economic and cultural environment of NNM road alignment.

4.1 Physical Environment

4.1.1 Topography and Geomorphology

The road alignment lies in the elevation range of 265 m (Mugling) to 1,500 m (Nagdhunga) from above mean sea level (amsl) (**Table 0-1**). The road alignment passes hilly area from Nagdhunga to Naubise (about 13%); after Naubise this alignment passes the valleys of Mahesh Khola and Trishuli River, following on the left bank of Mahesh Khola to Galchhi before meeting with Trishuli River. After Galchhi, the road alignment follows left bank of the Trishuli River upto Mugling (about 87%). Overall topography of road alignment is rolling type, ascending and partially descending in different sections.

The existing road runs from Nagdhunga to Mahadev Besi on the north aspect, after that the road traverses on the northeast aspect up to Belkhu. From Belkhu to Majhimtar the road alignment runs again on the north aspect. The alignment traverses from the north to northeast slope from Majhimtar to Mugling. The proposed new alignment between Sisne Khola and Dharke has the south to southwest aspect, crossing rivers like Sirke Khola, Khani Khola, Naubise Khola, Sugure Khola, Sopyang Khola, Juge Khola, Agra Khola, Phedi Khola, Kheste Khola, Machhedi Khola, Belkhu Khola, Galaudi Khola, MalekhuKhola, Gomati Khola, Charaudi Khola, Khataudi Khola, Hugdi Khola, Mauwa Khola, Chum Khola, Dahaki Khola, Barban Khola and Nagdi Khola. The road alignment follows more than 90% along the river valley of the Mahesh Khola and Trishuli River; running 5 to 150 m above from the riverbed.

Table 0-1: Elevation with chainage of locations

Sn.	Location	Chainage	Elevation (m)
1	Nagdhunga	0+000	1500
2	Sisne Khola	3+250	1320
3	Naubise	12+000	840
4	Dharke	14+500	800
5	Mahadev Besi	23+000	500
6	Galchhi (Baireni)	34+000	428
7	Belkhu	40+500	400
8	Gajuri	49+500	400
9	Malekhu	56+500	400
10	Benighat	62+500	375
11	Bahuntar	63+000	380
12	Bishaltar	65+500	380
14	Majhimtar	73+000	320
15	Kuringhat	86+000	300
16	Mugling	94+000	268

4.1.2 Climate and Hydrology

Meteorology

To understand the climate patterns of the study area, available meteorological data on temperature and rainfall were analysed.

i) Temperature

Analysis of 49 years of data from Kathmandu Airport records (closest weather station), from 1968 to 2016, shows increase in temperature pattern in the rate of 0.0508°C per year. The yearly average highest temperature was recorded in 2010 (20.3°C), whereas the yearly average lowest temperature was recorded in 1971 (17.4°C). The overall patterns of seasonal temperatures increase with various seasonal rates. The annual, spring, monsoon, autumn and winter patterns of temperature are presented in (**Annex 2.1 and 2.3**), as well as monthly maximum and minimum temperatures of the Kathmandu Airport from 1968 to 2016. The average annual temperature variation along the highway from Birgunj to Kathmandu is shown on **Figure 0-1**.

ii) Rainfall

Dhading (27°52' N, 84°56' E) – Index No. 1005 and Thankot (27°41' N, 85°12' E) - Index No. 1015, are the rainfall stations located within the distance of 20 km from the project alignment. Analysis of 49 years of data, recorded in 1968-2016, shows that the rainfall pattern of the study area decreases. The rate of decrease is estimated as 10.408 mm per year with maximum rainfall in 1978 (2501.4 mm) and minimum rainfall in 2015 (1207.5 mm). The overall patterns of seasonal rainfalls were also found to be decreasing. The rate of decrease in spring, monsoon, autumn and winter rainfalls were recorded to be 0.7722, 5.6198, 3.7369, and 0.2786 mm per year, respectively. The annual and seasonal patterns of rainfall are presented in **Annex 2.2**.

Hydrology

River System

The NNM road is located in mid-hill areas. There are 27 rivers and rivulets along Kathmandu (Nagdhunga)-Naubise-Mugling and tributaries of Trishuli River Basin. They are entirely dependent on rainfall for their runoff. Rivers and rivulets crossing the NNM road are listed in **Table 0-2**.

Table 0-2: Rivers/rivulets along NNM roadside

1. Mahesh Khola	10. Khesre Khola	19. Gomati Khola
2. Thare Khola	11. Trishuli Ganga Nadi	20. Bisural Khola
3. Jhapre Khola	12. Chiraudi Khola	21. Charaudi Khola
4. Sikre Khola	13. Belkhu Khola	22. Khatauti Khola
5. Khani Khola	14. Trishuli River	23. Hughdi Khola
6. Naubise Khola	15. Pokhare Khola	24. Mauwa Khola
7. Agra Khola	16. Galaudi Khola	25. Chum Khola
8. Phedi Khola	17. Malekhu Khola	26. Dahaki Khola
9. Machhedi Khola	18. Kadam Khola	27. Barban Khola

The existing road mainly follows the south bank of Trishuli River with 26 bridges, most of which are on tributaries of the Trishuli River. Additionally, a lot of small seasonal streams cross the existing road, where pipe and slab culverts of different sizes are established.

Inadequate sizes of drains have been identified in some places; therefore, recommendations were made to replace them by larger size (DoR, 2017).

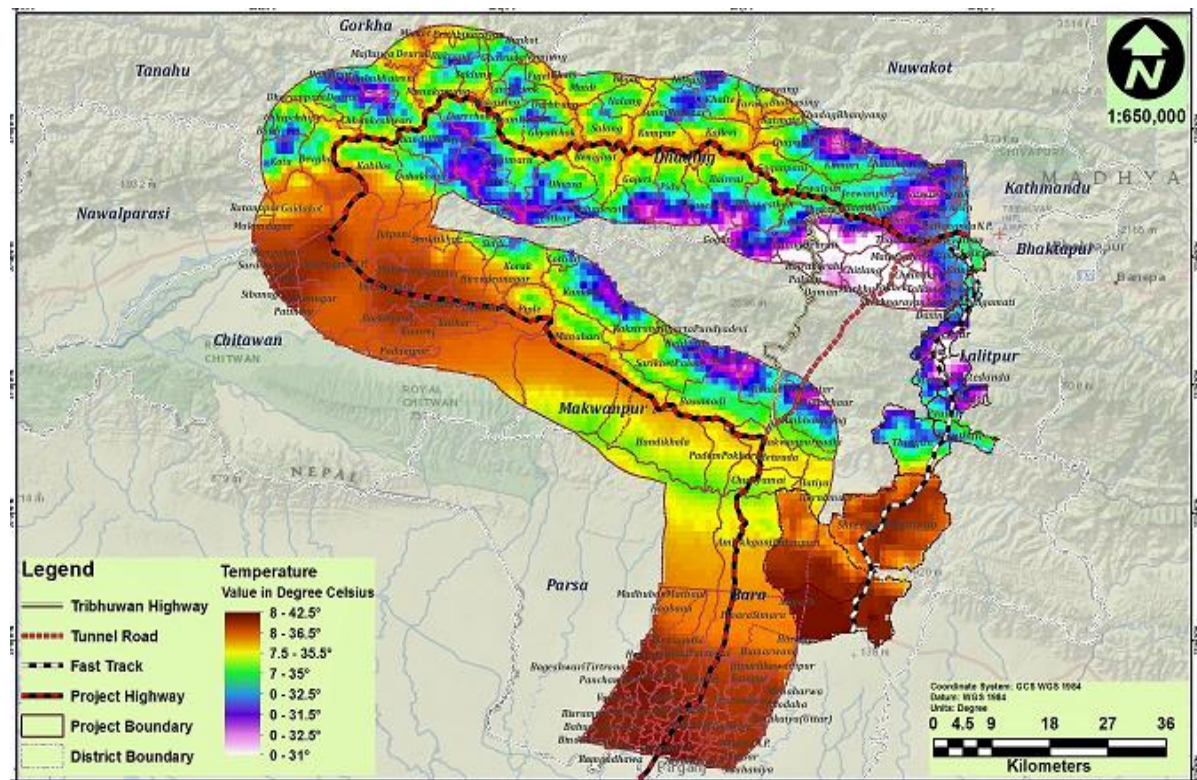


Figure 0-1: Temperature variation map in the road corridor from Birgunj to Kathmandu

In order to provide some information on the discharge patterns of the study area, an analysis of past recorded discharge data of Trishuli River at Betrawati (27°58' N, 85°11' E) – Station No. 447 from 1977 to 2015 (39 years) and Kali Khola (27°50' N, 84°33' E) – Station No. 449.91 from 1994 to 2015 (22 years) were analysed. The discharge pattern of the Trishuli River indicates that the annual flow has increasing pattern (**Annex 2.3**), whereas the annual instantaneous maximum flow has decreasing pattern. The rate of increase at Betrawati was observed to be 0.0289 m³ per year with maximum discharge in 2003 (275.1 m³) and minimum discharge in 2009 (142.2 m³). Similarly, the rate of increase at Kali Khola was observed to be 0.029 m³ per year with maximum discharge in 2003 (1068.8 m³) and minimum discharge in 2001 (654.6 m³). The rate of decrease of instantaneous maximum flow at Betrawati (**Annex2.4**) is estimated to be 1.21 m³ per year and that of Kali Khola it is to be 14.91 m³ per year.

According to the rainfall trend analysis, the annual average rainfall of the study area is decreasing at the rate of 10.41 mm per year (**Annex2.2**), but the Trishuli River shows increasing trend. However, the annual trend of maximum instantaneous flow of this river follows the decreasing trend of rainfall. Trishuli River is snow-fed river. Annual increasing trend of temperature causes increase in snowmelt trend. It indicates that the growing trend of annual flow is linked to snowmelt in runoff, however, the maximum instantaneous flow is of direct contribution of rainfall rather than snowmelt runoff. Monthly and yearly discharge of the Trishuli River at Betrawati (from 1977 to 2015) and Kali Khola (from 1994 to 2015) are presented in Annex 3. Annex 4 shows the maximum instantaneous discharge of the river at Betrawati and Kali Khola for the same period.

Flood Estimation for Drainage Structures

Taking 100 years return period, DoR (2017) estimated the design flood discharge passing through the existing bridges using rational formula and were compared with flood discharge estimated using several empirical methods (Table 0-3).

Table 0-3: Design flood estimation for existing bridges in the existing road alignment (cumecs)

SN	Bridge Name	Chainage (km)	Catchment Area, km ²	WECS/DHM 1990	Sharma& Adhikari (2004)	PCJ (1996)	Modified Dicken's Formula	Rational Method
1	Khatripauwa	4+139	0.8	22	17	10	4	13
2	Naubise	12+449	16.1	118	153	92	83	176
3	Ganesh	2+965	4.0	48	57	36	22	57
4	Sopyang	5+096	6.0	61	75	47	32	70
5	AgraKhola	10+923	111.8	470	618	410	473	495
6	Khahare	12+376	1.6	29	29	21	9	26
7	Phedi	14+453	3.1	41	46	63	17	50
8	Dangdunge	14+735	7.9	73	91	117	42	86
9	Kheste	18+165	22.8	150	197	257	114	165
10	Machedi	19+484	1.3	27	25	31	7	25
11	Gardo	23+128	4.8	53	64	85	26	80
12	Jundi	24+989	2.5	36	40	54	14	39
13	Chiraudi	26+488	12.0	96	124	152	63	100
14	Belkhu	28+803	88.0	395	520	653	383	424
15	Pokhare	33+155	5.3	57	69	92	29	64
16	Galaudi	36+316	19.7	135	177	228	99	150
17	Soti	38+384	1.7	30	30	39	9	32
18	Malekhu	43+379	101.5	438	576	711	434	435
19	Gomati	49+942	8.0	74	93	119	43	95
20	Charaudi	55+246	46.6	249	329	439	217	311
21	Khatauti	58+186	6.8	66	83	109	37	96
22	Hugdi	61+706	53.1	274	362	459	244	303
23	Mowa	65+887	9.6	83	105	120	51	101
24	Dahaki	72+344	1.0	24	21	23	5	17
25	Barbang	73+275	5.8	60	73	92	1	63
26	Nagdi	80+182	6.8	66	82	102	37	69

Note: For Khatripauwa and Naubise Bridges, 0+000 is at Nagdhunga while for rest of the bridges, 0+000 is at Naubise

Source: DoR (2017)

Cross drains will be designed for 50 years return period flood (DoR, 2017)¹⁰. Using rational formula for discharge estimation of cross drains, this study pointed out the necessity of new crossing structures along with replacing of existing culverts which are inadequate to pass design discharge. DoR (2017) also found that the existing side drains are more or less adequate for 25 years return period flood but might to be increased for increased return period of flood.

¹⁰ DoR (2017). Feasibility study for improvement of Kathmandu (Nagdhunga)-Naubise-Mugling Road and Bridges, Final Feasibility Report, Department of Roads Foreign Cooperation Branch, Ministry of Physical Infrastructure and Transport, Government of Nepal.

Climate Change Impacts on hydrology

Climate in the project area varies from sub-tropical to temperate and sub-alpine type. Maximum average temperature of the project districts is more than 30 °C and minimum average temperature less than 10 °C.

The present rainfall analysis shows decreasing trend of rainfall for the study area. Different studies (Viviroli et al., 2011; Nepal & Shrestha, 2015; Nepal, 2016; etc.) have suggested that extreme events in future are likely to be more frequent and magnitude of such events are likely will increase. Increased extreme rainfall could trigger landslides in several stretches of the road alignment and bring large flood discharge, which can wash away bridges, and other cross drainage structures along the alignment (like during 1993 flood event). Side drains may be inadequate to quickly remove water from the road surface. Similarly, high floodwater can cause toe cutting of the road slopes. It could lead to increase in sizes of the structures. In Nepal, guidelines for considering climate change in the design is not available currently. Increasing the design discharge to cover climate change uncertainty and/or designing cross drainage structures and side drains at higher return period will help reducing their vulnerability from extreme events (DoR, 2017). Dhading, Gorkha, and Chitwan districts are ranked as having high vulnerability to climate change; where the Kathmandu District is ranked as highly vulnerable according to an overall climate change vulnerability index. The low level of development and complex topography renders it vulnerability to climate change.

The annual pattern of temperature in Kathmandu and Hilly area was observed to be increasing in the rate of 0.0514 °C per year (**Annex 2.1**). The highest temperature was recorded in 2010 (20.25 °C), whereas the lowest temperature was recorded in 1997 which was 17.97 °C. The overall pattern of seasonal temperatures was also found to be increasing.

The annual rainfall of the NNM corridor showed increasing pattern. The rate of increase is estimated to be 6.487 mm per year with maximum rainfall in 2013 (1899.3 mm) and minimum rainfall in 1999 (1,067.9 mm) (**Annex 2.2**). All the seasons showed increasing trend of rainfall.

Hydrological condition of the entire road section is dry and wet, depending on locality and season. During construction phase of the road, there is chance that some failures may occur, so it is highly recommended to manage the surface drain and wall.

4.1.3 Regional Geology

Naubise (08+500 to 12+500): This section of the road alignment is 4.0 km long including short tunnel alignment and runs on the north aspect. Geologically, this section passes through the rocks of quartzite and phyllite of the Chandragiri Formation of the Lesser Himalaya. The rocks are slightly weathered in nature. Colluvial as well as residual deposits were observed along the road section. Thickness of residual soil and colluvial deposits is more than 5 m at the end part of the road section. The section passes through cultivated land, bushes and forest area. Hydrological condition of this section is wet. Slope stability condition is more or less stable but high possibility to occur failure in loose and thick soil area. In the rocks area, the slope stability condition is good.

Siureni Bazaar (Bahuntar)-Chuwatar (00+000-07+500) also represents the option one of the alternative 3. The road alignment passes from the southwest to south aspect of the hilly slope.

The bedrocks are presented by quartzite and phyllite, limestone and slate of the Galyang Formation, Lakharpata Formation and Syangja Formation. Colluvial and residual soil deposits were encountered along the road alignment. Thickness of the soil deposits along the road alignment is more than 5 m. Along the proposed road section some paleo-erosion and landslides can be seen. Initial part of the alignment on the right bank of Trishuli River is covered with bedrocks of the Galyang Formation and colluvial deposits. It is mainly composed by fresh boulders of phyllite. Limestone, quartzite, and phyllite can be seen in middle and end part of the proposed road alignment. The section is 07.50 km. It passes through cultivated land and forest area.

Bishaltar-Chuwatar (00+000 to 07+500) represents the option 2 of the alternative 3 and about 1 km towards west from the option 1. Geology is more or less same because same alignment is followed.

Chuwatar-Kurintar (07+500 to 21+000): This section of the road alignment is 13.50 km. It ascends very gently through the southwest aspect. The alignment passes through the rocks of limestone as well as quartzite and phyllite. Thin layers of residual soil and colluvial deposits were noticed along the alignment. Most of the section of alignment passes through the forest area including some parts though cultivated land. Some gully erosion and old slide scarp can be seen along the steep slope.



Figure 0-2: Relief along NNM road

Geologically, the project area (NNM Road) belongs to the rocks of the Lesser Himalaya and falls in Central Nepal. The proposed project area lies on the Mahabharat Range. This range is consisting of sedimentary rocks, mainly mudstone, sandstone and conglomerates. Geomorphologically, the alignment runs along middle mountains and high mountains in presence of ordinary soil, boulder mixed soil, hard rock and soft rock. The lithological units available within the district are carbonaceous schist, limestone schist, dolomite and gneiss schist.

The Nepal Himalaya has been subdivided into five tectonic zones from south to north and separated by south propagated thrust faults (e.g., *Main Central Thrust (MCT)*, *Main Boundary Thrust (MBT)*, and *Main Frontal Thrust (MFT)*). The project area is located in the Lesser Himalaya in between the MBT at south and MCT at north.

Table 0-4: Geological Characteristic of the Road Corridor area (explanation of following Geological Map: Fig. 4-3)

Regional Geological Characteristics (in sequence)
na: Nuwakot Group (Precambrian to Lower Paleozoic. Mainly shallow marine sediments, lower part dominant clastic (Phyllites, Sandstones, Quartzite and Calcareous Sandstones). Stromatolitic limestone and black slates occur in the upper part. Basic Sills and Dykes present)
kn: Kuncha Group, Precambrian, mainly flyschoid sequence (bedded schists, phyllites and metasandstones), locally shallow water quartzite beds and basic sills and dykes present

The Lesser Himalaya lies in between the Sub-Himalaya (Siwalik Group) in the south and Higher Himalaya in the north. Both the southern and northern limits of this zone are represented by thrusts, the MBT and the MCT, respectively. Tectonically, the entire Lesser Himalaya consists of allochthonous and para-autochthonous rocks. Rock sequences are developed with nappes, klippen and tectonic windows, which have complicated geology. The Lesser Himalaya is made up of mostly the unfossiliferous sedimentary and metasedimentary rocks, consisting of quartzite, phyllite, slate and limestone ranging in age from Pre-Cambrian to Miocene. Some areas are covered by high-grade metamorphic rocks in Lesser Himalayan terrain. Geologically, the project area (NNM Road) belongs to the rocks of the Lesser Himalaya and falls in Central Nepal.

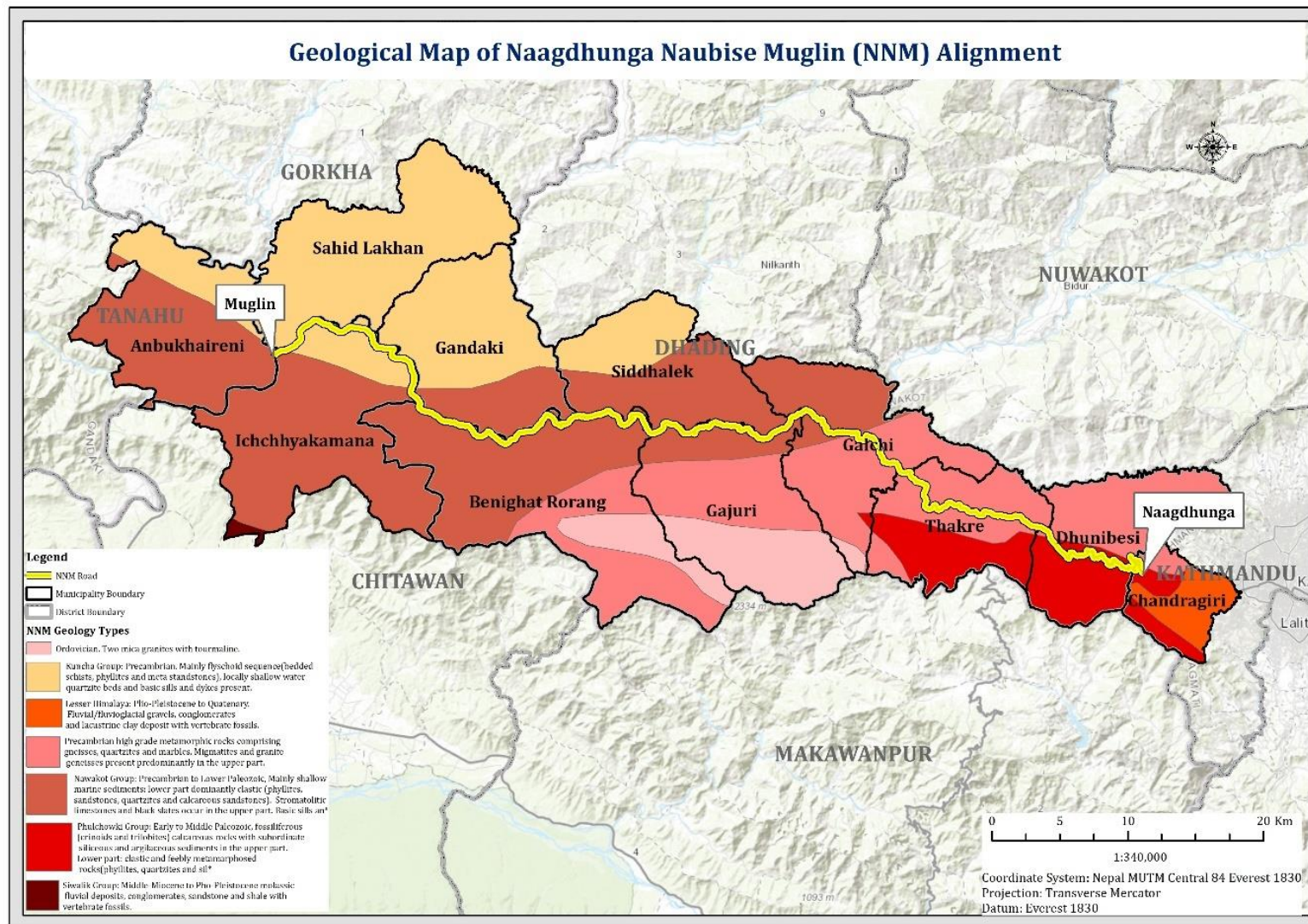


Figure 0-3: Geological Map of the Road corridor

4.1.4 Engineering Geological Condition

Road alignment between Nagdhunga and Mugling consists of three types of soil namely, colluvium, residual and alluvium. Residual soil deposits are dominantly found throughout the road alignment. The main reason for appearing of the residual soil is weathering of the parent rocks of phyllite as well as gneiss. Alluvial deposits are mainly found on banks of the Trishuli River. Thickness of soils on the bedrock's ranges from 2 to 10 m, and in some places alluvial deposits are found up to 15 m. Alluvial deposits along the road alignment cover 8.84 km or 9.40% and colluvial and residual soil deposits covers about 28.82 km/30.66% length of the road alignment, whereas the remaining alignment (55.34 km/ 58.81%) runs on the rocky terrain. The lithography of the central Himalaya region is provided in the **Annex 2.5**.

Table 0-5: Geomorphology and Geology of road alignment of Existing Road alignment

S N	Section	Chainage	Length (km)	Elevation range (m)	Cross slope	Aspect	Geology	Geomorphology	Soil type	Land use pattern
1.	Nagdhunga- Sisne Khola	00+000- 03+750	3.75	1500-1320	15-30°	North east	Phyllite and quartzite/ limestone	Gentle to steep sloped	Colluvial/residual soil deposits	Cultivated land/ forest/barren /river valley
2.	Sisne Khola- Naubise	03+750- 12+000	8.25	1320-840	10-30°	North to north east	Quartzite/ phyllite	Gentle to steep sloped	Colluvial and residual soil deposits	Forest/cultivated land/ bushes
3.	Naubise- Thakre	12+000- 16+500	4.50	840-800	5-25°	North east	Phyllite/ quartzite	Gentle to steep	Residual soil and Colluvial deposits	Cultivated land/bushes
4.	Thakre- Simle	16+500- 25+500	9.00	800-500	10-30°	North	Schist/ gneiss	Gentle slope	Residual soil and Colluvial deposits	Forest/cultivated barren land
5.	Simle- Belkhu	25+500- 40+500	15.0	500-400	5-30°	North to north east	Gneiss/ schist/ quartzite	Gentle slope	Residual soil and Colluvial deposits	Forest/barren land
6.	Belkhu- Majhimtar	40+500- 73+500	23.00	400-320	5-25°	North	Quartzite/ slate/ limestone	Gentle to steep slope	Colluvial and residual soil deposits	Forest
7.	Majhimtar- Kurintar	73+500- 89+000	15.5	320-300	5-20°	North east to east	Quartzite/ slate and phyllite	Gentle to steep slope	Colluvial and residual soil deposits	Forest/cultivated land
8.	Kurintar- Mugling	89+000- 94+000	5.00	300-265	20-30°	North	Quartzite/ phyllite	Steep slope	Colluvial deposits	Forest/cultivated land

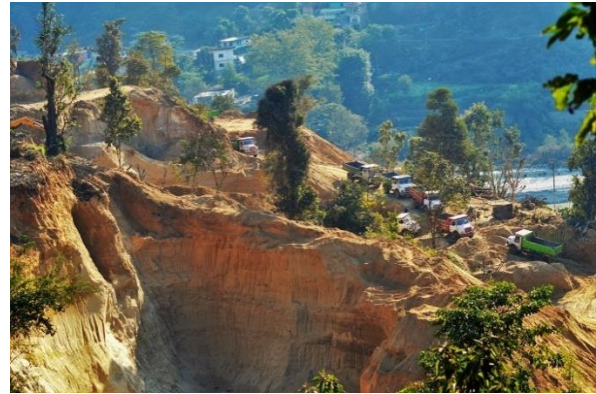


Figure 0-4: Alluvial and residual soil types in the open deposit area along existing Highway

Table 0-6: Soil Types and their distribution

Chainage	Length	Phyllite/ quartzite	Limestone	Slate	Gneiss/ Schist	Colluvium/ Residual soil	Alluvium
2 00+000-03+750 3 Nagdhunga- Sisne Khola	3.75 km	2.62 km				1.13 km	
4 00+000-11+500 5 Sisnekhola- Dharke	8.25 km	5.78 km				2.47 km	
6 16+500+000- 25+500 7 Dharke-Thakre	4.50 km	3.78 km				1.25 km	
8 16+500-25+500	9.00 km	6.75 km				1.75 km	0.50 km
9 25+500-40+500	15.00 km	2.75 km	2.65 km	2.10 km		5.50 km	2.50 km
10. 40+500-73+500	33.50 km	2.50 km	3.50 km	9.65 km	3.55	7.40 km	3.45 km
11. 73+500-89+000	15.50 km	3.56 km	1.23 km	2.34 km		5.68 km	2.39 km
12. 89+000-94+000	15.00 km	9.35 km				6.65 km	

Source: Field Survey, 2016

Table 0-7: Distribution of the soils and terrain along the road alignment

S.N.	Common soils	Coverage length (%)	Coverage length (m)	Remarks
1	Boulder mixed soils of alluvial deposits	9.40%	8840	Alluvial soils
2	Boulder mixed soils of colluvial/residual soil deposits	30.66%	28820	Colluvial and residual soil
3	Rock (phyllite/quartzite/gneiss/limestone)	55.81%	55340	Soft and hard rock

Source: Field Survey, 2016

Table 0-8: Section wise Hazard Category

Section	Hazard category
Mugling-Benighat	High to medium
Benighat-Galchhi	Low
Galchhi-Naghdhunga	Medium to high

Source: Field survey, 2016

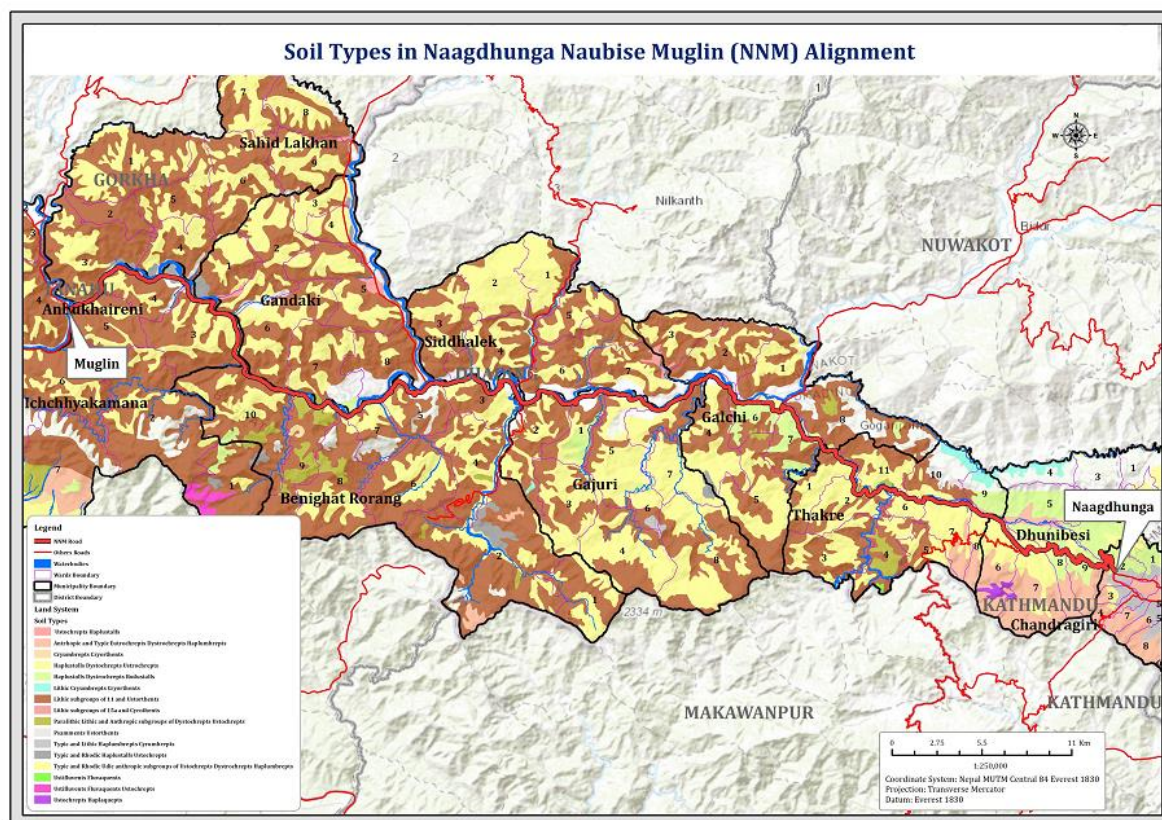


Figure 0-5: Soil types along NNM Road: Source: Data analysis, 2019

4.1.5 Seismicity

Earthquake records of Nepal since 1253 indicate that Nepal was hit by at least 19 earthquakes (the last major earthquakes were in 1988 and 2015) with various degrees of damage. However, the records may not be complete, and the data on loss of life and property may not be very accurate as such data with high reliability are difficult to find. Out of these, the records of the 1833 (magnitude 7.7) and 1934 (magnitude 8.3) earthquakes that occurred at an interval of 100 years give better details and show that these earthquakes were highly disastrous. The effects of these earthquakes were particularly severe in the Kathmandu basin. Nepal established its first seismic station in 1978 under the DMG, GoN. Today it has 21 telemetric seismic stations covering the whole country with Kathmandu (central Nepal) and Surkhet (mid-western Nepal) as base recording stations. Over the years a great amount of data has been collected, which have become very useful for earthquake research in the region.

According to Bajracharya (1994), the Nepal Himalaya has been subdivided into five seismic zones (Zone1, Zone 2, Zone 3, Zone 4, Zone 5) with relation to the seismic hazard (Low, Moderate and High). The road alignment falls in the seismic low to moderate hazard area

(Seismic zone 2 to 3) (Fig. 4.6.). According to Thapa and Wang (2012), the area has Peak Gravitational Acceleration (PGA) value range from 0.105 to 0.145g (**Figure 0-7**).

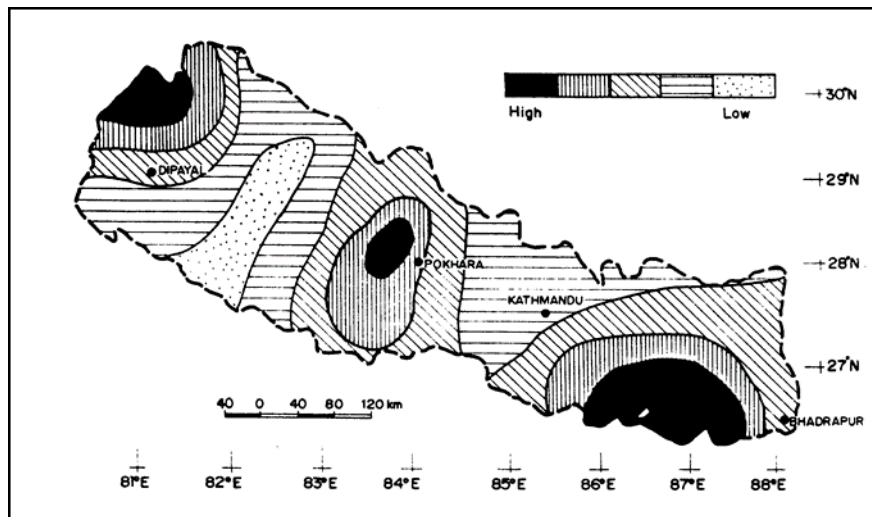


Figure 0-6: Seismic Map of Nepal

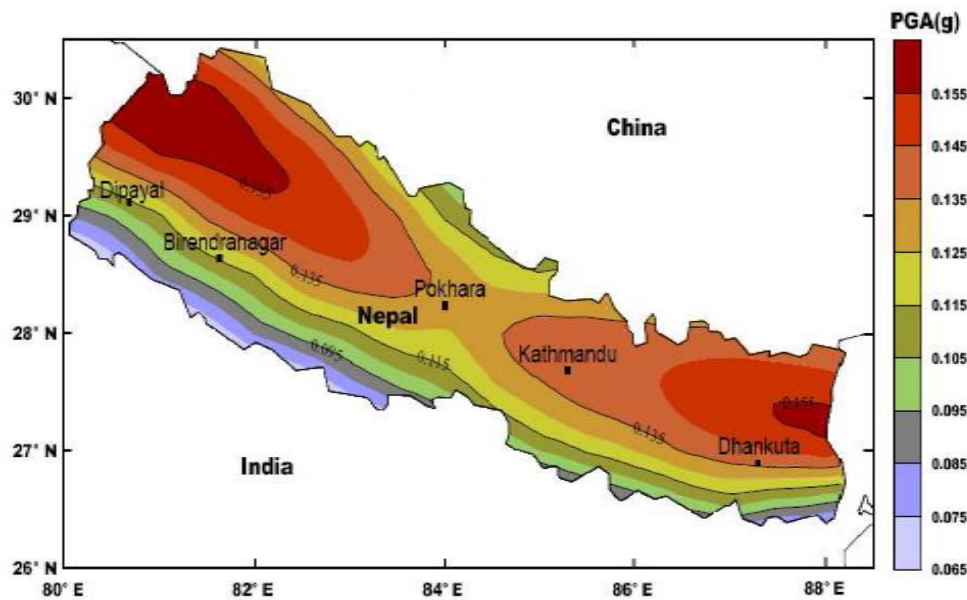


Figure 0-7: Peak Ground Acceleration Map of the Nepal Himalaya (Thapa and Wang, 2012)

Historical Seismic Activity

The Nepal Himalaya has experienced several large earthquakes over the past centuries. The National Building Code Development Project (BCDP, 1994) has developed an earthquake catalogue using earthquake data catalogues of the US Geological Survey, The National Earthquake Information Centre (NEIC), National Oceanic and Atmospheric Administration and National Geological Data Centre (NGDC). The complete earthquake catalogue for the magnitudes M 4.5 and greater is given in **Table 0-9**.

The largest event reported in the catalogue is the magnitude 8.3 Bihar–Nepal earthquake (Chainpur), which appears to have occurred in 1934. The big earthquake occurred in 2015 of

the Richter scale of 7.9. The quake of 2015 did not damage (no subsidence and collapse) the road alignment between Nagdhunga and Mugling.

Table 0-9: Instrumentally Recorded Earthquake

S. N	Magnitudes	Catalogue Year
1	M 6.0 and greater than M 6.0	Catalogue complete for the period 1911 to 1992
2	M 5.5 and greater than M 5.5	Catalogue complete for the period 1925 to 1992
3	M 5.9 and greater than M 5.9	Catalogue complete for the period early 1960 to 1992
4	M 4.5 and greater than M 4.5	Catalogue complete for the period late 1970 to 1980s

The design seismic coefficient for the project can be taken in the range of 0.11g to 0.15g which is more or less same value represented from the return period of the earthquake. The method used to convert the maximum acceleration of the earthquake motion into the design seismic coefficient is provided in **Annex 2.6**.

4.1.6 Landslide and Slope Stability

As of November 2004, the condition of Mugling-Naubise section of Prithvi Highway had been very poor due to a number of slope failure sites and landslide deposits. The problem of Krishnabhir landslide, which had been reported several times in various national and international publications, has remained almost unaltered except for the reduction in the amount of new debris deposits due mainly to natural stabilization of the failed debris and complete failure of all unstable slope masses. Efforts of the DoR, particularly by applying vegetation and surface drainage system have reduced the chance of its further failure. A number of other places along the section can also be observed to have been hazardous due to unprotected rock mass failures, creeping landslide-caused road level subsidence, river cutting failures, etc. The active and relict landslides (indicated by red ovules) and the debris deposits, terrace deposits, and talus deposits (indicated by red-spotted ovules/areas) lies along the Prithvi Highway corridor.

The entire section of the road from Manakamana Cable Car to Mugling from Km 90+1 00 to Km 92+500 is old landslide zone. However, only the road section from Km 91+900 to 92+500 for about 600 m is active landslide zone and the rest has been stabilized in due course of time.

The road section from Chumlingtar to Manakamana Cable Car is aligned either through the river terraces of Chumlingtar and Kurintar made by Trishuli River and its tributaries or through the colluvial deposit consisting of talus material as Lewatar. The rock types to be encountered are mainly slightly weathered to fresh fairly strong gritty phyllite and quartzite of Kunchha Formation belonging to Lower Nuwakot group dipping into the hill slope.

The road section from Hugdi Khola to Chumlingtar is one of the most challenging sections for road widening. The famous Jogimara landslide (Rock fall) is located in this section of the road. The road alignment passes through very rugged topography and complex geological arrangements in steep slope. The rock types appearing in this area are dolomite, quartzite, phyllites and grit-stone or gritty phyllite and meta-sandstones of Lower Nuwakot group of rocks. However, toward the Hudgi Khola area the rocks are black slates and some limestone and/or dolomite. At least three different faults are dissecting the area and they are Khani Khola fault at Phisling running along Khani Khola F2, the Trishuli fault running almost along the Trishuli River from near Mauwa Khola to Phisling and beyond Fl and a fault running almost

east west direction from Ghyalchok crossing Trishuli River near Mauwa Khola confluence and continue beyond the project area.

Tectonically the area is very complex and the rocks dip in different directions. Although recently active large-scale mass movement is not observed in this area, but evidence of old landslides and creeping slopes were observed at some places. Since the infamous Jogimara landslide is located in this section of the road it will be necessary to make sure not to reactivate it while widening the road. Previously in Jogimara area, there was a stone quarry just above the road level and rock fall occurred in the direction of road causing many accidents. At present that particular quarry is shut and no problem is faced. The road was also shifted slightly toward the valley side that enhanced the road safety by constructing high wall. From Benighat to Hugdi Khola the existing road is aligned not only through the alluvial terraces of Trishuli River and its tributaries, but also through the steep rock slopes vulnerable to landslides passing through Bishaltar, Charaundi, Krishnabhir, Majhimtar, up to Hugdi Khola and Jogimara, Phisling and Kurintar and beyond. The rocks area highly fractured and frequently sheared. Moreover, the Mahabharat Thrust (MT) running in almost east-west direction is located on top of the Krishnabhir Landslide making the area more vulnerable. One of the main causes of occurrence of Krishnabhir landslide is the presence of thick pile of loose rock and soil deposit on top of the slope together with the occurrence of highly fractured, sheared and highly weathered nature of the bedrock due to the influence of MT.

From Galchhi to Benighat the road is aligned mainly either along the big terraces of Trishuli River and its tributaries or the Trishuli River bank slopes. Except the requirement for the correction of steeper gradient and for sharp curves at some places like in Chiraundi Khola bridge site, Gajuri, and Malekhu bends etc. not major slope cut will be required.

The road alignment from Naubise to Galchhi traverses mainly along the valley of Naubise Khola and Mahesh Khola along their left bank. The topography along this alignment is although mountainous, but due to the presence of river valley alluvial terraces are encountered for considerable length of the road. Moreover, the Mahesh and Naubise river valleys have seasonal streams, where it will not be difficult to work on the valley side. At Galchhi, Mahesh Khola meets Trishuli River coming from north flows toward west. The road from Galchhi onward is also aligned along the left bank of Trishuli River. The rock types to be encountered along the road alignment from Naubise to Galchhi are of Kathmandu Complex the phyllite, meta-sandstone, carbonates and some metamorphic rocks like schist and gneiss. In general, the rocks are dipping into the hill slope, or strikes of the rock are oblique to the road. Active landslides or rock slides are not visible throughout the length of the road from Naubise to Galchhi.



Figure 0-8: Landslide and instable slopes along NNM section.

From Sisne Khola to Naubise the existing road section passes through very rugged and dissected topography consisting of the highly weathered rocks. Hence, the road in this section runs along steep downhill grade frequently encountering sharp hairpin bends, deeply incised gullies and narrow hilly spurs. There are sharp bends, narrow road sections, and high gradient at several locations in this road section. The rock types encountered in this road section is mainly highly weathered and fractured meta-sandstones and phyllites Complex. The bedding plane of the rock is varying considerably mainly due to tight folding nature of the rock. The Nagdhunga-Kalanki section comprises the lower four formations of the Phulchowki Group belonging to the Kathmandu Complex. The rock sequence is represented by metasandstones, phyllites, slates, limestone, and dolomites. In several places, the rocks are covered either by fluvial-lacustrine sediments or alluvial fan deposits of the Kathmandu basin. The fan deposits are confined mainly to the foothills of the Chandragiri Range.

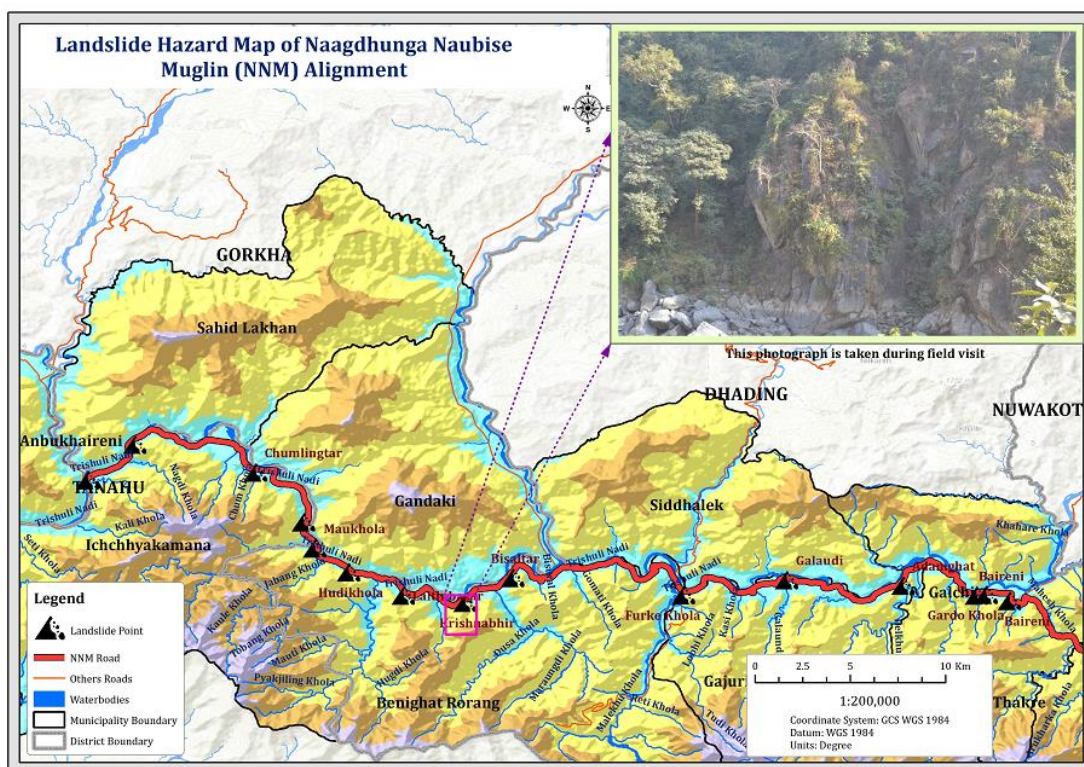


Figure 0-9: Landslide Hazard map along NNM Road in the project area.
(Source: Project data analysis, 2019)

4.1.7 Landslide Hazard Mapping and Active landslide area

Active landslides areas were identified along the proposed road alignments of all the alternatives of the Nagdhunga- Mugling road. Although, the status of landslide in almost all unit slopes encountered by the road alignment were indicated in landslide hazard map (Fig. 4.9), however area of existing active landslides and/or old landslides which were previously stabilized by various means are listed in the **Table 0-10**, presented below. As per the tabulated data the TH section of the road from Nagdhunga to Naubise, consists of at least 6 locations of either active or previously stabilized landslides. Similarly, along the PRM section of the highway from Naubise to Mugling there are either high potential of landslide or the slope has already failed and stabilized at 6 locations including Krishnabhir and Jogimara.

Table 0-10: Active landslide areas in the proposed road alignment

From	To	Distance (m)	Name of the Place	Remarks
Nagdhunga Naubise				
0+050	0+200	150	Nagdhunga	Hillside
2+250	2+400	150	Jhakribas	Active L/S
2+790	2+830	40	Jhyaple Khola	Vally side L/S
3+950	4+075	125	Khatri pauwa	Hillside
4+125	4+175	50	Khatri pauwa	Active L/S
4+400	4+650	250	West of Khatripauwa	Stabilized L/S
Total		765		
Naubise Mugling				
13+350	13+550	200	Koiralagaon	Potential L/S
16+625	16+925	300	Eklephant	Deep Rock cut
42+540	42+600	60	Malekhu	
57+050	58+050	1,000	Krisnabhir	Stabilized L/S still potential
66+800	66+925	125	Jogimara	Potential rock fall zone
69+000	69+200	200	Fisling	Slow and Active L/S
79+550	80+050	500	Mugling	
Total		2,035		

Source: Field survey, 2017

4.1.8 Air Quality

The air quality monitoring was carried out in 3 locations (Mugling, Malekhu and at Nagdhunga Check post) (**Table 4.11**) to determine the quality of air around the project area. All parameters were within the National Ambient Air Quality Standard except for the PM10 and PM2.5 (**Annex 2.7**)

Table 0-11: Air Quality of Project Area

Location	PM ₁₀	*PM _{2.5}	TSP	*Lead	SO ₂	NO _x	*Benzene	CO (%)
	(ug/Nm ³)							
Mungling (Near 3 sister restaurants - 1253 - AA - 1)	122.0	28.0	150.0	<0.002	<0.01	2.4	<2.0	**ND (<1.0)
Malekhu (At Temple – Near Ambe petrol Pump - 1253 - AA - 2)	132.0	31.0	163.0	<0.002	<0.01	4.7	<2.0	**ND (<1.0)
Nagdhunga Check post (At Chndragiri Ward Office - 1253 - AA - 3)	326.0	38.0	364.0	<0.002	<0.01	3.3	<2.0	**ND (<1.0)
NAAQS	<120	<40	<230	<0.5	<70.0	<80	<5.0	<1.0

Source: Field Study 2017

4.1.9 Noise Level

The observed equivalent noise pressure levels were found to exceed the National Noise Quality Standard Limit (NNQSL) (and OSHA TLV guideline).

Table 0-12: Noise Quality Level of Project Area

S. N.	Location Spots	Test Parameters								Range
		L _{max}	L _{min}	L _{eq}	L ₅	L ₁₀	L ₅₀	L ₉₀	L ₉₅	
1	Mugling (1253 - NM - 1) **	99.6	58.4	80.6	86.0	84.1	81.9	75.2	73.9	
2	Kuringhat (1253 - NM - 2) **	98.1	53.9	78.8	89.3	88.1	85.3	80.5	74.1	
3	Malekhu (1253 - NM - 3) **	109.3	53.9	90.1	91.4	89.8	84.1	70.8	64.8	*
4	Galchhi (1253 - NM - 4) **	104.4	54.8	85.4	89.3	88.5	82.5	64.6	61.8	*
5	gdhunga Check post (at VDC Ward Office - (1253 - NM - 5) **	105.6	59.5	86.5	96.8	96.2	82.8	60.0	59.9	*
NNQS for Industrial Area**				70						
<i>Note: OSHA TLV Range acceptable at industrial workplace area for 8 working hours*</i>				85						

Source: Field Study, 2017

Table 0-13: National Ambient Sound Quality Standard, 2012

S.N.	Land Use	Sound limit Leq (dBA)	
		Day	Night
1.	Industrial	75	70
2.	Commercial	65	55
3.	Rural Residential Area	45	40
4.	Urban Residential Area	55	50
5.	Mixed Residential Area	63	55
6.	Quiet Area	50	40

Source: Ministry of Environment, Science and Technology

Note: Leq (24) = Equivalent Sound Level in decibels.

Table 0-14: Noise exposure limits for the work environment (adopted from Occupational Safety and Health Administration (OSHA))

S.N.	Noise Exposure (dBA)	Permissible exposure (Hours and Minutes)
1.	85	16 hrs.
2.	87	12 hrs. -18 min.
3.	90	8 hrs.
4.	93	5 hrs - 18 min.
5.	96	3 hrs.-30 min.
6.	99	2 hrs. - 18 min.
7.	102	1 hr. - 30 min.
8.	105	1 hr.
9.	108	40 min.
10.	111	26 min.
11.	114	17 min.
12.	115	15 min.
13.	118	10 min.
14.	121	6.6 min.
15.	124	4 min.
16.	127	3 min.
17.	130	1 min.

4.1.10 Water Quality

To understand the water quality of the water bodies along the road, following parameters were tested: Ammonia, Nitrate, Phosphate, Sulphate, Sulphide, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Total Hardness, Calcium, Mg, Chloride, Iron, Fluoride, Chromium, Sodium, Potassium, Cadmium, Copper, Lead, Mercury, Oil & Grease, and coliforms. The test results showed that, fluoride level is lower than the NDWQS¹¹ limit in all water samples. Iron is high in the water sample of Agra Khola, Majhimtar Across at Trishuli River and Near Shree Chandrodaya H. S. School at Trishuli River. Biologically, water is contaminated with Total Coliforms in all samples. Detailed result of the water quality analysis is presented in the **Annex 2.8**.

During the study, major contamination indicator reported was **Total Coliforms**. **Iron and sediment** contents were found high at **Agra Khola and Trishuli river water**. **Fluoride** content was found lower than NDWQS recommended limit in all of the samples. Aggregate (sand, etc.) washing activities were found in few of the river such as Agra, Belkhu Khola as well as at the Baireni to Belkhu river zone mainly.

There are 8 water quality guidelines in Nepal, covering various aspects and goals of water standards for different categories of water use (**Annex 2.10**). They are consistent with WB IFC guidelines. All these guidelines have to be followed during the time of construction as per requirements.

4.1.11 Land Use

Land use patterns of the NNM Road project alignment were overlaid in digital topographical maps and its patterns were analysed (Error! Reference source not found. **Figure 0-11**). Land use calculation was conducted within the ROW (25 m on both sides of the road), along direct impact area (DIA) within the 300-meter corridor of the road, and in the indirect impact area (IIA) within 2 km corridor along existing road and new alignments. Calculation of 7 main land use classes was done to evaluate land use in the above-mentioned sections and impact zones, including agricultural land, forest, grassland, shrubland and barren areas, built-up areas and waterbodies. For the land use in RoW, the agricultural land is the main land use class along the existing highway.

Table 0-15: Land use within the ROW, DIA and IIA of NNM and (area in Ha.)

Land use type	Within RoW		Within 300 m Corridor (DIA)		Within 2km corridor (IIA)	
	Ha	%	Ha	%	Ha	%
Agricultural land	156.74	54.7	1225.85	44.1	6586.05	38.2
Forest	57.43	20	1309.9	47.2	4654.01	27.0
Shrubland	0.62	0.2	22.81	0.8	450.1	2.6
Grassland	4.51	1.6	12.81	0.5	870.63	5.0
Built-up area	2.27	0.8	140.03	5.0	4496.93	26.1
Barren land	14.19	4.9	14.63	0.5	55.71	0.3
Water-bodies	50.98	17.8	52.01	1.9	135.4	0.8
Total	286.74		2778.04		17248.83	

Source: GIS Map (ESIA Study Team)

¹¹National Drinking Water Quality Standard, 2005.

The existing land use patterns along the NNM road alignment is predominantly Forest/Bush and Grassland/ Orchard and agricultural farm lands followed by built up area, barren and others. The area along the highway is highly populated, which is confirmed by analysis of land use in 2 km road corridor with 26.1% of total area, occupied by settlements (mostly villages and small towns located along highway). But the carriageway of road is 7 m with shoulders of 1 to 2.5m, which means road upgrading will occur on already existing carriageway of 5.5 to 6.5 m requiring the minimal additional land area. Therefore, forest area and agricultural land need not be acquired.

The land use patterns following the upgrading of existing NNM Road is likely to undergo a substantial level of change from agricultural farm lands and open fields to residential and commercial uses with the later becoming more prevalent leading to increase in property value and positive impact on local community. As it can be seen from **Figure 0-10** and **Figure 0-11**, the land along the road is mostly occupied by agriculture with some forest patches in the indirect impact area.



Figure 0-10: Settlements surrounded by forests and agricultural fields

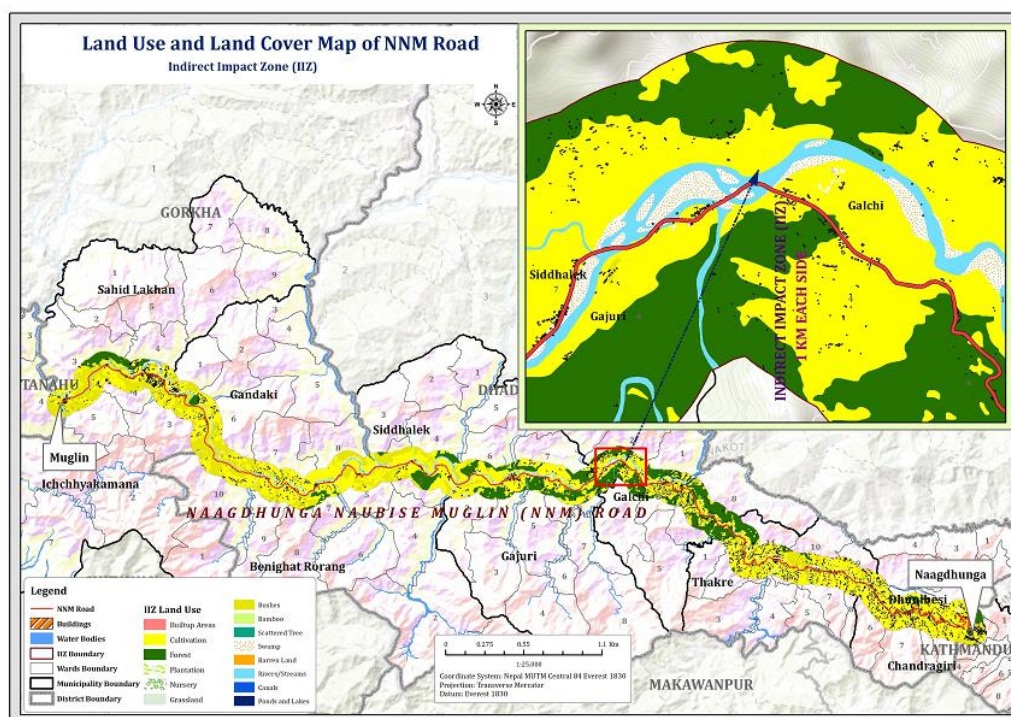


Figure 0-11: Land Use and Land Cover Map in the IIA along NNM Section

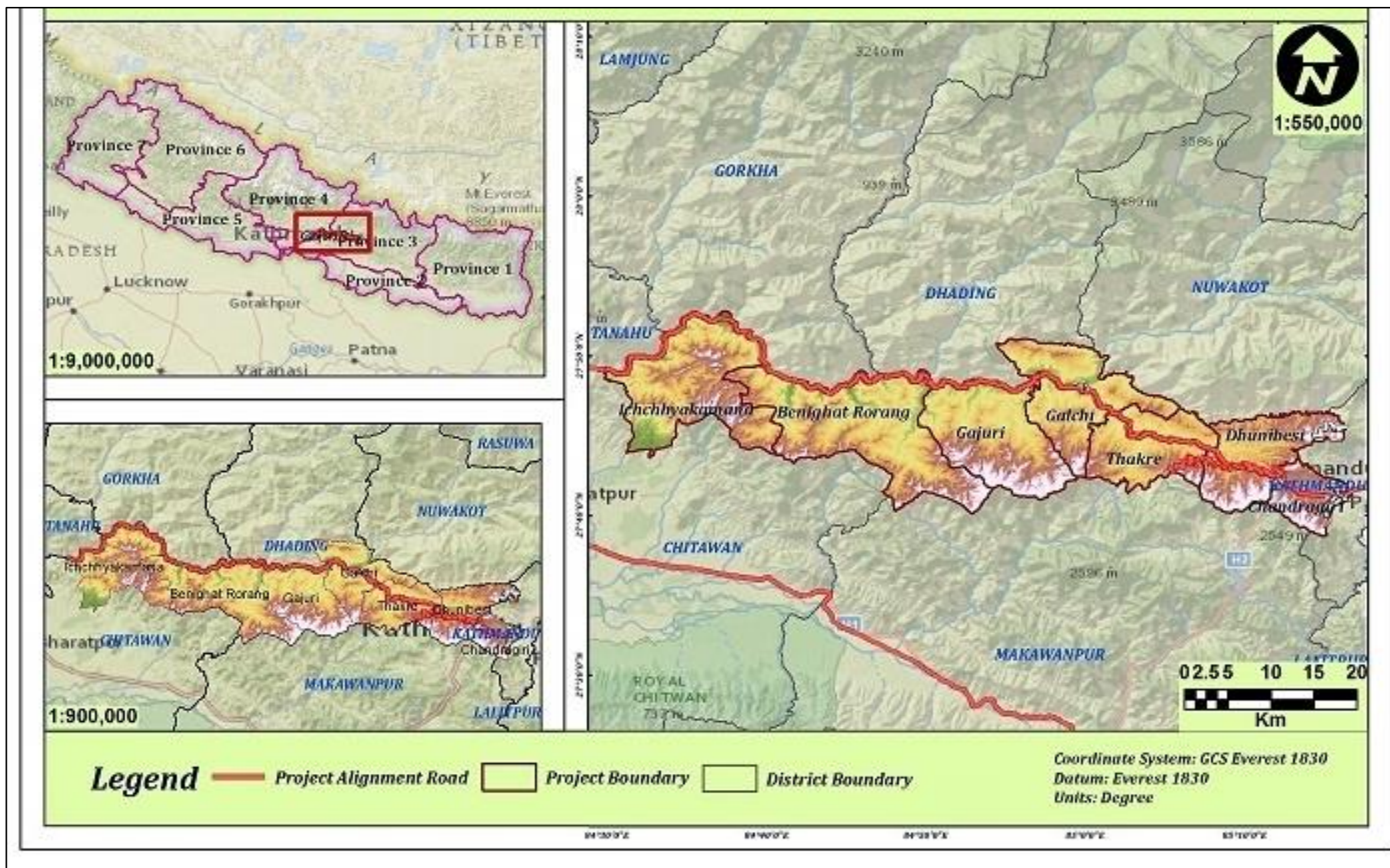


Figure 0-12: Road alignment showing Rural Municipalities and Municipalities

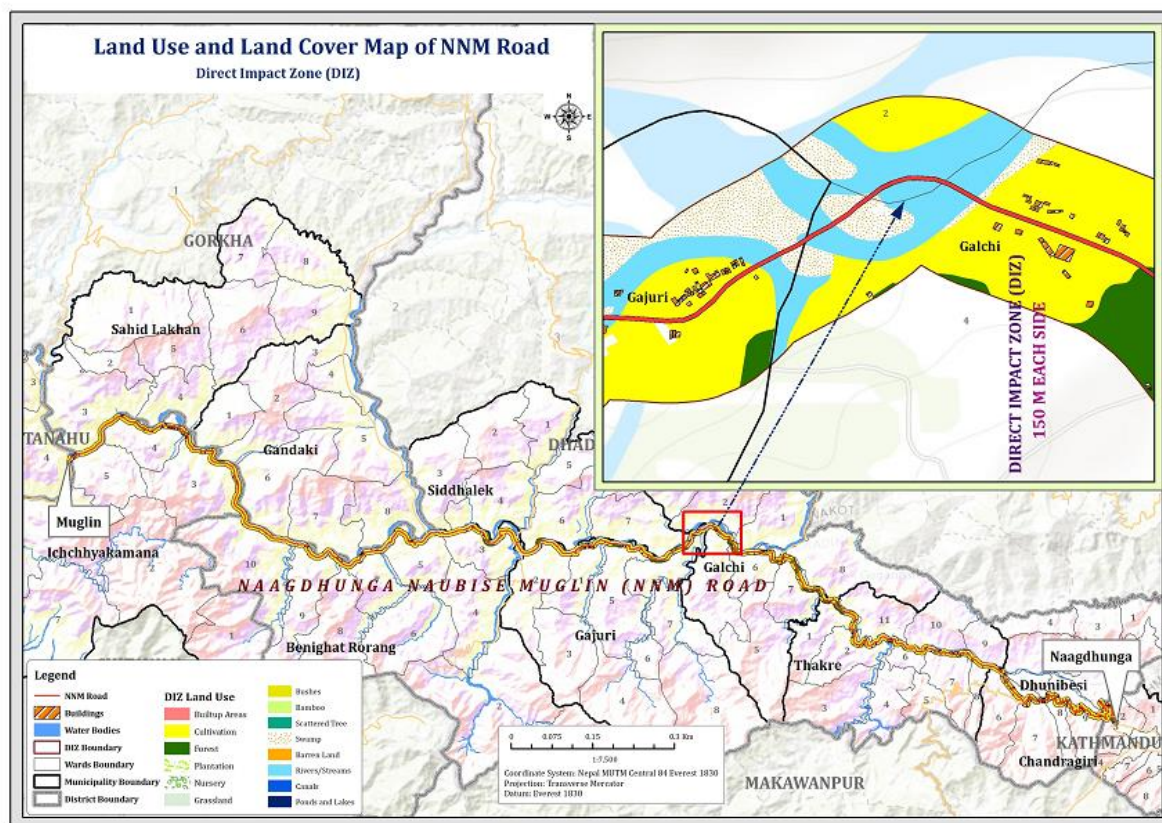


Figure 0-13: Land use map of NNM road (Direct Impact Area)

4.1.12 Solid Waste Management

The settlement along interior part of the roadside manages the degradable waste by local

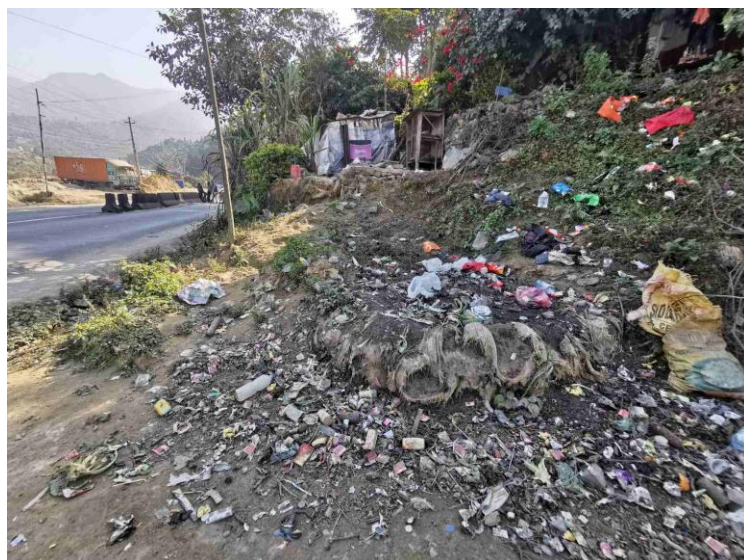


Figure 0-14: Solid wastes dumped along the road (Near Naubise)

technology, i.e. they make compost manure. However, non-biodegradable wastes are thrown either along the roadside, highway or directly disposed into river.

Although almost all municipalities and rural municipalities allocate budget for the management of solid waste, the breakdown of expenditures is rarely available. Roadside market, small shops, grocery, restaurants, and teashops are the major source of waste, which are seen along the roadside. Either side of the road is seen like

a dumping site. The major percentage of waste generated from the roadside market and hotels are organic wastes such as waste food materials, fruits and vegetables, wood pieces, etc. whereas remaining percentage of waste are plastics, pet bottles, beer/whisky glass bottles, tin cans, broken pieces of glasses, rubber, iron pieces etc. No any institution, private organization

working for the management of waste is existed along the existing highway as well as along the proposed new alignment area.

4.2 Biological Environment

A detailed field survey, conducted in 2016-2017, indicated that the NNM Road does not cross any protected area, wildlife reserves and wildlife migration corridors. The habitats in the ROW and in surrounding areas of the NNM Road is already fragmented and anthropogenic pressure on the area is very much prevalent due its long history of development and human settlements. Based on a critical habitat screening conducted following the criteria for critical habitats under Environmental and Social Standard (ESS) 6 and IFC Performance Standard 6, the project zone of influence (i.e., within the 50-m ROW, 300-m Direct Impact Area from the center of the road and 2-km radius Indirect Impact Area) has recorded presence of critically endangered and endangered species of animals and plants within the remaining forest patches along rivers and streams, which are mainly within the 2-km indirect impact area but outside the physical footprint of the project, ROW and the 300-m direct impact area. Description of Criteria and detailed screening are presented in the Annex 2.14 and 2.16. The critical habitat screening indicated the presence of two critically endangered bird species (*Gyps bengalensis* [White-rumped vulture] and *Sarcogyps calvus* [Red-headed vulture]; three endangered bird species (*Aquila nepalensis* [Steppe eagle], *Neophron percnopterus* [Egyptian vulture] and *Sterna acuticauda* [Black-bellied tern]; one critically endangered mammal (*Manis pentadactyla* [Chinese pangolin]; and one endangered fish species (*Tor putitora* [Golden mahseer] within the ZoI. The ESIA further indicated that the improvement of the existing NNM road will only affect a total of 4 hectares scattered along the entire ROW out of 57 hectares of forest. The direct impact involves the cutting of a total of 52 trees and some poles. In addition, there will be minimal land acquisition and natural habitats disturbance under the project. The road was built many years ago, the territory is heavily populated by human settlements and wildlife can be found only in small forest patches along rivers, mountain streams and in the remaining mountain forests. The large animals mostly use the natural landscape features and not through the road to move across such as deep gorges and river valleys under bridges. Many invasive plant species grow along the ROW, indicating the high degree of disturbance of natural habitats.

4.2.1 Forests in the Project Area

Major forest types by vegetation along the road is discussed below.

4.2.2 Types of Forest by Vegetation

Five different forest types are found in the project area, including: *Schima-Castanopsis* forest, pine forests (*Pinus roxburghii* and *Pinus patula*), Hill sal forest, Khair Sissoo and upper Terai Mixed Hardwood Forest types. As the forests do not exist in a single chunk, these vegetation types are distributed all along the project area among Community Forests (CF), Governmental Forest (GF) and Leasehold Forests (LHF), a mileage break down was not done.

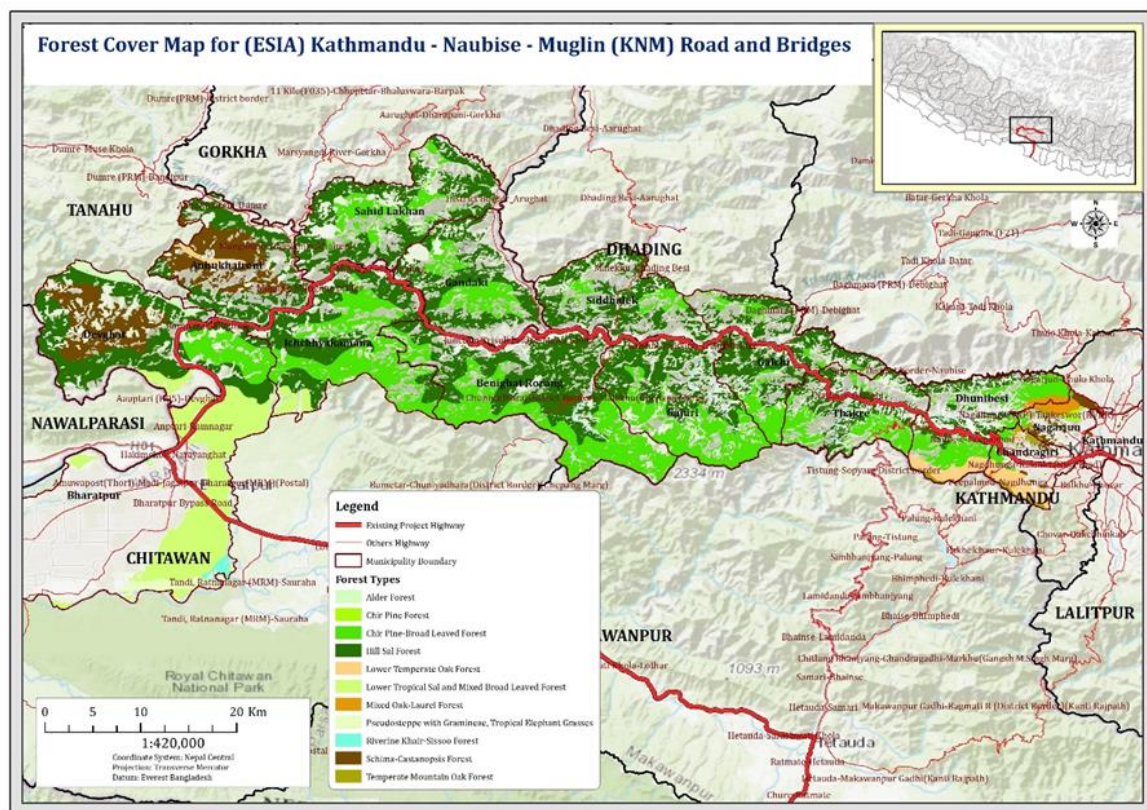


Figure 0-15: Forest Cover Map of NNM Road



Figure 0-16: Spots with wildlife species presence along NNM road

Schima-Castanopsis forest

The *Schima-castanopsis* forest is found along the old Kathmandu (Nagdhunga) - Naubise section.

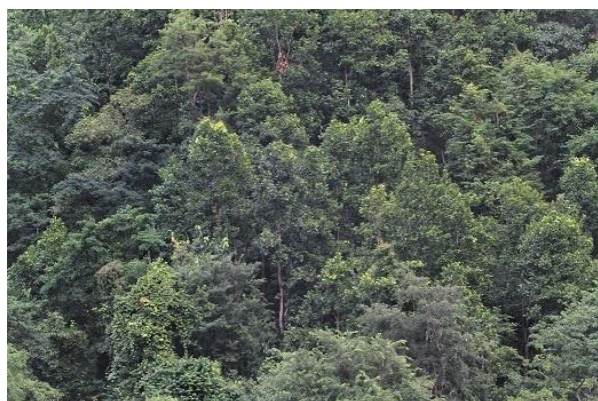


Figure 0-17: Schima-Castanopsis forest in Kathmandu district

In the upper part, the dominant species is *Castanopsis tribuloides*. Other presented species include *Schima wallichii*, *Merica esculanta*, and several others. The Schima Castanopsis forest area at Nagdhunga is enriched with Nepalese Alder or Utis (*Alnus nepalensis*) plantation. This forest is mostly presented in Kathmandu District. The majority of the forest is composed by *Schima Castanopsis* Forests from Kathmandu towards Naubise (12+000) of Dhading district. Species distribution showed that the forest type starts with upper middle layer, which slowly changes to middle and to lower layer, including other tree species, toward Naubise, i.e., *Castanopsis indica*, *Schima wallichaii* domination. This is a forest type that has the diversity of woody and other species, which are listed in Appendices.

Hill Sal forest

Both hill Sal forest and upper sub-tropical Sal forest are available along the lower end of the project area.



Figure 0-18: Hill-Sal Forest along NNM section

Along the new alignment in Gorkha district, species available are those from hill sal in total and along the Mugling end in Chitwan district, the species domination is that of Terai mixed hardwood forest. Most of the Sal species is found in the community managed CF, hence, forest is relatively less degraded despite being located close to the highway. Hill sal forest has diverse type of woody and other tree species.

Riverine Khair-Sissoo forest

This is a pioneer forest that appears on the bank of rivers and along landslide areas (movement or new land) in the sub-tropical zone.



Figure 0-19: Riverine forest in the Trishuli River Valley

This forest exists on both banks of Mahesh Khola and Trishuli River from Naubise until Mugling. The forest represents a sizable distribution in the project area. The species composition of *Acacia catechu* (Khair), *Dalbergia sissoo* (Sissoo) is prominent in this type of forest. Due to the steep slope, majority of this forest is inaccessible.

Mixed forest

Along the alignment many patches are composed of mixed forest, resembling upper mixed hardwood, with species including *Mallatus philipinnes* (Sindure), *Lagerstroemia parvifolia* (Bodhangero), *Schima wallichiana* (Chilaune), *Adina cordifolia* (Karma), *Melia azedarach* (Bakino), *Engelhardia spicata* (Mahuwa), *Castanopsis indica* (Dhale katus) and others. Other species available along the alignment with the Mixed forest type resemble the “Lower Tropical Sal and Mixed Broadleaved Forests” has been listed in **Annex 2**.

***Pinus roxburghii* forest**

This forest of native pine is distributed along the alignment in Dhading district only. This is a plantation forest found in Nishakot VDC of Dhading district. Some scattered plantations of the species (not blocks) can be observed from Kathmandu (Nagdhunga) until Naubise in the existing alignment, providing substantial living conditions for wildlife typical in coniferous forests. Main species of this plantation forest is *Pinus roxburghii*; some *Alnus nepalensis* is also found along the fringes in the lower part where the location is moist comparatively.



Figure 0-20: Pine forest in NNM section.

4.2.3 Types of Forest by Ownerships and Area Being Affected

On the basis of ownership, there are three types of forests in the project area. These are government managed forests (GF), community forests (CF) and leasehold forest (LHF).

- i. Government Managed Forest:** There are altogether 7 patches of GFs being traversed by the proposed construction/improvement. The GFs occur mostly on the steep slopes and they are degraded due to high demand of fuel wood and timber by the people and in the result of weak governance.
- ii. Community Forest:** The forest area those traversed by the alignment largely are community-managed forests. These forests are both natural and planted. Only 2 CFs are found in Nagdhunga-Naubise section and 26 in Naubise-Mugling Section (Table 0-16).
- iii. Leasehold Forest:** These are largely degraded forest land, leased to groups of 5-10 households (poor household hamlets), for income generating activities. Government has a focus of subsisting the livelihood of the poor people through this approach of forest management to rehabilitate the degraded forest or prevent the degradation of forests. The area is leased for a specified period. Within the project alignment, there are 7 LHF with the affected length of 1.55 km and area of 4.54 ha as shown in Table 0-16. Among these only Madan Pakha LHF, Dhading district has 22 poles.

From all the three differently managed Forest management regimes, 52 trees and 2,253 poles of 24 different species of trees will need to be cleared.

4.2.4 Estimated Number of Trees Along the Road Alignment

During the improvement of the highway, trees, poles and shrub will be removed. The project will apply the mitigation hierarchy to avoid, minimize, mitigate and compensate of damage to forest and trees needing to be cut.

There are very few scattered poles available, and they are found in Madanpakha LHF only. On the other hand, these LHF were densely grown by seedlings and saplings. In Madanpakha LHF, a total of 22 tree species, including Khair and Sindure, were found. LHF is degraded forest area as the principle of the government is to lease degraded forests. However, other LHF have few saplings of Sal, Khair, Kyamun, etc. and fruit trees and cash crops including Mango, Banana, Lemon, Pineapple, Bamboo, Cassia, Guava, etc.

Table 0-16: Impact of NNM on forest, trees, wood volume, biomass and carbon¹²

SN	Forests under different management options	Linear cut and field distance (m)	Affected number of trees, wood volume, biomass and Carbon						
			Forest area (ha)	Number of Trees			Wood volume (m3)	Total biomass (ton)	Carbon (ton)
				Trees	Poles	Total			
Nagdhunga-Naubise									
1	Near Subbako Ban - GF	600	0.043	1	16	17	2	2.6	1.46
2	Near Patle Ban CF - GF	50	0.024	1	9	10	1.12	1.46	0.81
3	Naubise area - GF	300	0.033	1	13	14	1.56	2.03	1.13
	Sub-Total	950	0.1	3	38	41	4.68	6.09	3.4
Naubise Mugling									
4	Satiko Ban - CF	200	0.037	1	47	48	5.55	8.32	5.37
5	Bhasme – CF	200	0.024	0	9	9	0.17	0.26	0.17
6	Setidevi – CF	750	0.254	3	101	104	8.64	12.96	8.36
7	Thulodanda – CF	550	0.093	0	16	16	4.57	6.85	4.42
8	Balkumari – CF	800	0.134	0	235	235	12.6	18.91	12.2
9.	Sutkeri Dhunga - CF	250	0.181	0	68	68	4.81	7.22	4.66
10.	Chiraudi – CF	100	0.012	0	4	4	0.17	0.25	0.16
11.	Indrayani – CF	400	0.036	3	42	45	3.76	5.64	3.64
12.	Gauri Bhanjyang - CF	350	0.037	7	49	56	13.69	20.54	13.26
13.	Indradevi – CF	200	0.082	0	92	92	4.16	6.24	4.03
14.	Panchakanya – CF	600	0.086	1	71	72	5.94	8.91	5.75
15	Amaltari – CF	100	0.021	1	15	16	1.27	1.9	1.23
16	Mahadev Kholsi - CF	100	0.016	0	0	0	0	0	0
17	Kankali – CF	400	0.057	0	31	31	3.34	5.01	3.23
18	Kashi Khola – CF	650	0.148	2	83	85	9.95	14.93	9.64
19	Phale Pakha – CF	500	0.084	4	89	93	9.56	14.35	9.26
20	Gomati Bhairab - CF	400	0.062	5	57	62	13.35	20.03	12.92

¹²The dimensions stated by Govt. of Nepal are diameter of breast height (DBH) 10cm and above. Technically, DBH 10-30 is pole and above 30 is tree. There are more poles (92%) in GoN categorized trees (Tamrakar 1999)

SN	Forests under different management options	Linear cut and field distance (m)	Affected number of trees, wood volume, biomass and Carbon						
			Forest area (ha)	Number of Trees			Wood volume (m3)	Total biomass (ton)	Carbon (ton)
				Trees	Poles	Total			
21	Bishal Samjhauta – CF	900	0.189	5	101	106	12.54	18.82	12.14
22	Jabang Mauwa Khola - CF	929	0.139	0	70	70	3.09	4.64	3
23	Jaldevi - CF	2800	0.856	0	535	535	24.58	36.88	23.8
24	Bharyang Pakha - CF	550	0.164	0	0	0	0	0	0
25	Tapre - CF	500	0.156	12	109	121	19.64	29.47	19.02
26	Galbagdi - CF	350	0.064	0	16	16	1.29	1.94	1.25
27	Chepang - CF	1100	0.161	0	132	132	14.19	21.29	13.74
28	Dharapani - CF	800	0.312	0	129	129	12.72	19.1	12.32
29	Sirudanda - CF	550	0.165	0	64	64	3.89	5.84	3.77
30	Before Majhimitar – GF	400	0.058	2	22	24	2.72	3.53	1.97
31	Near Benighat – GF	800	0.078	2	30	32	3.64	4.73	2.65
32	At Pida – GF	1900	0.023	1	9	10	1.06	1.37	0.77
33	Near Malekhu – GF	500	0.014	0	5	5	0.63	0.82	0.46
34	Jana bhabana – LHF	30	0.01	0	0	0	0	0	0
35	Madan Pakha - LHF	300	0.046	0	22	22	2.02	2.62	1.47
36	Kumbogaira - LHF	950	0.023	0	0	0	0	0	0
37	Simle Gaira - LHF	320	0.023	0	0	0	0	0	0
38	Dhap Pakha - LHF	80	0.032	0	0	0	0	0	0
39	Bombay Aanp - LHF	300	0.032	0	0	0	0	0	0
	Total	20,609	3.91	52	2253	2302	203.54	303.37	194.66

Source: Field survey, 2017

4.2.5 Wood Volume, Biomass, and Carbon Conversion of the Trees Affected in the Project Area

Biomass and carbon were calculated for felled trees from community managed, government managed and Leasehold forests. Total biomass that will be harvested during the construction and upgrading of the NNM is 303.37 tons. Carbon Sequestered in the wood biomass is 194.66 tons. Wood/timber volume of the trees 203.54 m³.

4.2.6 Tree Species Diversity in CF

The most affected tree species are Sal (*Shorea robusta*) and Khair (*Acacia catechu*). Forest inventory enumerated that, of the total species composition, 47% was Sal and 22% was Khair.

4.2.7 Tree Species Diversity in Leasehold Forest

In case of LHF, only few scattered trees and poles are available (only in Madanpakha LHF), however, these forests are densely populated with seedlings and saplings.

4.2.7.1 Tree Species diversity in Government forest

The Government forest patches found in alignment is also degraded because of over exploitation of the resources, the number of tree species is big and consisted by 2-5 species such as Khair (*Acacia catechu*), Sindure (*Mallatus philipinus*), Utis (*Alnus nepalensis*) and Chilaune (*Schima wallichii*). Tree and pole species estimated to be felled in the government forest is presented in the Annex. There are 98 species of woody vegetation recorded in regeneration category of the project area forests.

4.2.7.2 Protected, Rare or Endangered Species

Khair (*Acacia catechu*) and Sal (*Shorea robusta*) are the two species found in the area which are under the protected species category and *Dalbergia sissoo* under CITES Appendix II (Table 0-17).

Table 0-17: List of Protected, Rare or Endangered Plant species

SN	Local Name	Latin name	Protection Status				Remarks
			GoN	CITES status	IUCN status	NRBD	
1.	Khair	<i>Acacia catechu</i>	P		T		
2.	Sal	<i>Shorea robusta</i>	P				
3.	Sissoo	<i>Dalbergia sissoo</i>		II			

Legend: P= protected by GoN: Government of Nepal, NPWC Act: National Park and wild life conservation Act, CITES Appendix II: Not yet threatened but could become endangered, if trade is not controlled, IUCN – International Union for Conservation Nature; E=Endangered, V=Vulnerable, R=Rare, I=Intermediate, insufficiently known=Threatened, NRDB= National Red Data Book

4.2.8 Fauna in the Project Area

4.2.8.1 Mammal species in the project area

Due to the long history of disturbance and exploitation of the vegetated area and increase in human population along the existing NNM section of highway, no wildlife habitats are found within the existing ROW. As confirmed by survey and reported by the locals and forest user groups and other secondary sources, 16 mammals were recorded, although some of them – mongoose, marten and squirrel – were not identified even to the species level (Table 4-18). The forest area along NNM section is severely fragmented by human settlements and agricultural lands. Therefore, there is no sufficient habitat for large mammals near the road, and special biodiversity management plan is not needed. There were no any wildlife movement corridors found in the project area, because of forest fragmentation and disturbances due to heavy traffic, increased human settlements and activities along the highway and most part of mammal species occurs in the IIZ on the certain safe distance from NNM. The road crosses hilly area with steep slopes and deep gorges, serving as habitats for listed mammal species. There is one species that is considered critically endangered- Chinese pangolin (*Manis pentadactyla*), but adverse impacts are not expected on the species due to the minimal vegetation clearing scattered within the ROW.

Table 0-18: Global and national status of Mammal species reported in the ZOI of the road

No	Species Name	Occurrence	Status	
			IUCN	Nepal
1	Chinese Pangolin – <i>Manis pentadactyla</i>	+ (NN)	CR	CR
2	Common Leopard – <i>Panthera pardus</i>	+ (NM)	VU	VU
3	Jungle cat - <i>Felis chaus</i>	+ (NM)	LC	VU
4	Leopard Cat - <i>Prionailurus bengalensis</i>	+ (NaM)	LC	VU
5	Bengal fox - <i>Vulpes bengalensis</i>	+ (NM)	LC	VU
6	Golden Jackal - <i>Canis aureus</i>	+ (NM)	LC	LC
7	Grey Wolf - <i>Canis lupus</i>	+ (NaM)	LC	VU
8	Mongoose- <i>Herpestes spp</i>	+ (NM)	LC	LC
9	Marten – <i>Martes spp.</i>	+ (NaM)		
10	Rhesus Monkey - <i>Macaca mulatta</i>	+ (NM)	LC	LC
11	Terai Gray Langur – <i>Semnopithecus hector</i>	+ (NaM)	NT	LC
12	Indian Porcupine - <i>Hystrix indica</i>	+ (NM)	LC	LC
13	Squirrel - <i>Funambulus spp.</i>	+ (NN)		
14	Himalayan Goral – <i>Naemorhedus goral</i>	+ (NaM)	NT	NT
15	Wild Boar – <i>Sus scrofa</i>	+ (NN)	LC	LC
16	Barking Deer - <i>Muntiacus vaginalis</i>	+ (NM)	LC	VU

Source: Field Survey, 2016/17

Legend: Species classification is done in accordance with IUCN categories and criteria: LC – Least Concern, VU – Vulnerable, EN- Endangered, CR - Critically Endangered, NT – Near Threatened. Areas: NN – Nagdhunga – Naubise Section, NaM – Naubise – Mugling Section; NM – Nagdhunga – Mugling Section.

Main threats to the listed mammal species in the project area are poaching or illegal hunting and persecution. According to observations as well as reports of local people and DFO officers, two monkey species can be often observed near the road, because they attracted by solid waste and look for food near the roads. Other species are mostly avoiding road.



Figure 0-21: Highly disturbed and fragmented landscape along NNM road; monkey attracted to road

4.2.8.2 Avian Fauna in the project area

Altogether, 276 species of birds have been recorded along the ZOI of NNM road alignments, of which, 134 species were recorded during current survey and other species with the help of literature reviews and personal communications with bird experts who have been doing regular bird watching in the area.

Of total recorded species, more than two third species were resident, while summer and winter visitors were presented by a smaller number of species. Based on literature review, 63% birds, probably, breed along the adjacent areas of the highway; few nests (12) were also observed along the highway during the survey period. Forest dwelling birds represented 73.9%, wetland birds encompassed 15.21%; other groups were presented by few species. Several globally and/or nationally threatened bird species were recorded during survey, but mostly during migration or wintering. Details of birds found in the project area is presented in **Annex 2.11**.

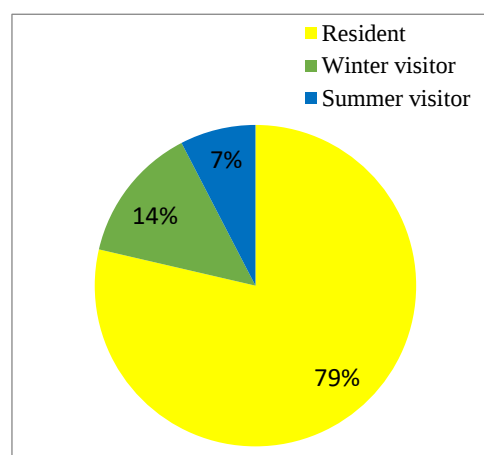


Figure 0-22: Migration status of birds found along road alignments

Birds along Nagdhunga to Naubise

In this section, 16 bird species, included in IUCN Red List and nationally protected were recorded. However, 5 of them are associated with wetlands and occur along rivers and water-streams. They will not be affected by project directly, but can be affected during construction of bridges. So, the bridge construction may be recommended to be taken after breeding season (from June up to winter). There were observed also 8 bird of prey and vulture species, which occurs in various habitats (but mostly in cliffs near mountain peaks) and can be found near the road during migration or flying over, usually in the high sky. Some of these vultures are also attracted to crematoria and can be spotted nearby to such places. *They will not be affected by road upgrading.* Other species – 2 owls and prinia – can breed in surrounding forests and gardens along the road.



Figure 0-23: Globally threatened Steppe Eagle stopped for night in the woods near the road during migration in April (left); Common Myna – one of the most abundant species along the road, inhabiting human settlements (right).

The most common birds, found along these road alignments, were represented by species adapted to live in highly altered anthropogenic landscapes. These are “urban” species like a Rock Pigeon, Oriental Turtle Dove, Black Kite, House Crow, Large-billed Crow, Black Drongo, Barn Swallow, Red-vented Bulbul, Oriental Magpie Robin, Common Myna, House Sparrow, White-rumped Munia, Cattle Egret, Indian Pond Heron, etc. Many species of birds are also observed in orchards or small forest patches or near rivers along the road including such species as the Great Barbet, Blue-throated Barbet, Long-tailed Shrike, Blue Whistling Thrush, Grey-headed Canary Flycatcher, Black-lored Tit, Himalayan Bulbul, Spotted Forktail, Oriental White-eye, Common Tailorbird, Grey-hooded Warbler, Slaty-backed Forktail, Grey Wagtail, White-browed Wagtail, etc. Several other species such as Kalij Pheasant, Spotted Owlet, Steppe Eagle, and Himalayan Griffon were also common in the area. Habitat for Steppe Eagle and Himalayan Vulture was found at about 500m down towards Naubise from Nagdhunga (Near Piplamode).

Birds along Naubise - Mugling Road

This road section runs along Trishuli River and passes through the settlements, followed by forests with other tributaries like Budigandaki, small streams and rivers joining the Trishuli. Forest is composed by mature and intact trees, which lie along the Trishuli gorge mainly from Malekhu to Charaudi in Naubise-Mugling section, as well as forests on the side of the Phisling are important habitats for forest species including vultures and eagles.

Trishuli itself is important habitat for migratory and resident wetland species. As in the previous section, the birds found may be mostly categorized as “urban” and “edge” generalist species: Great Barbet, Blue-throated Barbet, Rock Pigeon, Oriental Turtle Dove, Black Kite, Long-tailed Shrike, Rufous Treepie, House Crow, Large-billed Crow, Black Drongo, Grey-headed Canary Flycatcher, Oriental Magpie Robin, Pied Bushchat, Common Myna, Black-lored Tit, Barn Swallow, Red-vented Bulbul, Himalayan Bulbul, Oriental White-eye,



Figure 0-24: Black Kite is one of the most common scavengers, found near the road

Common Tailorbird, Grey-hooded Warbler, Grey-breasted Prinia, Purple Sunbird, House Sparrow, White-rumped Munia, Crested Bunting, etc. At the same time, certain number of wetland bird species also was recorded closely to rivers and streams: the Common Pochard, Mallard, Common Kingfisher, Blue Whistling Thrush, White Wagtail, White-browed Wagtail, Common Sandpiper, River Lapwing, Cattle Egret, Indian Pond Heron, etc. The Ibisbill, Great Cormorant, Woolly-necked Stork etc. migrate through the Trishuli River gorge. There were also found such species as Kalij Pheasant, Red Jungle Fowl, Plum-headed Parakeet, Spotted Owlet, Steppe Eagle, indicating the presence quite good forest habitats along the alignments. *However, the upgrading of the road will not affect the habitat of the birds reported. Also, the critical habitat screening indicated that the global population of two critically endangered bird species (*Gyps bengalensis* [White-rumped vulture] and *Sarcogyps calvus* [Red-headed vulture] and three endangered bird species (*Aquila nepalensis* [Steppe eagle], *Neophron percnopterus**

[Egyptian vulture] and *Sterna acuticauda* [Black-bellied tern] will not be affected by the project as the project area is too small and there will be minimal clearing, land acquisition and disturbance to natural habitats for birds, which usually inhabit in natural landscapes on the distance from roads.

4.2.9 Herpetofauna and Aquatic Fauna

Fish diversity of the study area was mostly cited from the literature. However, fish diversity may have changed significantly since most studies were carried more than a decade before. Also, the area is under severe influence of mining and excavation for construction materials along with plying of automobiles through springs/ channels for transportation of construction materials, polluting water and destroying fish habitats (**Annex 2.12**).

4.2.9.1 Herpetofauna and Aquatic fauna along Nagdhunga-Naubise Section

This section of road has five streams with alder as the dominant vegetation. Majority of streams



Figure 4-17: Himalayan Agama is a lizard species found in the road alignment

have unconstrained channel with open valley form. This section starts from Kathmandu valley; thus, it has higher influence of human activities and urbanization. Among five springs present in this section: Jhyaple Khola, Sisne Khola and Khatripauwa Khola were dry during the survey time in December 2016. This means that these springs are intermittent type. Jhyaple Khola and Sisne Khola is more as a drainage and filled with wastes, while Khatripauwa khola was under mining of gravel. Unlike these springs, Sikre Khola and Khani Khola is wet with low water flow, but these springs too filled with waste. Hence, no sign of fish in all the springs in this section. However, local residents informed presence of frog and they have occasionally seen rat snake in the springs and in the periphery (i.e. within 2 Km alongside the existing highway).

4.2.9.2 Herpetofauna and Aquatic fauna along Naubise-Mugling Section

The existing road runs along the Mahesh Khola from Naubise to Galchi, where the Mahesh



Figure 0-25: Fish harvest from the Trishuli River

Khola meets the Trishuli River. Among many tributaries of Mahesh khola flowing across the existing road from Naubise to Galchi, survey of five feeder rivers (i.e. Naubise Khola, Junga Khola, Agra Khola, Kheste Khola, Dangdunge Khola) showed that the rivers were running with low flow contributing less than 30 percent of total flow of Mahesh Khola. Naubise Khola, Junge Khola and Agra Khola are under human influence. Dumping of waste in the banks of Naubise Khola and Junga Khola is highly polluting water, while vehicles transporting sand and gravel mined at the upstream

of Agra Khola plying through the river course is increasing the turbidity and significantly affecting the aquatic fauna.

Polluted and turbid water from these tributaries pollute Mahesh Khola. In addition, numerous sand refining activity and crushers are operating along the Mahesh Khola further polluting the river. Its effect can be seen in the Trishuli river as well. Locals reported collecting some common fish species such as Barna baril (*Barilus barna*), Ring loach (*Schisturea sovana*) and Barb (*Punctius sp.*) in the monsoon. Along with these fish species, the Copper Mahseer (*Nelissochilus hexagonolepis*) in Dangdunge Khola is collected from 700 meters upstream. The list of fish species that can occur in the rivers, compiled on the literature sources, is presented in the Annex.

Majority of streams that flow intersecting existing highway are small, intermittent and were dry during the survey time. However, thirteen streams such as Chiraudi Khola, Belkhu Khola, Galaudi Khola, Soti Khola, Malekhu Khola, Kadam Khola, Khatauti Khola, Chiraudi Khola, Hugdi Khola, Mauwa Khola, Chum Khola, Kum Khola and Nagdi Khola were flowing and studied in detail. Water flow in all stream during the survey time was very low contributing less than 15 percent comparing with total flow in the Trishuli River at confluence point.

During the field survey, Skittering Frog (*Euphlyctis cynoplyctis*) and Barna baril (*Barilius barna*) were observed near the confluence of Belkhu Khola with Trishuli River, which on distance at 500 m from the road. Putitor Mahseer (*Tor putitora*) categorized as an endangered fish species, noted from the Trishuli River that is at 200 m distance from the existing road at this site.

Sand cleaning machines are in operation in Galaudi Khola riverbank. No fishes were recorded in this khola at the time of survey and similar case was found with Soti Khola. Moreover, this Khola is very small with very low flow. Hamilton's Barila (*Barilius bendelisis*) was recorded from Malekhu Khola. Fish species such as; Golden Snowtrout (*Schizothorax plagiostomus*), Gangetic Laita (*Crossocheilus latius latius*), Annandale Garra (*Garra annandalei*), Gotyla (*Garra Gotyla gotyla*), Asiatic Snakehead (*Channa orientalis*) were reported in Kadam Khola and Trishuli River at Malinga. No aquatic fauna was found in Kum Khola during the survey time as it had significantly low flow (almost dry).

Golden Snowtrout (*Schizothorax plagiostomus*), Gangetic Laita (*Crossocheilus latius latius*), Annandale Garra (*Garra annandalei*), Gotyla (*Garra Gotyla gotyla*), Asiatic Snakehead (*Channa orientalis*), Bata labeo (*Labeo bata*), Ring Loach (*Schistura sovana*) and Copper Mahseer (*Neolissochilus hexagonolepis*) are some fish species found in the Trishuli River. Moreover, River Rohu (*Labeo dero*), Stinging catfish (*Heteropneusteus fossilis*), Striated or Banded Snakehead (*Channa striatus*), Longfin Freshwater eel (*Anguilla bengalensis*) are some other fish species present in the river, added in the list by the local resident during social survey. The Golden Monitor Lizard (*Varanus flavescens*) was detected in Naubise – Mugling section during survey of mammals. Two other lizard species Common Garden Lizard (*Calotes versicolor*) and Himalayan Agama (*Paralaudakia himalayana*) were spotted by project team members during visit of the area. As the area is already under huge anthropogenic pressure, the road upgrading works will have no significant impact on the aquatic fauna.

4.2.9.3 Status of Herpetofauna, Fish and Macroinvertebrates

Seasonal study is required for detailed information on fish and herpetofauna diversity. However, the study of species diversity of the area was based on the relevant literatures. Shrestha, T.K. (1990) has recorded 34 fish species from the Trishuli River. Dhital, R.R. and Jha, D.K., (2002) collected fourteen species of fishes from Trishuli River at Kuringhat and Trishuli-Marsyangdi confluence at Mugling during their study of Fish fauna of the Narayani River system and their impact on the fishermen community in Chitwan, Nepal.

Table 0-19: : Herpetofauna Species Observed During the Field Survey

S N	Species	Common Name	Local Name	Family	Status (Nepal, IUCN)	Remarks
Amphibia						
1	<i>Duttaphrynus melanostictus</i> (Schneider, 1799)	Black-spined toad/ Common Asian toad	Khasre bhyaguto	Bufonidae	Most common toad; LC	Photo evidence
2	<i>Euphlyctis cynoplyctis</i> (Schneider, 1799)	Skittering frog	Dholbaje paha/Tik-tike paha	Ranidae	Common frog; LC	Photo evidence
Reptiles						
1	<i>Calotes versicolor</i> (Daudin, 1802)	Common garden lizard	Chheparo	Agamidae	Most common lizard; LC	Photo evidence
2	<i>Paralaudakia himalayana</i>	Himalayan agama		Agamidae	Very common; LC	Photo evidence
3	<i>Mabuya carinata</i> (Schneider, 1801)	Brahminy skink/Common Indian skink	Bhanemungro	Scincidae	Very common; LC	Photo evidence
4	<i>Varanus flavescens</i>	Golden Monitor Lizard/ Bengal Monitor		Varanidae	Rare in Nepal; LC	Observations during mammal survey

Source: Field survey, 2017

Table 0-20: Some Macroinvertebrates of the Study Area

S. N	Species	Common Name	Local Name	Family	Status	Remarks
1	<i>Nepa sp.</i>	Water scorpion	—	Nepidae	—	Photo evidence
2	Dragonfly nymphs		—	Odonata	—	Photo evidence
3	<i>Lymnea sp.</i>		—	Lymnaeidae	—	Photo evidence
4	Water Beetle	Water Beetle	—	Hydrophilidae	—	Photo evidence

Source: Field survey, 2017

Besides three large reptilian species (*Gavialis gangeticus*, *Varanus flavescens*, *Python molurus*), there are no other reptilian and amphibian protected by Government of Nepal. Many species of study area- amphibian, reptile, and fish species are under category of common, least concern and data deficient. Two species of fish (*Tor putitora*, *T. tor*) found in the study are reported as endangered and five species of fish (*Anguilla bengalensis bengalensis* (Gray), *Chagunius chagunio* (Hamilton-Buchanan), *Neolissocheilus hexagonalepis* (McClelland), *Schizothorax plagiostomus* (Heckel), *Schizothoraichthys progastus* (McClelland), are reported as vulnerable.

4.2.10 Protected, Rare or Endangered Flora and Fauna Species in ZOI

Endangered fauna species in the ZOI are represented by 16 globally and nationally threatened bird species, by 5 globally threatened mammal species and by 16 threatened fish species, included in national lists. However, none of these species will be affected by the road upgrading works directly.

Assessment of critical habitat is given in Annex 2.13, 2.14 and 2.15.



Figure 0-26: Himalayan Vulture

Table 0-21: Globally and nationally threatened birds found in the project area

Common Name	Scientific Name	Nepali Name	Road Section	Global Status	National Status	CITES Appendix
Common Pochard	<i>Aythya farina</i>	कैलोटाउके हाँस	NM; BK	VU	NT	-
Black-bellied Tern	<i>Sterna acuticauda</i>	उत्कोशी फ्यालफ्याल	NM	EN	CR	-
Egyptian Vulture	<i>Neophron percnopterus</i>	सेतो गिद्ध	NM; BK	EN	VU	II
White-rumped Vulture	<i>Gyps bengalensis</i>	डगर गिद्ध	NM; BK	CR	CR	II
Red-headed Vulture	<i>Sarcogyps calvus</i>	सुन गिद्ध	NM; BK	CR	EN	II
Greater Spotted Eagle	<i>Aquila clanga</i>	जीवाहार महाचील	NM; BK	VU	VU	II
Steppe Eagle	<i>Aquila nipalensis</i>	गोमायु महाचील	All	EN	LC	II
Asian Woollyneck	<i>Ciconia episcopus</i>	लोभीपापी गरुड	All	VU	NT	-
Grey-crowned Prinia	<i>Prinia cinereocapilla</i>	घेघरी घाँसेफिस्टा	NM	VU	VU	-
Ferruginous Pochard	<i>Aythya nyroca</i>	मालक हाँस	NM; BK	NT	VU	-
Barn Owl	<i>Tyto alba</i>	गोडे लाटोकोसेरा	All	LC	VU	II
Brown Wood Owl	<i>Strix leptogrammica</i>	चशमे उलूक	All	LC	VU	II
Ibisbill	<i>Ibidorhyncha struthersii</i>	तिलहरी चरा	NM; BK	LC	EN	-
Brahminy Kite	<i>Haliastur indus</i>	सेतोटाउके चील	NM	LC	CR	II
Himalayan Griffon	<i>Gyps himalayensis</i>	हिमाली गिद्ध	All	NT	VU	II
Cinereous Vulture	<i>Aegypius monachus</i>	राजगिद्ध	NM; BK	NT	VU	II

Source: Field survey, 2017

Legend: NM-Naubise-Mugling; BK - Benighat Kurintar

LC-Least Concern, NT-Near-threatened, VU-Vulnerable, EN-Endangered and CR-Critically Endangered (Birds in the table occur in forest habitats, in wetlands and along river banks. Some of those species are seasonal migrants, others are resident species, breeding in local forests)

4.3 Socio-economic and Cultural Environment (Baseline)

4.3.1 General Profile of Project Area

Location of Project Area (PA)

The project area covers Kathmandu, Dhading and Chitwan districts. Dhading is adjoining district of Kathmandu and likewise Dhading is adjoining district to Chitwan. The project area is mostly located in hill area. The population density of Kathmandu is 4,416 persons/per square kilometer followed by Chitwan (261 persons/per square kilometer), Dhading (174 persons/per square kilometer). The project area lies in Chandragiri Municipality in Kathmandu; Dhunibeshi municipality and Thakre, Galchhi, Gajuri, and Benighat Rorang rural municipalities in Dhading district and Ichchhakamana rural municipality in Chitwan.

Settlement Pattern

Most existing settlements along the NNM Road alignment are semi-clustered and clustered type.



Figure 0-27: Clustered settlements along existing highway.

The major settlements include Khanikhola, Naubise, Dharke, Mahadevbesi, Galchi, Gajuri, Baireni, Majhimatar, Malekhu, Benighat, Charaudi, Kurintar, Ramailo Danda, and Mugling. Naubise, Dharke, Mahadevbesi, Baireni, Gajuri, Malekhu, Benighat, Charaudi, Kurintar and Mugling are belonging to clustered settlements. The settlement patterns in the project area generally reflect the distribution of arable land and market centers.

Demography

As stated earlier, the project area lies in 1 municipality of Kathmandu; 1 municipality and 4 rural municipalities in Dhading; 1 each RM in Chitwan district. The project municipality in Kathmandu comprises Chandragiri municipality. The municipalities in Dhading district comprise Dhunibeshi municipality, and Thakre, Galchhi, Gajuri and Benighat Rorang rural municipalities. The total number of HHs within DIA of these project municipalities is 3591. The total population within DIA is 16,959 (Males: 8,407 and Females: 8,550).

Caste and Ethnic Groups

The caste and ethnic groups found in project area are Brahmin, Chhetri, Sanyashi, Dalit, Muslims, Madheshi and Janajatis/IPs. The IPs groups are namely Newar, Gurung, Magar, Tamang, Chepeng and Bhujel. The affected population within the DIA is 16,959 (males - 8,407 and females - 8,550). Out of this population, the population of males and females are 9,280 and 9,560 respectively. Out of total HHs within the DIA (3,591), 61.04% HHs belong to Brahmin and Chhetri, followed by Janajatis (32.25%), others (2.67%), Dalits (1.42%), Muslims (0.95%), Sanyasi (0.89%), Chepeng (0.61%) and Madhesi (0.17%). Janajatis (IPs) and Dalits are the

most disadvantaged and vulnerable groups in context of Nepal as a whole and in context of present project area within DIA in particular. Muslims are religious minority groups. Madhesi are Terai/plain dwellers. Both Muslims and Madhesi also belong to deprived and disadvantaged groups. The list of these caste/social groups of project municipalities is presented in the table in **Annex 2.16**.

Religion, Language and Culture

The project area is multi-cultural, multi-ethnic, multi-lingual and multi-religious. Different caste and social groups have their own specific religion, language and culture. The majority of the populations follow Hinduism, followed by Buddhism, Christianity, Islam and others in the DIA. The Nepali language is spoken as an official language by the majority of population in all project municipalities, where the Gurung language in Chitwan district and the Newari in Kathmandu are generally spoken secondarily. Specific ethnic groups like Chepangs, also have their own dialect to speak but in lack of preservation, their traditional language is on the verge of extinction.

The specific caste/social groups have their own cultures based on their religion and traditions. Major festivals celebrated by the common people in the DIA are Dashain and Tihar. However, there are many festivals which are specifically celebrated by specific types of social/caste groups. For instance, Lhosar and Buddha Jayanti are generally celebrated by Buddhist community of Gurungs and Tamangs. Likewise, Maghe & Shawaune skranti, Nepal Sambat, Janaipurnima, Naag Panchami, Buddha Jayanti, Thulo Ekadashi, Holi, Shivaratri etc. other major festivals being celebrated by general people in the project area.

Literacy Rate

The literacy rates of populations of project influenced municipalities within the DIA ranges from 55% to 85%. Amongst the project affected municipalities, the highest literacy rate is in Ichakamana RM (77.4%) and lowest in Gajuri RM (55.5%). The literacy rate of Chandragiri Municipality is in range of 73 to 85 percent. The literacy rate of women is low as compared to men indicating low profile of education of women in the DIA. The literacy rate of the population within DIA of project affected municipalities/rural municipalities is presented in **Annex 2.17**.

Poverty Status of Project Districts

According to Human Development Report of Nepal, the human poverty index (HPI) is 31.1. The HDI values of project affected districts varied indicating variation of poverty level of the project affected districts (Kathmandu, Dhading, and Chitwan). The HPI of Dhading district is 33.4 with HPI rank of 37. Kathmandu district is better due to the capital city of Nepal. The HPI of Kathmandu district is 22.5 with HPI rank of five. The HPI of Chitwan district is 24.8 with HPI rank of seven. Poverty situation of the project districts has been presented in **Annex 2.18**.

Occupational Status in Project Districts and Municipalities

Major occupations being adopted in the project districts include agriculture, animal husbandry, small business and cottage industry including armed forces, managers, professionals, technicians and associated professional, office assistant, service and sale workers, agriculture, forestry and fishery workers, craft related trade workers, plant and machine operators and

assemblers, elementary occupations and others alike. The same implies in the project influenced municipalities and rural municipalities.



Figure 0-28: Bananaproduction along NNM.

Gender of Household Heads in the Project Districts

Gender of household head is looked at the role played by its individuals in providing households' needs. The household affairs can be understood by the types who is heading either by the male or female. The percentage of women heading households in Nepal is 25.73%. The greater percentage of HHs in Chitwan is headed by females (33.7%) followed by Kathmandu (27.8%) and Chitwan (27.09%). The highest proportion of HHs being headed by women in Chitwan district indicates the highest rates of outmigration from the district. The details of women headed HHs of the project district is **Annex 2.19 and 2.22**.

Out Migration Pattern in Project Districts

Migration from hill to Terai and rural area to urban area is a common phenomenon in our country. The main cause of migration to urban area is for seeking the better economic opportunities and social services. For employment, service and education are major purposes of out-migration in the project area. Out of the total HHs in the project districts (641731), 19.48% of them belong to HHs with absentee members. The total numbers of absentees in the project districts is 172,763, of which 79% and 21% belong to males and females respectively. Substantial numbers of people have been migrated from within DIA of project affected M/RMs. The list of absentee HHs and populations is presented in **Annex 2.20**.

Land holding Pattern in the Project Area

The land operational holding is one of the most important variables for assessing the vulnerability and socio-economic condition of any groups and communities. The existing land holding patterns within the DIA of project affected municipalities and rural municipalities are khet (irrigated low land), Bari (unirrigated upland) and grass lands at slope (Kharbari). The low land is mostly used for paddy, wheat and vegetable cultivation and the upland for growing other types of the cereals like maize, millet, somewhere wheat and vegetables. Due to easy access to transport and market facilities along the highway, the main occupation of the local residents are trade and small business rather than agriculture within DIA.

Land Value

There have been significance changes in the values of land properties over few decades in Nepal including the project area. These changes will be further exacerbated by the upgrading of the NNM road alignment. Alongside the land use change will be a corresponding increase in both rental and capital values of landed properties on both sides of the upgraded road along the alignment. The increase in demand for residential and commercial use in turn leads to increase in property values with its positive impact on the local community. The current value of land within DIA at Dharke and Gomati settlement along the NNM road alignment is NRs 12,580 per m².

Agricultural practices

Nepal is an agricultural country having 66% of the population directly engaged in farming. Farming is subsistent in nature and crop is mostly integrated with livestock in Nepal. The same implies in the context of the project area along the NNM road alignment. The cereal crops are mainly grown for meeting the food grain needs of the farming households. In addition, Nepal grows a number of fruit and vegetable crops. The subsistence nature of agriculture is gradually shifting to commercialization. Due to ever increasing demands of fresh vegetables in Kathmandu valley, farmers are oriented towards commercial production and marketing of high value vegetables in the project area. Many other people from outside are also becoming involved in commercial production and marketing of vegetables, mushrooms and others. Fish farming is also being grown along the road alignment. The cropping patterns include: Rice-Vegetables-Rice, Maize-Millet-Wheat, Rice-fallow-rice etc.

Food Sufficiency Level

The food self-sufficiency level of HHs in the project area varies. As revealed by the study, only 13.9% HHs were found to have surplus amount of production of food grains along the road corridor. 9.1%, 10.3%, 13.9%, and 52.3% HHs was found to have food sufficiency gradually for 9-12 months, 6-8 months, 3-5 months and less than 3 months. 0.5% HHs responded of no production. From this analysis, we can conclude that overwhelming majority of the sampled HHs had food deficit problems. The food deficit months in the community was reported to be from February to July the most chronic deficit was revealed to be March and April every year. The reason for food deficit during this period is because this is the dry season. The land remains fallow during the dry season. Farmers cannot produce food in lack of year-round irrigational facilities. Seasonal variations in production and seasonally high food prices are often important contributors to transitory food insecurity of poor HHs in the project area.

Off-farm Activities

Most rural households are involved in agricultural activities as their main source of livelihood; however, they also engage in other income generating activities to augment the main source of income and to cushion the effects of poverty in the project municipalities/rural municipalities along the NNM road alignment. Households are pushed into off-farm sector due to lack of opportunities. Off -farm are supplementary or complimentary activities that farmers engage in either offseason or on-season to support their household affairs. The off-farm income is the sum of rural non-farm income and wage earning in agriculture. On the other hand, off-farm

refers to all income-generating activities except crop and livestock production. The off-farm activities include: seasonal labour, fishing and raffling in Trishuli River, selling agricultural products and goods within DIA along the NNM high way etc.



Figure 0-29: Markets along the road.

Non-Timber Forest Products (NTFPs)

Non-timber forest products (NTFPs) are useful substances, materials and/or commodities obtained from forests which do not require harvesting (logging) trees. NTFPs have their ability to be produced as commodities for rural incomes and markets, as an expression of traditional knowledge or as a livelihood option for rural household needs, and as a key component of sustainable forest management and conservation strategies. Chepangs are forest dependent indigenous peoples residing in forest along the NNM road alignment. They depend on NTFPs for household subsistence, maintenance of cultural and familial traditions, spiritual fulfilment, physical and emotional well-being, house heating and cooking, animal feeding, indigenous medicine and healing, scientific learning, and income. Only this group of people involve in collection and marketing of NTFPs along the road alignment. No other social groups are found involving in NTFPs based micro-enterprises in the project area. Remaining fraction of caste groups also use NTFPs like wood, firewood, roofing materials, fodder, forage and others.

Household income and expenditure patterns

Pensions, wage employment, non-farm enterprises, remittances, house/land rental, agriculture production, and livestock production are the major sources of income in the project area. The main areas of expenditure in project area are on food, housing, clothing, health care, children's schooling, utilities and amenities, agricultural input (including seeds/seedlings, fertilizers, pesticides), and hiring labour during peak production periods. However, household income and expenditure patterns vary among inter caste and social groups. It also varies within the intra caste groups depending on their income sources and expenditure needs.

Cottage and small industries

Nepal is an agricultural country, where there is high unemployment rate, because of the seasonal nature of agriculture. This unemployment problem can be solved by establishing cottage and small-scale industries. Due to the low level of saving, people can't invest a large amount in industries. Thus, in the Nepalese context, cottage and small scale industries are very

important in economic development because: they are easy to establish; they increase access to employment opportunities; they utilize local resources; they are the basis of development of large scale industries; they preserve local culture; and they are the sources of national income. There are some ever increasing numbers of quarry sites, crusher industries, mineral water factory, poultry industries, gas filling factories etc. along the NNM road alignment. The traditional skills of weaving bamboo vessels of certain indigenous peoples like Tamangs and Chepangs are have been completely vanished or on the verge of extinction due to imported goods of plastic goods in the project area.

Market centre and marketing

There is the existence of several market centers at strategic locations along the existing NNM road alignment starting from Naghdhunga to Mugling. The major settlements include: Khanikhola, Naubise, Dharke, Mahadevbesi, Galchi, Gajuri, Baireni, Majhimatar, Malekhu, Benighat, Charaudi, Kurintar, Ramailo Danda, and Mugling etc. with possibility of developing as permanent main business centers in the future. These market centers supply daily commodities to people of its nearby settlements and to the passengers traveling to different places of the country via NNM. The average time to walk to the closest daily market is 15-20 minutes' walk. This is an indicative of easy access to market facilities in the project area. Households are built close to existing road alignment within ROW along the existing NNM alignment. The trend of ribbon development of settlements and market areas along the existing highway is still continued at the immediate ROW of the highway.

Mode of transportation

The major mode of transport for travelling and transporting goods and materials for local residents in the project area along the NNM road alignment are bus, mini/micro bus, truck, motor cycle, cycle, rickshaw and others.

Sources of Energy

Access to electricity facility is the important utility and amenity of the household in terms of household welfare. Electricity facility is available for lighting in proposed project area. 90.1% of households in the have access to electricity. Remaining 4.9%, 2.6%, 0.3% of Households are using Kerosene, Solar, and Bio-gas for electricity facility respectively. About 1.3% percent of households are depending upon other sources for lighting and 0.6% HHs have not stated about usually used for lighting. Majority (63.9%) of households in the project is depending upon LP Gas and 30.6% of HHs depending on wood/firewood for cooking purpose. Minimum 2.5%, and 2.0% HHs depending upon Biogas, and Kerosene use for cooking purpose respectively.

Historical, cultural, religious and aesthetic sites and values

Heritage is anything that is considered important enough to be passed on to the future generations. Significant numbers of cultural structures such as temples and resting place with religious trees (Bar/Pipal Chautaro) occur along the existing highway within a significant distance from the road alignment. All the cultural and religious sites are of public importance. Where local people are worshipping daily considering some as holy deity. Altogether, there 3 temples along the road alignment which will be affected and will require relocation and

rehabilitation. These temples are being located at 12+300 and 44+050 chainages. During consultations, that it was understood that these temples are newly built by households living along the ROW, and do not hold significant or important agricultural value. There are otherwise no historically, religiously or archaeological important cultural heritage which will be affected along the NNM road alignment.

Tourism

Tourism in Nepal holds great potential to establish itself as a means of significant economic activity. Numbers of tourism-based businesses like Hotels, Cottages, Home stays etc. are being conducted by local and by outsiders at different settlements along the NNM road alignment. Water sports (Rafting in Trishuli River), Hiking & Tracking/mountaineering, Manakamana temple & Cable car, Chitwan national park, Cultural programs etc. are the centers of attractions for promoting tourism in the project affected districts.



Figure 0-30: Pilgrimage and touristic places along NNM

Potential economic activities

The potential economic activities along the NNM road alignment include: bricks/tiles production, handmade paper manufacturing, handicraft production, construction materials production, food processing, vegetable farming, livestock farming, dairy production, hotel/lodge enterprises, water adventure (rafting), and conduction of home stays, poultry farming, mushroom cultivation, beekeeping and so forth.

Gender and GBV situation in the Project area

Nepal has a high incidence of GBV with mostly women as victims. Out of the 15 most GBV prevalent countries in the world, Nepal ranks 4th in domestic violence and violence by a partner.¹³ The current status of gender inequality and gender-based violence in Nepal reveals the serious need to mainstream gender sensitivity and GBV risk mitigation measures at all organization levels and all phases of project cycle. In Nepal, GBV is prevalent due to unequal gender relations and discrimination towards women in both public and private sphere. It has direct implications on the reproductive health status of women and physical, emotional, and mental health of their children.

¹³<http://nwchelpine.gov.np>

The World Bank's Good Practice Note (GPN) helps in identifying, assessing and managing the risks of GBV that involves major civil works.¹⁴ The GPN states that the labor influx could possibly have adverse social and environmental effects leading to changes in community dynamics as well as increase the risk factors of GBV. The Project's GBV risk assessment carried out in August 2019 is measured to be "Moderate". However, because NNM and KDP are the two major strategic highways with regional connectivity and trade, the social team decided to carry out an additional GBV mapping of the area to validate and triangulate the risk of GBV through identifying GBV typology, existing mechanism and utilization of services as well as to have a broader purview of the situation where large infrastructure projects and major civil works could incur GBV.

The GBV mapping research found that both the project areas had existing high volumes and various forms of GBV; lack of well-defined and coordinated response mechanism with potential GBV risk associated with labour influx. Therefore, the research suggests a 'substantial' level of GBV risk in the SRCTIP. Furthermore, the lack of institutional and infrastructural capacity of the GBV service provider increases the inefficient response to GBV survivors.

Public and private services

The available public services in the project area include government services provided by the sector line agencies and local government bodies. The private services include the services being provided by the NGOs, private sectors and others. Both types of services are being availed in the project area.

Workforce and employment

There are ever increasing trends of outmigration of workforce in lack of local employment opportunities. The opportunities at the local level is very limited as a result, a larger section of the population is moving outside the project area. It seems inevitable to stop the out-migrating labour-force thereby creating ample opportunities at the local level.

Infrastructure

Infrastructure such as electric poles, water supply pipelines, road tracks, irrigation canals etc. situated within the direct impact zone are presented in the following tables. The list of existing tracks along the existing highway is presented in the **Annex 2.29**.

Table 0-22: Electric Poles within the direct impact zone (in Nos.)

Road Section	Chainage	Type of Poles			Total
		Metal	Wooden	Cement	
Improvement of Existing Nagdhunga – Mugling Road					
Nagdhunga - Naubise	0+000~ 12+200	35	6	41	82
Naubise - Baireni	0+000~24+200	250	35	35	320
Baireni – Bishaltar	24+200~3+000	300	41	62	403
Bishaltar - Mugling	53+000~82+000	305	8	43	356
Total		890	90	181	1161

Source: Field Survey, 2017

¹⁴ <http://documents.worldbank.org/curated/en/399881538336159607/Environment-and-Social-Framework-ESF-Good-Practice-Note-on-Gender-based-Violence-English.pdf>

Table 0-23: Water Supply Pipe Lines existing within the direct impact zone (in km)

Road Section	Chainage	1" Dia. Pipe		0.5" Dia. Pipe		1.5" Dia. Pipe		2" Dia. Pipe	
		GI	PVC	GI	PVC	GI	PVC	GI	PVC
Nagdhunga - Naubise	0+000~12+200	0.09	4.7	-	2.0	-	1.5	-	-
Naubise – Baireni	0+000~24+200	0.55	11.0	-	-	-	-	-	1.8
Baireni – Bishaltar	24+200~3+000	-	8	-	-	-	0.8	-	1.5
Bishaltar– Mugling	53+000~82+000	-	11	-	-	-	-	-	2.32
Total		0.64	34.7	-	2.0		2.3		5.62

Source: Field Survey, 2017

4.3.2 Profile of Project Affected People

Project Affected HHs

In total, 78 households will be affected by the NNM Road improvement works. Out of total affected households (78), 52.36 percent belong to Brahmins followed by Janajati (34.62%), Chhetri (7.69%), Dalits (2.56%) and Muslims religious minority groups (2.56%). They are likely to be affected by losing private land and structures. Out of total affected HHs, Dalits and Janajatis are more likely to be affected by the project because they will lose their means of living. Among the surveyed project affected HHs, 84.1% HHs are being headed by males and remaining 15.9% are being headed by females. The percentage of HHs being headed by females among the project affected surveyed HHs within ROW along the NNM road is less than the national average of 25.73% (National Housing and Population Census 2011) indicating deprived situation of women. The project affected HHs by caste/ethnic groups is presented in **Annex 2.16**.

Demographics of project affected surveyed households

Out of the impacted population, 52.8% and 47.2% are males and females respectively. Surprisingly, the female population of the affected surveyed HHs was less than males and the national figure of 51%. The average size of households of the project affected surveyed households is 5.3, greater than the national average of 4.8. The greater family size within the ROW along the NNM road indicating prevalence of poverty and greater proportion of dependent populations.

Caste and ethnic composition of project affected surveyed HHs

Out of total project affected surveyed households, 39.7% belong to Brahmins followed by Chhetri (12.7%), Magar (9.5%), Newar (7.9%), Gurung (6.3%), Chepang (6.3%), Gharti (4.8%), Dalits (3.2%), Tamang (3.2%), Sanyasi (3.2%), and Muslim (3.2%). The caste and ethnic composition of project affected surveyed households is presented in **Annex 2.24**. Out of total project affected surveyed households, 55.56% households belong to non-vulnerable¹⁵

¹⁵ Non-vulnerable: Brahmins, Chhetri and Sanyasi considered non-vulnerable communities in the context of NNM project context.

followed by indigenous peoples (38.10%) and vulnerable communities¹⁶ (6.35%). The distribution of project affected surveyed HHs by IPs and VCs is presented in **Annex 2.25**.

Education and Literacy

The total project affected surveyed population is 335. Out of this, 23 persons are below school age. Excluding the below school age children, the above 5-years population is 312. Out of this 5 years above population of the project affected surveyed households (312), the educational status of 28.8% population had an educational status of 6-10 Class followed by literate to class 5 (25.6%), SLC -12 Class (16%), graduate and above (15.4%) and illiterate (14.1%) indicating varying degree of educational status of the project affected surveyed population within DIA (300 m road corridor or 150m on either sides of the road from the central line) along the NNM road alignment. Educational status of school going age and above population of project affected surveyed households is given in **Annex 2.26**

Occupational Status

Among the economically active population of the project affected surveyed households (218), overwhelming majority of them are engaged in trade (40.4%) followed by housewives (16.5%), others (11.9%), labour (10.6%), agriculture (7.8%), foreign job (7.8%), and service (5.0%) along the NNM road alignment. The largest fraction of the economically active population engaging in trade is due to trade related opportunities along the highway. More than 10% percent of them were found engaging in labour works indicating easy availability of construction workers at local levels in course of upgrading and constructing the NNM road. The occupational status of the project affected and surveyed economically active population within DIA along the NNM road alignment is presented in **Annex 2.27**.

Households Income

The average annual HH income of the project affected HH is NRs. 589,416 whereas the per capita income is 106,191. The details of HH incomes of the project affected surveyed HHs is presented in **Annex 2.28**.

Identification of vulnerable and disadvantaged groups, communities and individuals

Vulnerable groups are those who experience a higher risk of poverty and social exclusion than the general population. Dalits, ethnic minorities, women headed households, below poverty level income households and aged member households are categorized under vulnerable. 10 households were revealed to fall under vulnerable groups with DIA along the NNM road alignment. Out of total vulnerable HHs identified, 4 belong to Chepangs, 3 Brahmins, 2 Dalits and 1 Chhetri households. Likewise, out of these vulnerable HHs (10), 4 HHs are being headed by women and 4 and 2 households belong to IPs and Dalit categories respectively.

Vulnerability of Project Affected Families

Vulnerability have long been recognized that some people are more likely to be impacted adversely by construction works than others and least able to react effectively. The causes of

¹⁶ Dalits and Muslims, the religious minority group considered as vulnerable communities (VCs) in the context of NNM project context.

vulnerabilities might be physical, social, political, demographic, economic, environmental and attitudinal. The vulnerability of IPs and VCs within ROW along the NNM road alignment is attributed to loss of private property like housing structures, falling to deprived and disadvantaged groups like IPs and Dalits category and households being headed by women counterparts along the NNM road alignment

4.3.3 Indigenous Peoples in the project area

There are six IP communities, namely Newar, Gurung, Magar, Tamang, Chepang and Bhujel, which are living in the project area. However, these groups are all outside the RoW where the project interventions will take place. The project will not cause any direct adverse impact to their land, will not cause any relocation of IPs from land they customary use or occupied and will not cause negative impacts to their cultural heritage.

Chapter 5: Stakeholder Engagement and Public Consultations

5.1 Introduction

Stakeholder engagement is an inclusive process, conducted throughout the project lifecycle. ESS10 of the ESF recognizes different stakeholders, where engagement is done in all different phases of project intervention (from design through to implementation) in a timeframe, which enables meaningful consultations with stakeholders, in a manner that provides stakeholders with opportunities to express their views on project risks, impacts, and mitigation measures to consider and respond to them. As per ESS10, three major types of stakeholders are, affected parties, other interested parties and disadvantages/vulnerable individuals or groups.

The major thrusts of public consultation were for information disclosures, enhancing engagement and participation of relevant stakeholders in identification and mitigation of environmental and social risks and impacts, seeking commitments from the affected communities and stakeholders to engage and support the project activities; grievance redress and others. Various issues were raised in the public consultations by the respective communities and by the relevant stakeholders.

5.1.1 Mapping of Stakeholders

The potential stakeholders of the NNM Road improvement works have been identified by the stakeholder mapping. In addition to project-affected parties, key identified stakeholders include: local governments (of 2 M & 5 RM), local NGOs, civil society, teachers, political leaders, women groups, local entrepreneurs led by women groups, vulnerable and IPs, differently-abled people and marginalized groups, local business groups and suppliers (such as United cement, Kepy Cement, Gas bottling plant and Stone crusher plants etc.) local user groups (forest, water, irrigation etc.), local journalists, security personnel (traffic police and army), travel agency, drivers and road users (travelling passengers).



Figure 0-1: Consultant team meeting and stakeholder interview

5.1.2 Affected Parties

Project Affected Families (PAFs) or Project Affected Persons (PAPs); project-affected vulnerable households (both last groups include HHs losing private residence and residence & trade opportunities along NNM road); indigenous Peoples (IPs) and their organizations and

networks; marginalized communities (Dalits, Janajatis/Adivashi) and their organizations; Other different Social Groups; Women Groups; Mother Groups; Youth clubs; Farmer Groups; Users' Committees; Local affected communities; Rural Municipalities; Municipalities; NGOs/CBOs and Associations working at local levels; Trade centres; Various Market actors, Local Security, Media, Transport organization, and others alike.

5.1.3 Other Interested Parties

General Groups include Civil society, Mother Groups; Youth clubs; Farmer Groups; Users' Committees; NGOs/CBOs and Associations working at local levels; Trade centres; Various Market actors, Local Security, Media, Transport organization (Prithvi Highway Bus Operation Committee, etc.), differently abled people organisation.

Government Line Agencies include the District Level District Administration Office (DAO); District Coordination Committee (DCC); District Land Revenue Office (DLRO); District Forest Office (DFO); District Public Health Office (DPHO); Divisional Road Offices and Central Level (Ministry of Physical Infrastructure and Transport (MoPIT); Department of Road (DoR); Ministry of Forest and Environment (MoFE); Department of Labour and Occupational Safety (DoLOS); Ministry of Health and Population; Department of Archaeology, Nepal Federation of Indigenous Nationalities (NEFIN), and National Dalit Commission.

5.2 Methods of Stakeholder Engagement and Public Consultations

Transect Walk, Focus Group Discussions (FGD), Key Informants Interviews (KII) and mixed group discussions were employed tools for consultations with different stakeholders. The stakeholder consultation, carried out during ESIA preparation, covers the issues of indirectly affected groups including local government line agencies (RM/M). The ESIA consultations do not cover the requirements of the ESF framework. Thus, additional stakeholder consultations were carried out during updated ESIA to incorporate the issues of directly affected groups and other interested parties.



Figure 0-2: Stakeholder consultations and key informant interview

5.3 Stakeholder Consultation

The discussions during preliminary study (pre-feasibility) were organized to share the information to the local people of project affected wards of RM/M (**Annex 3.1, 3.2 and 3.3**). Initial walkover survey was carried out followed by individual interviews with local government officials. The preliminary consultation during prefeasibility stage was carried out

at four different locations of Dhunibesi M, Gajuri RM and Benighat Rorang RM from 26-30 January 2017 (**Annex 3.2**). Total 115 participants took part with 104 males and 11 females. The participants were only from the indirectly affected groups. The public hearing was carried out at 4 different locations of Dhunibesi M, Galchhi RM, Benighat Rorang RM and Ichhankamana RM with 259 participants (male- 228, female-31) (**Annex 3.4**). The supplementary consultation was carried out at 22 different locations of the affected RM/M focusing on female groups (210 females and 106 males out of 316 participants) in June 2018 (**Annex 3.5**).

Up to the public hearing and supplementary consultations, there were still gaps in the consultations with direct affected groups (project affected vulnerable groups and IPs), and other interested parties (broader and general groups). Additional consultations with the specific groups such as women, vulnerable/IPs, project affected parties, stone crusher plants workers, female groups, business women, security personal, travel agencies, transportation agencies, other interested parties were carried out during May-December 2019 (**Annex 3.6**). The total participants of additional consultation were 312 (females - 312, males - 86).

The agenda for discussions covered impacts on private/ public structure, common property and public utilities along with cultural heritage including GRM mechanism and GBV related issues. The key issues raised during consultations were: compensation for impacted land, affected private and public structures, construction of public structures as footover bridges near schools and major market places, construction of vegetable collection centres, gender-friendly public toilets with refreshment centres etc., as well as landslide risks during construction of road, establishment of ward level Grievance Redress Mechanism, ensuring priority for local employment (including female), more communication, coordination and collaboration between stakeholders to solve problems; advance agreement, along with its proper monitoring and implementation, on rules and regulation between all the stakeholders (project, contractors, locals, government officials) proper road facilities to facilitate mobility of differently abled person and stakeholder engagement during road upgrading works. The summary of the issues raised are presented in the summary **Table 0-1**.

Table 0-1: Summary of the raised issues during stakeholder consultation

Date	Issues Raised	Settlements of RM/M and Stakeholder Engagement Methods	Response
From 26-30 January 2017 to 15 December, 2019	Road Safety issues • Zebra crossing spot should be marked in market area and dense settlement areas • Road safety sign and structures i.e. overhead bridge, Zebra crossing should be design in Mahadev Besi bazar area and adjacent. • Safety for school children Quick rescue/response is needed in case of accident and incident	Chandragiri M, Dhunibesi M, Thakre RM, Galchi RM, Gajuri RM, Benighat Rorang RM, Ichhakamana RM The issues were raised during public consultations and hearings	• The road safety issues will be incorporated in the detailed design report. Rapid Response team will be mobilized during project implementation.

Date	Issues Raised	Settlements of RM/M and Stakeholder Engagement Methods	Response
	Environment Issues - Retaining wall/gabion construction in steep slope area along the roadside - Public land and river bank should be followed to protect productive agricultural land. The spoil and the waste generated during construction should be disposed of properly and should not be dumped in the river.	Chandragiri M, Dhunibesi M, Thakre RM, Galchi RM, Gajuri RM, Benighat Rorang RM, Ichhakamana RM The issues were raised during consultations with local municipalities, focus group discussion and consultations	Environmental safety will be incorporated in the detailed design The contractors ESMP will cover the issues of spoil and the waste management
	Road Infrastructures - Road expansion work should be conduct equally in each side. - Road improvement/widening works should start rapidly. There should be uniformity in the expansion of road all along from Naubise to Mugling.	Chandragiri M, Dhunibesi M, Thakre RM, Galchi RM, Gajuri RM, Benighat Rorang RM, Ichhakamana RM The issues were raised during public consultations	The incorporation of issues of road infrastructures will be recommended to design team
	Public infrastructures - All the public infrastructures such as canals, local water supply pipelines and taps should be rebuilt - Construction of foot-over bridge nearby school area - Additional foot-over bridge has been demanded at Galchhi area (Galchi RM) - New recreation facilities and parks should be built - Separate Parking Place in a fixed location - Construction of vegetable collection center in Mahadevbesi bazaar (Thakre RM) Overhead Foot Bridge in Junge Khola (Thakre RM)	Dhunibesi M, Thakre RM, Galchi RM, Gajuri RM, Benighat Rorang RM, Ichhakamana RM The issues were raised during public consultations, hearings and meetings with municipalities	- The responsibility of operation and management of public toilet after construction will be borne by local community - The responsibility of protection of foot-over bridge will be borne by local community Local people have suggested to construct foot over bridge at Lewatar, of Ichhakamana RM
	Traffic Management: - Contraction of separate lane to collect the road toll - Urgency of daily traffic status update during construction time - Highway should not be affected during local access road construction	Chandragiri M, Dhunibesi M, Thakre RM, Galchi RM, Gajuri RM, Benighat Rorang RM, Ichhakamana RM Issues were raised during municipality visits and public consultations	- The detail design report will incorporate the issues of traffic management - Updates of daily traffic status and road condition will be updated via informative board will as well as FM and social media (Facebook, Viber group)

Date	Issues Raised	Settlements of RM/M and Stakeholder Engagement Methods	Response
	Social and Cultural issues • Compensation of land and structures with standard replacement value • Relocation of public utilities and cultural assets (shrines/small temples and religious trees) • Loss of livelihood Damage of public/private structures	Dhunibesi M, Thakre RM, Galchi RM, Gajuri RM, Benighat Rorang RM, Ichhakamana RM Issues were raised during public consultations and hearings	• Resettlement Action Plan and will be prepared and incorporates the issues • ESMP will incorporate the issues
	Employment • Employment priority should be given to the project affected households • Priority should be given to vulnerable, disadvantaged groups and females Livelihood restoration training for project affected parties (PAFs)	Dhunibesi M, Thakre RM, Galchi RM, Gajuri RM, Benighat Rorang RM, Ichhakamana RM Issues were raised during public consultations and hearings	The ESIA, RAP/IPDP will incorporate such issues
	Gender Issues: • Gender equality should be taken into consideration for employment • More involvement of women in construction and project work • Issues of gender-based discrimination in terms of wages and works Gender friendly working environment and accommodation	Dhunibesi M, Thakre RM, Galchi RM, Gajuri RM, Benighat Rorang RM, Ichhakamana RM Issues were raised during public consultations and hearings	The ESIA, RAP/IPDP will incorporate such issues
	Gender Based Violence Issues • Gender based risk • Human trafficking Transmission of HIV/AIDS and STI	Chandragiri M, Dhunibesi M, Thakre RM, Galchi RM, Gajuri RM, Benighat Rorang RM, Ichhakamana RM Issues were raised during public consultations and hearings	• The GBV action plan will help to minimize or prevent the issues Contractors will develop Code of Conduct of the labors/workers
	Grievances Mechanism • Issues of project related grievances during construction phase • Grievances related to workforce/labor • Community related grievances (due to labor influx) GBV related grievances	Chandragiri M, Dhunibesi M, Thakre RM, Galchi RM, Gajuri RM, Benighat Rorang RM, Ichhakamana RM Issues were raised during public consultations and hearings	ESIA recommends overall one GRM and within that two-separate committee (one for labour related grievances and one for GBV related grievances)

5.4 Grievance Redress Mechanism

The process for resolving complaints that may arise in the project will be handled by the project-level grievance redress mechanism (GRM).

5.4.1 Project-Related Grievances

The project GRM addresses overall project-related grievances. The construction-related issues, impacts related to land acquisition and compensation, relocation and rehabilitation of public utilities, impact on private and public structures, impacts on forest and natural resources, issues of landslide, draining management, road safety, traffic management and community-related grievances etc. will be covered by the project-level GRM.

Any household or stakeholder who feels that they are impacted adverse and material harm caused by the project may contact municipality leaders or local leaders of affected municipalities or rural municipalities who would then forward the complaint to the SC or the stakeholder may contact directly GESU-DOR or DCID-DOR. The Municipality and SC staffs will also be ready to receive a complaint and resolve and will take to the higher level of authority if necessary.

Stakeholders will have access to both locally established grievances redress committee (GRC) as Local Consultative Forum (LCF) and formal courts of appeal system. The Local Consultative Forum will be formed prior to the project implementation consisting of the representative of SC, representative from proponent site office, representative from project affected municipalities and wards, representative from construction contractor, local NGO, Community Based Organizations and local political representatives. The LCF will be responsible to assist the project during compensation determination, distribution of compensation and compliance monitoring. However, LCF will act as GRC in order to settle all the social and environmental complains and grievances registered during the time of project construction. Every PAP can appeal to the court if they feel that they were not compensated appropriately. They may appeal to appellate court within 35 days of the public notice given to them.

5.4.2 Grievance related Project workers

A GRM will be established specifically for worker-related grievances, in accordance with ESS2. This includes all issues of project workers. The accommodation (health and sanitation), availability of safety gazettes, equal wages to male and female for works of similar nature, delay in payments, hiring of labours without contract document and GBV. The project workers related GRM will be detailed in the Labour Management Procedures (LMP).

5.4.3 Gender Based Violence (GBV) Related Grievances

This includes issues of Gender Based Violence within the project, workers and in the community level (PAP), where a well-equipped separate mechanism for reporting cases of GBV-local based GBV-GRM with GBV skilled community members will respond to such cases and contractors will need to have a Code of Conduct (CoC) as well as proper documentation of each labourer including social sanctions.

5.4.4 Implementation of GRM in the Project Cycle

The Safeguard and Monitoring & Evaluation Unit under the Project Management and Supervision Consultant (SC) will establish the project GRM within 1 month from start of the project and before construction work begin. The types of grievances expected to be handle

concerning either land acquisition or more generally, construction-related grievances, and any other social and environmental issues brought up during construction by households and affected people who live relatively close to construction sites.

Local households and stakeholders will be informed about the setting up of the Grievance mechanism by the SC before start of any construction as part of the community mobilization process. Besides, the information board will be in place at construction site with specific information related to the construction works and will provide in local language the description of project and grievance mechanism, where and to whom stakeholders can deliver their complaints, and in what form: verbal or written.

When obtaining the information from the complainant, in verbal or written form, either directly or from the Municipality/District Coordination Committee (DCC) and Community offices, SC office will complete a Grievance Action Form (GAF) to record all grievances and actions taken in a Grievance log. Minimal information recorded in this form will include (i) basic data about the affected person (name, address, contact number); (ii) category of grievance filed (legal, social, environmental, technical/ engineering, financial, etc.); (iii) detailed description of grievance; and (iv) type of action taken. The GAF will be filled out by the person receiving a grievance and signed by the affected party and the receiver of the complaint. The affected party will receive a copy signed by both.

The Safeguard and M&E Unit will handle received grievances related to works on the road construction in collaboration with the GESU-DOR and the construction contractor. In each case, the Safeguard and M&E Unit will be supported by the SC in cooperation with the proponent DCID, DOR. The construction contractor will clarify, if the construction works cause the complaint. The SC will inform and update the complainant about the progress of grievance mitigation within 24 hours for urgent issues and 7 days for non-urgent issues.

Once verified problem/complaint is well founded and due to the construction works, decision will be implemented together with the Safeguard Unit, SC and Contractor. Contractor will take the necessary corrective actions and try to resolve the grievance informally directly with the complainant. If any sort of filled level grievance is not possible to redress or at the choice of the complainant, a formal redress can be forwarded to the Grievance Redress Committee (GRC).

The GRC will be formed to review complaints that cannot be resolved immediately. The committee will be formed by the Project Director of the proponent as a chair, the Unit Leader from the Safeguard and M&E Unit (SC) and members of local stakeholders involved: Municipality representative, community members, NGOs, etc. A complainant has the right to appear in person, to be accompanied by a family member, and/or to request to be represented by senior community member. In the event that the contractor, proponent, SC do not address a grievance, the affected person can seek legal redress of the grievance in the appropriate courts under the formal legal court system.

In the case the established GRM is not in a position to resolve the issue, affected people can also use the World Bank Accountability Mechanism through direct contact (in writing) to the

World Bank or Government of Nepal (GoN). The complaint can be submitted in any of the official languages of WB or in local Nepali language.

Depending on the complaints and the mitigation measures decided and implemented, if necessary, the ESMP will be updated in order to avoid similar problems afterwards. The SC Safeguard unit will provide monthly reports of any complaint registered, and how it has been dealt with to the local authorities. The SC Safeguard unit will regularly provide information to dissemination to the local stakeholders and communities of any grievances received and how they have been resolved, through the community mobilization process or through the Communication Strategy Plan implementation.

Grievance recording register will be established at the project office, Contractor's Office and Consultant's RE office as well. Project affected people as well as local people can lodge their complaints at these Offices related to assets acquisition and other social and environmental concerns due to construction related activities.

Special project grievance mechanisms such as on-site provision of complain hearings allows project affected persons to get fair treatment on time. The GRC will be established in each road sections covering affected Rural Municipality/Municipality to handle initial grievances of the project-affected people. The greivant will have unhindered access to the grievance redress office to forward and file complains. The provision of Social Mobilizer in the project implementation is good practices in this regard. Social Mobilizer can be mobilized in order to help grievants to file the complaints to the concerned agency. Grievants will be exempted from all administrative fees incurred, pursuant to the grievance redressed procedures except for cases filed in court Proposed mechanism for grievance resolution is given below:

Stage 1: Complaints of grievants on any aspect of compensation, relocation, or unaddressed losses will be settled in first instance verbally or in written form in field-based project office. The concerned personnel to settle the issues at local level can discuss the complaint in an informal meeting with the grievant. The community consultation, involvement of social and resettlement specialist and environmental specialist will be helpful in this regard. It will be the responsibility of the GRC and Project In-charge to resolve the issue within 15 days from the date of the complaint received.

Stage 2: If no understanding or amicable solution reaches or no response from the project office, the grievant can appeal to the CDC and project proponent/DOR. While lodging the complaint, the grievant must produce documents to support his/her claim. The CDC will provide the decision within 15 days of registering the appeal. In the case if established GRM is not in a position to resolve the issue, affected people can also use the World Bank Accountability Mechanism through direct contact (in writing) to the World Bank or Government of Nepal (GoN).

Stage 3: If the grievant is not satisfied with the decision of CDC and project proponent or in absence of any response of its representatives, within 35 days of the complaint, the grievant, in his/her last resort, may submit its case to the court.

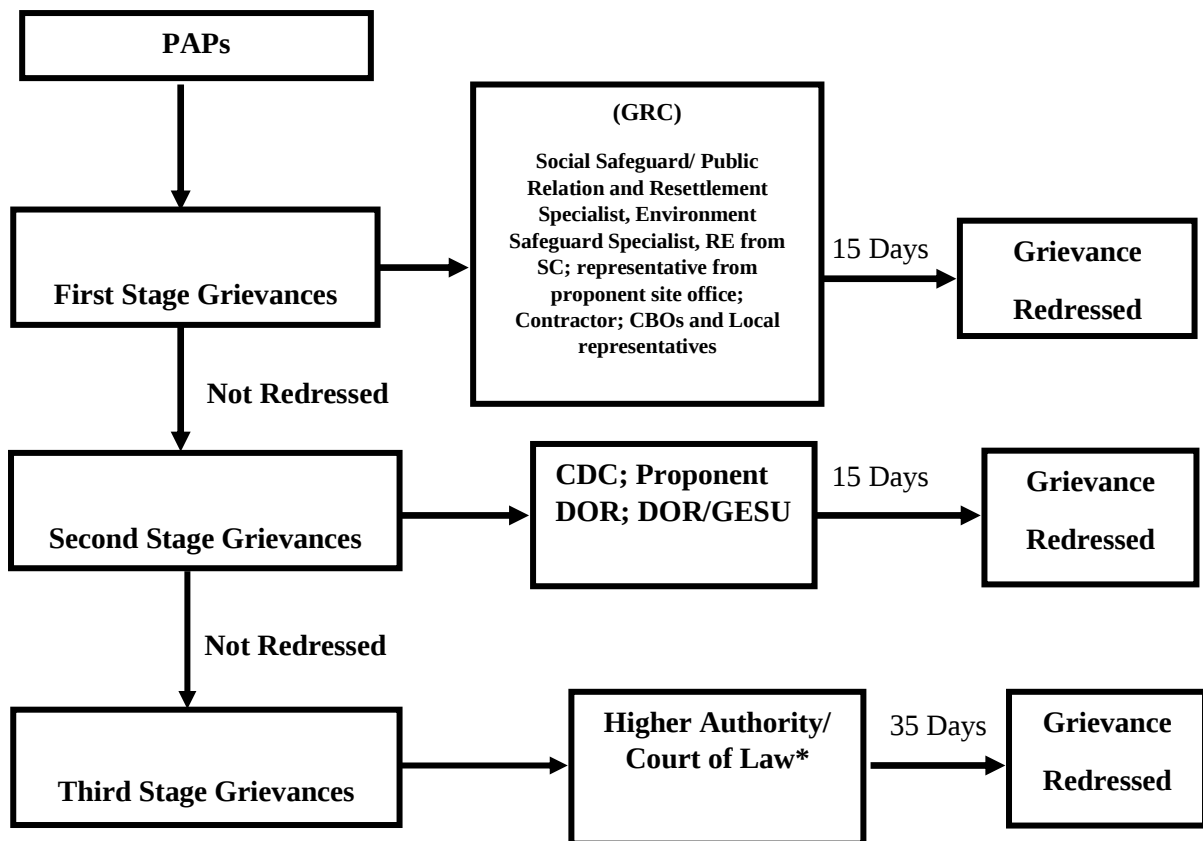


Figure 0-3: Grievance Redress Mechanism structure in the project cycle

CDC= Compensation Determination Committee, PAPs= Project Affected Persons, GRC= Grievance Redress Committee, SC= Project Management and Supervision Consultant, DOR= Department of Roads, GESU= Geo-Environment and Social Unit. *Aggrieved person may also access the country's legal system at any stage (of the three stages) of the grievance redress mechanism.

Chapter 6: Environmental and Social Risks and Impacts

This chapter highlights environmental and social risks and impacts during the improvement of the NNM Road. To study the risks and impacts involved with the project, risk screening criteria based on WB ESF was employed as shown in the **Table 0-1**.

Table 0-1: Risk Screening Criteria

Risk Category	Screening Criteria
High	The resource/receptor would likely experience a large magnitude impact that would endure for a long time, extend over a large area, exceed national/international standards, endangers public health and safety, threatens a species or habitat of national or international significance, and/or exceeds a community's resilience and ability to adapt to change. The Project may have difficulty in complying with the applicable ESF requirement, and significant mitigation would likely be required.
Substantial	The resource/receptor would experience a clearly evident change from baseline conditions and would approach but not exceed applicable standards. The Project would comply with the applicable ESF requirement, but mitigation would be required.
Moderate	The resource/receptor would experience a noticeable effect, but the magnitude of the impact is sufficiently small (with or without mitigation) that the overall effect would remain well within applicable standards. The Project would comply with the applicable ESF requirement, but mitigation may be required.
Low	The resource/receptor will either not be affected or the likely effect would be imperceptible or indistinguishable from natural background variation. The Project would comply with the applicable ESF requirement and mitigation would typically not be required.

6.1 Beneficial Impacts of NNM Road Improvement

Beneficial impacts are related to the improvement of road infrastructure and its technical efficiency, economic development and livelihoods of the local people. Upgrading of the NNM Road will facilitate economic development and transport efficiency, providing multiple services to local communities and industries, contributing to safety issues and allowing solving the environmental problems, associated with road inefficiency and traffic congestions. The likely beneficial issues, envisaged during construction and operation stages, have been provided in **Table 0-2**.

Table 0-2: Beneficial Impacts of NNM section improvement

Beneficial Impact	Impact Rating		Rationale
	Construction	Operations	
Improved road infrastructure	Moderate	High	Improved safety Better transportation and transport efficiency Improved access to services, including social services Development of new local infrastructure Better environmental conditions Established linkage to other districts

Beneficial Impact	Impact Rating		Rationale
	Construction	Operations	
Employment generation	High	Moderate	Opportunities for local labour-force Enhancement of technical skills and know-how Opportunities for women and gender specific benefits
New income generation (trade, agriculture, businesses, industry)	Moderate	Moderate	Enhancement of local economy Opportunities for women and gender specific benefits Tourism development Poverty alleviation Improved living standards Facilitated industrial development Diversification of local economy
Increase in land and property value	Low	High	Better living standards
Carbon Emission Savings/Reduction in GHG emissions	Low	Moderate	The upgrading of road will enhance efficiency of transportation and will eventually result in net carbon emission savings

The beneficial impacts are elaborated below.

6.1.1 Improved Road Infrastructure

The most significant benefit of road rehabilitation/upgrades is improved road infrastructure responding to Nepal road standards, including increased width of the road, pedestrian walks, bus stops, transportation public and gas stations, proper traffic lights (especially in urban sections), underpasses/overpasses and other crossing structures for pedestrians, improvement of sidebars for safety issues, mirrors where road bends, etc., responding to safety issues. Health and safety of road users including drivers will be enhanced with the implementation the good road conditions and other additional roadside facilities. The upgraded road will provide better access to services and transportation, including easy access to the social services such as health posts, hospitals, schools and other education institutions, offices of local authorities, municipalities, district coordination committees, etc. Freight transportation between Birgunj and Kathmandu will be substantially increased reducing travelling time and cost as well as accidents due to freight transportation and freight related vehicles, such as large trucks. Transportation facilities will save time and energy of locals, improving their economic activities along the route. Paved roads will provide all-weather transportation service to the local people to cash these services and facilities. Quick access to, for example, health facilities is crucial and the improved access will bring improved quality of life in the project area. Once the road comes into operation, people will have improved access to many goods such as seeds, fertilizers, irrigation and technology leading to increased agricultural production and diversification. Implementation of the proposed project will enhance the development of new infrastructures such as service stations along the road, as well as adjoining road networks, irrigation facilities, electricity supply lines, water supply and sanitation, sewerage and drainage within the project areas. The implementation of proposed project will address the existing environmental problems along the proposed alignments such as landslides, dust pollution and waste management. The project will promote best practices and establish the mitigation

measures for landslides, compensatory replantation of native trees along the proposed new alignments, selected places for waste management, etc. The upgraded road also will provide better linkage to other districts such as Chitwan, Makawanpur and Ghorka, and enhance market cooperation activities, exchange of goods and services.

6.1.2 Employment Generation

The road improvement activities will provide opportunities for local employment along the settlements in the project area. It will be direct employment (741,635 man-days of skilled and 3,711,632 man-days of unskilled work) for construction-related work for the inhabitants all along the existing alignments for construction-related work prioritizing the inhabitants along the existing alignments, or indirect employment on project-support activities such as construction activities, food supply and transport. It is also likely to increase the commercial agriculture, industrial and trade business activities after road upgrading. Creation of service centres along the road will provide opportunities for local employment on small markets, cafeteria and service stations. The NNM Road development project will adequately use the local people for construction works, facilitating the unique chances for the transfer of skills and technical know-how in construction and related construction technical sectors. Considerable number employed workers will convert themselves into fully skilled labourers in works such as masonry, gabion wires weaving, construction of dry and foundation walls, slope cutting and stabilization, rock cutting, bio-engineering works and other open opportunities. These skills will not only benefit the locals by providing long-term employment opportunity, but also contribute to local human resource development in project areas that have limited opportunities. Local women will have more chances for education and training and relevant enterprise development.

6.1.3 New Income Generation (Trade, Agriculture, Business, Industry)

Trade and business of local products, business of forest products, establishment of small-scale and medium industries, agro-businesses, etc., will generate long-term opportunities for local people to be involved into economic activities. New market areas will be developed especially adjoining link roads enhancing more income generation activities and livelihood at local level. The road connects with some pilgrimage sites, holding great historical and cultural importance, such as Manakamana at Gorkha District. The cable car station to the temple is situated to the close distance from existing NNM road at Kurintar. The area along Trishuli River is known for its rafting. The improved road will enhance tourism due to increased influx of domestic and international tourist to these places, including improved access to well-known tourist destination places such as Pokhara. Local women will have direct benefit with the widening of existing highway and construction and operation of two new alignments. They will have opportunity to establish shops, hotels and resorts along existing road. All-weather road facilities will enhance the trade and business of local communities, contributing to poverty alleviation and facilitating industrial development, through establishment of small and medium enterprises for processing of local agricultural products. Local products could be transported to outside markets at suitable costs, benefiting to producers and consumers. Improved road linkages will open potential opportunities for the production off-season fruits and vegetables.

The improved road will create opportunities for diversification of local economy, providing better opportunities in exploring untapped potential of natural and human resources.

6.1.4 Increase in Land and Property Value

The price of adjacent lands after the improvement of transportation corridor will increase significantly, especially in the places with fertile soils and scenic landscapes due to increase in economic activities. The land owners will be benefited directly with the increment in the price of land. More shops, hotels and other economic activities will be developed along the new proposed highway alignment. The poor people will be benefited indirectly through growth of demand in jobs such as services, agriculture and industry.

6.1.5 Carbon Emission Savings/Reduction in GHG Emissions

The upgrading of road will enhance efficiency of transportation and will eventually result in net carbon emission savings and ultimately will have a positive impact in terms of reduced Green House Gas (GHG) emissions.

Table 0-3: Estimate of Carbon Emission (2019 – 2042)

Details	Annual Vehicle km (2019 - 2042) – Million	Annual Carbon emission - (2019 - 2042) Tonnes	Annual Carbon emission - (2019- 2042) Tonnes/Million vehicle km
1. Without Project	12,281	289,525	23.58
2. With Project	16,024	142,587	8.90
3. Savings		146,938	14.68

Source: Adapted from Preliminary Assessment of carbon emission along NNM road based on IPCC 2014

6.2 Adverse Impacts

All adverse impacts have been grouped in as per the new WB ESF and ESSs. Further, the general and site-specific impacts were also divided. All those impacts were split up between relevant Environmental and Social Standards and evaluated against risk screening criteria as high, substantial, moderate or low (**Table 0-1**).

6.2.1 General Impacts

All general impacts have been analysed in the **Table 6.2** below, which provides the summary of all risks and impacts on physical, biological and socio-economic and cultural environment at the construction and operation stages. The matrix is organized in order to link observed risks and impacts with WB ESF. The description of specific generic impacts associated with ESSs follows after the table.

Table 0-4: Generic Adverse Impact Assessment Matrix along NNM

ESF Standards, Environmental and Social risks and impacts	Risk Rating		Rationale
	Construction stage	Operation stage	
ESS1 Assessment and Management of E&S Risks and Impacts			
Erosion or mass wasting resulted from site preparation	High	Low	Removal of existing protection walls, movement of heavy equipment and civil works along the highway are likely to aggravate landslides situations. Slope stabilization and protection measures are included in the design of the road and will be implemented.
Greenhouse Gas (GHG) Emission	Moderate	Low	GHG emission will be moderated during construction stage due to engagement of large machinery and other technical work. At the operation stage GHG will be associated with vehicular emission.
Cumulative Impacts	Moderate	Low	The improvements of NNM Road has low to moderate risk for cumulative impacts as works are mainly confined within the existing ROW and in an area that has already been altered, fragmented and highly disturbed for many decades as a result of human population growth, encroachment and establishment of new settlements along the highway, land transformation, agriculture development and other associated development. With or without improvement works in NNM Road, land use change and land transformation have already taken place and will continue to take place as a result of other factors such as decentralization, urbanization and development of rural areas on the way of shift to decentralization.
ESS 2 Labour and Working Conditions			
Working conditions:	Substantial	Low	Poor working conditions common problem with large construction projects in Nepal. The NNM project is likely to impact the working conditions.
Worker accommodations	Substantial	Low	Provision of appropriate worker accommodations is a common problem in Nepal. The immigrant workers are likely to face the risk of accommodation at the construction sites.
Child Labour	Substantial	Low	Child labour is a common problem in Nepal and verification of age is difficult. There is risk of using children in different phases of the NNM road construction project threatening to the security and rights of the children engaged.
Forced Labour and Trafficking in Persons (TIP)	Substantial	Low	Forced labour and TIP are known issues in Nepal. The NNM project may have risks of using forced labour and trafficking in person while upgrading and improving the NNM road alignment.
Occupational Health and Safety:	Substantial	Low	Occupational health and safety of the workforces is one of the risks and impacts to likely occur while updating NNM road. During construction, workers could be exposed to various health risks and hazards. Accidents and health hazards are likely during excavation, operation of construction vehicles such as excavators and dump trucks, operation of crusher plants, operation of quarry sites likely to have impact upon health and safety. The labourers could encounter injuries and accidents (sometimes casualties) in lack of adequate safety measures.
ESS 3 Resource Efficiency and Pollution Prevention Management			
Landscape aesthetic	Substantial	Moderate	The stockpiling of materials, construction excavation for structures and clearance of vegetation are some of the issues related to the general aesthetics. Long-term effect due to vegetation clearing.

ESF Standards, Environmental and Social risks and impacts	Risk Rating		Rationale
	Construction stage	Operation stage	
Air pollution	Substantial	Moderate	Air pollution due to operation of machines is likely in the vicinity of the project alignment situated within the mountainous area of Dhading and Gorkha district and majority of the alignment passes through undulated and vegetated land. Excavation for the improvement along such area may lead to massive air pollution during construction. Influence of dust and noise pollution on settlement areas due to operation of crusher plants, batching and bitumen-mixing plant close to such area might cause air and noise pollution, creating disturbance to nearby settlements, school, and health posts. During transportation of construction materials, operation of dump trucks and excavation activities dust pollution along the existing highway is likely.
Potential hazards caused by bitumen and other toxic chemicals	Moderate	Low	The use of chemical hazardous materials for road such as epoxy, gypsum, additives, admixtures, cements, bitumen etc. is inevitable during the time of construction. The storage of such chemical should meet by special precautionary measures. Containers of such chemicals such as bitumen drums often are damaged during transit, leading to a leakage in storage places that often are not or not adequately cleaned up afterwards. The bitumen could remain at the boiling area and decanter sites for many years after the road construction if it is not properly rehabilitated along the existing natural drainages.
Noise pollution	Substantial	Moderate	Noise pollution is likely due to operation of excavators, crusher plants, batching and bitumen mixing, concrete-mixing plants and their activities with the widening of existing highway might cause inconvenience to nearby settlements in terms of air and noise pollution.
Solid waste management	Moderate	Low	Solid wastes (mostly plastic) will be generated in significant quantities. Bad odour, blockage and obstruction of road side drain, traffic congestion, contamination of ground and river water and soil close to the highway is likely due to direct disposal of waste from the income generation activities such as small enterprises along the highway.
Pollution of water resources	Substantial	Moderate	Degradation of water quality of existing rivers (Mahesh khola, Trishuli) is likely, especially during the time of construction due to disposal of soil and chemical wastes from construction works and from camps. Impact upon small streams along the existing NNM is expected due to likely disposal of wastes. Existing Trishuli and Mahesh khola is muddy, due to local activity like extraction of sand for the river, operation of crusher plants and sand cleaning plants along the Trishuli riverbanks. Impact on water sources due to vehicle washing, fuel leakage, poor sanitation practices, increased human activities/ settlement/ market center expansions/hotel operations to the nearby water sources is very likely during operations
Land use change	Low	Low	Improvement of existing NNM comprises agricultural land (156.7 ha), forest land (57.43 ha), water bodies (50.98 ha), barren (14.19 ha), grass land (4.51 ha), settlement (2.27 ha), and shrub land (0.62 ha) within the 50-meter ROW are likely to be affected. Lands such as barren land, flood plain, will be temporarily used for the establishment of labour camp, crusher sites, worker camp site, for the disposal of spoil, and will be changed during the time of construction temporarily.
ESS4 Community Health and Safety			
Traffic management	High	Moderate	Management of traffic along the existing highway will be most challenging task during the time of widening of road width and excavation. Traffic management plan prepared prior to the construction.

ESF Standards, Environmental and Social risks and impacts	Risk Rating		Rationale
	Construction stage	Operation stage	
Traffic and Road Safety	High	Low	Existing urban areas will be more vulnerable to traffic safety and has 15 accident prone areas along the existing NNM with many frequent reported cases of accidents. With an improved road, vehicular traffic will increase and over speeding in busy sections of the road might occur, thereby increasing risks of accidents in overcrowded areas along the NNM road alignment. It can be the major issue during the time of operations of the improved NNM road alignment, but the establishment of the road infrastructures (signs, zebra, light) will help improve road safety.
Ecosystem Services	Substantial	Substantial	The Project area provides several ecosystem services to the local communities, including fish, non-timber forest products, and medicinal herbs, among others. Various project activities have the potential to impact these services, including but not limited to the construction of civil works and access roads, and potential increased risk of landslides.
Community Exposure to Health Issues and Labour Influx:	Substantial	Low	Due to regular influx of immigrant labour force, the local host communities are likely to be exposed with risk of various communicable diseases including STDs. Poor sanitation practice of the outside workforce in camps and construction sites is likely to create the community health problems. The workers from diverse culture and places are likely to adversely impact the homogenous society's traditions and way of life. There is risk of inflation of prices of goods and commodities along the road sides. Social unrest and dispute may arise due to inter-cultural differences between the immigrants and local community. There will be increased pressure on and competition for using resources and infrastructures in the area such as competition on taking rents and others. The maximum sales and consumption of beverage drinks like alcohol by the immigrant workers at the construction and camp sites may cause many social risks.
Hazardous Materials	Moderate	Low	The Project will use a variety of hazardous materials and transport these materials through several local communities along the access road. The usage of hazardous materials by the NNM project is likely to create risk and impact in the project area.
Emergency Preparedness and Response:	Substantial	Substantial	Project poses several risks to local communities, including traffic accidents, fuel spills, landslides, sudden changes in river flow etc. creating need of establishing emergency preparedness and response along the road alignment.
Gender Based Violence (GBV)	Substantial	Low	GBV is prevalent in Nepal due to unequal gender relations and discrimination towards women in both public and private sphere. There is the potential for GBV as a result of labour influx and stress on local villages
ESS 5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement			
Land Acquisition:	Moderate	Low	A total area of 0.21 ha of private land will be acquired for road upgrading work.
Economic Displacement	Moderate	Low	Due to loss of private property and assets (land and housing structures including trade structures), 78 HHs are likely to be economically displaced requiring compensation and restoration of livelihoods. Likewise, numbers of small business entrepreneurs along the NNM road alignment are also likely to be economically displaced losing livelihoods through upgrading works. They need to be relocated to nearby public places.

ESF Standards, Environmental and Social risks and impacts	Risk Rating		Rationale
	Construction stage	Operation stage	
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources			
Forest habitat	Moderate	Low	52 trees and 2253 poles along the ROW will be cut down, mostly in the community forests. This vegetation grows in human disturbed environment, and there will not be any substantial impact from the road improvement to forest habitats. However, the workforce unless their energy needs for their meal cooking is met from fossil fuel, may exert pressure on the local forests of the surrounding areas.
Aquatic habitat	Moderate	Low	Construction can affect flows affecting aquatic wildlife. Roads may also provide barriers to movement of aquatic species, especially where culverts are used. Disposal of excavated materials in water bodies may increase turbidity of water and result in reduction in dissolved oxygen content. Inappropriate driver practices connected with vehicle washing in streams and rivers can cause local water pollution by leakage of fuel that may put hazards on people and animals using these as drinking sources. Continual water pollution will also affect the aquatic biota, with subsequent negative consequences for fisheries and the economic return.
Threatened wildlife	Moderate	Low	16 threatened bird species and 6 threatened mammal species have been recorded known mostly from secondary sources. There will be no direct effect on them, but, construction noise and pollution will affect them indirectly.
Impact on forest land	Moderate	Low	3.91 ha of forest land will be cleared in the RoW
Disturbance and poaching wildlife	Moderate	Low	Although the wildlife population is reported low in the project area, illegal hunting and poaching can take place in natural forests by road workers. Where the road stretch is crossed by forests concealing wildlife including game value, it may become a good ground for the locals for hunting and poaching of wildlife of game value due to open public transportation.
Wildlife movement	Low	Low	Increase in traffic flow and speeds may cause wildlife population disturbance and decline due to vehicle-wildlife collisions, more likely in Ch. 21+400 – 21+500, 33+340 – 33+600, 35+000 – 35+400, when fast driving (especially during night time).
ESS 7: Indigenous Peoples			
Free Prior and Informed Consent (FPIC)	Low	Low	The project will not cause any adverse impacts to the land of IP communities in the project area (but living outside the ROW), will not cause any relocation of IPs from land they customary use or occupied and will not cause negative impacts to their cultural heritage. Therefore FPIC is not required under this component.
ESS 8: Cultural Heritage			
Tangible Heritage	Moderate	Low	The likely impact of NNM project on tangible heritage (e.g. shrines, cremation sites, etc.) is not found.
Intangible Heritage	Low	Low	A significant majority of the population along the NNM road alignment is composed of Tamnags, Gurungs and Chepangs (Indigenous peoples). These social groups of people have their own religions and cultural assets along the road alignment. The construction and operation phases of the NNM road construction project is not likely to impact intangible cultural heritage, such as religious heritages and practices.
ESS 10: Stakeholder Engagement and Information Disclosure			

ESF Standards, Environmental and Social risks and impacts	Risk Rating		Rationale
	Construction stage	Operation stage	
Compensation of impacted private properties	Moderate	Low	Issues of compensation of impacted land, affected private and public structures; construction of public structures
Issues of necessary infrastructures related to road safety.	Moderate	Low	Construction of foot bridge near school and major market places; construction of vegetable collection centres, gender friendly public toilets with refreshment centres; mitigation of landslide risks during construction of road; establishment of road safety measures; establishment of ward level GRM, ensuring employment to locals (including female).

The following sections summarize the environmental and social risks and impacts likely due to the NNM Road project by each relevant environmental and social standard (ESS 1- 8).

6.3 Assessment and Management of Environmental and Social Risks and Impacts (ESS 1)

Under ESS1, impacts to environment and social aspects have been analyzed. In the case of the overall environmental impacts, it has been rated as substantial to moderate risk condition and in case of social risk, especially, impact to the vulnerable community has been rated as moderate risk condition.

Out of total project affected HHs (78), 6 HHs belong to vulnerable HHs. They are likely to be affected by losing their residences along the NNM road alignment, within the ROW. Although Brahmins and Chhetri are not generally considered vulnerable but their HHs are being headed by women so that they have been considered falling under the category of vulnerable in the NNM Road project context. Livelihood restoration training and additional assistance support is needed to those affected vulnerable groups. Awareness and enhancement training will be provided to those vulnerable communities.

6.3.1 Cumulative Impacts

The improvement works of NNM road that will be carried out within the existing ROW and with small land acquisition and minimal tree cutting and habitat disturbance are assessed to have moderate to substantial risks and impacts that are largely construction-related and short-term. Impacts mainly relate to environmental degradation, increased risk to health and safety of workers and communities, increased traffic flow and traffic-related accidents and social issues related to increased labor influx such as gender-based violence and child labor – all expected to take place during construction. The improvements of NNM road is also assessed to have no significant cumulative impacts as works are mainly confined within the existing ROW and in area that has been already fragmented and highly disturbed as a result of human population growth, encroachment and establishment of new settlements along the highway, land transformation, agriculture development and other associated development. With or without improvement works in NNM road, land use change and land transformation have already taken place and will continue to take place as a result of other factors such as decentralization, urbanization and development of rural areas as a result of shift to decentralization. In addition, the surrounding rural roads have been constructed in recent years, often without any environmental assessment and mitigation measures. Increased density of road network and lack of protective measure have aggravated the adverse impacts on environment that have already taken place such as siltation and sedimentation of river, increased barrier effect for wildlife movement, threat of poor water drainage and community health and safety. The impacts might be exacerbated by climate change and uncoordinated development of local communities, that, finally, may cause significant economic losses

Cumulative impacts can be described as a sum of impacts, synergetic (impacts that interact to produce greater impact than the sum of individual impacts), or antagonistic (impacts that interact each other reducing overall effects). Cumulative impacts may last for many years beyond the life of individual projects; for example, roads induce competition for resources,

create home range boundaries, increase stress among animals, producing many unrelated direct and indirect impacts such as barrier effect, human colonisation of wild habitats, and habitat contamination (Rajvanshi et al., 2001).

Land use change is one of the major cumulative impacts associated with road development and operations in many countries, including Nepal. Construction of roads facilitates the transformation of natural landscapes into cultural. Current trends of landscape fragmentation and land use change for increasing agricultural and industrial production contradict with principles of sustainability, because rapid changes affect natural world, stimulate and speed-up continuous extinction process in isolated habitats. Road development accelerates land use changes and causes permanent wildlife habitat loss. Natural habitats can be transformed into agricultural areas, human settlements, industrial parks, etc., because roads improve opportunities for economic exploitation of resources in the area (Quintero, 2015). Commercial agriculture is one of the main drivers of deforestation process in many parts of the world (Holosuma et al., 2008). Highway development stimulates growth of trade and commerce near towns and in places of stop for rest along the road attracting many people to such places and stimulating growth into zones of urbanization (Rajvanshi et al., 2001). However, given the fact that NNM road has been constructed decades ago and land transformation and land use change have already taken place in the area, the improvements of NNM road is expected to have minimal cumulative impacts on land use in the project area.

Middle-Mountain Physiographic Region occupies more than 43,062.3 sq. km (29.2% of the entire country territory). The elevation of the regions varies from 110 m to 3,300 m above sea level. The climate of this region also varies depending on the location from sub-tropical and sub-humid in river valleys to mild-temperate and cool-temperate in the mountain ranges. The greatest proportion of forest cover in this region is 52.3%; together with other wooded land it numbers 53.75%. Most part of forest areas (98.8%) lies outside of protected areas. The forest patches are highly fragmented by development; their average size is 59.4 hectares. About 58.3% of forest patches has size less than 2 ha, and 28.3% of patches has the size between 2 to 10 ha. Less than 1% of forest patches has the size more than 1000 ha. Among different types of forest disturbances, livestock grazing is more common. Other disturbances were categorized as landslides, lopping, leaf litter collection, bush cutting, forest encroachment, forest fires, tree cutting, plant diseases and infestation, etc. Around 18% of forests have the strong impact of human activities, and 34% are under medium impact. Community forestry program has been developed in this region since 1978; the greatest proportion of community managed forests is located in the Mid-mountain region. Community forests have lower impact of anthropogenic activities comparing with government forests (DNPWC, 2014).

Historically, the Mid-mountain region was the most populated in the country. Currently the population of Mid-mountains is around 10.5 million people or 42% of the total population of Nepal (WWF Nepal, 2015). The road in NNM section does not cross any protected areas. It is mostly going along mountain slopes closely to river and crossing the area of several towns, biggest of which is Dhunibesi. The forest cover along the road corridor in Mid-hill region accounted 63.92% in 1990, consisting the highest proportion of predominant land cover class. The forest area considerably reduced there to 2016 and currently accounts only 52.94% in 10

km buffer zone. It is decreased almost by 11%. Even more dramatic changes are observed closer to the road (with buffer zone in 5 km): where forest cover decreased from 58.7% in 1990 to 44.35% in 2016, accounting in 14.35% change. So, it is evident that forest is mostly impacted closer to the road. Taking into account that deforestation in this region is usually associated with land degradation and high probability of landslides on steep slopes, this is very trouble trend, because it can cause and causes right now many safety problems associated with soil erosion and landslides, threatening traffic and destructing the road. Deforestation also effects local environment, including water, air and wildlife.

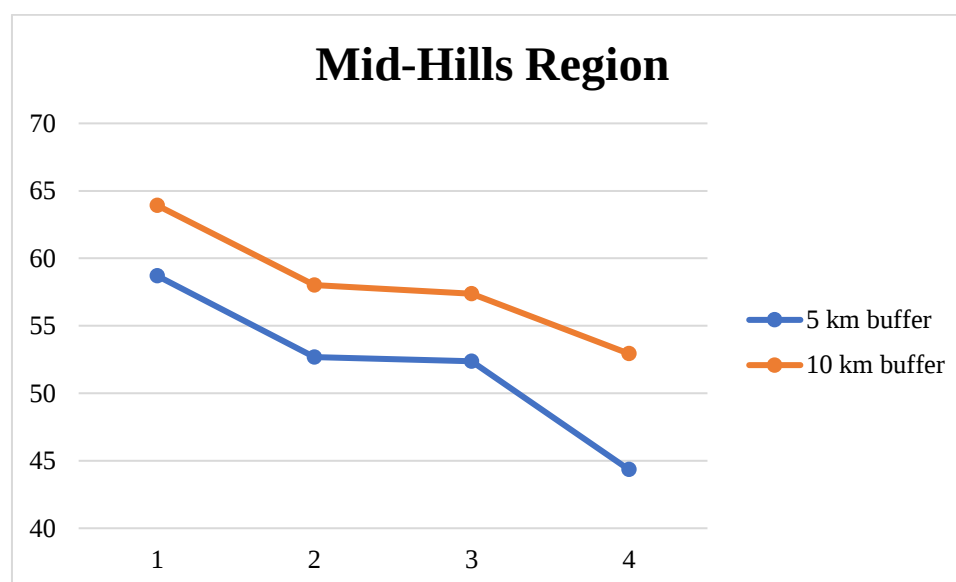


Figure 0-1: Deforestation trends along Birgung to Kathmandu Trade Corridor in Mid-Hill region.

Currently, the proportion of forest cover in project area (along the road) is approximately the same as in entire Mid-mountain region (52.9% and 52.3% respectively). However, the forest cover along the road significantly decreased during last 26 years. Especially sharp forest loss was observed near the road in last 6 years from 2010 to 2016. Forest loss in Mid-hill region can have unpredictable consequences, taking into accounts its important role in supporting of ecological balance and ensuring the flow of ecological services. Loss of forests near the road creates the safety problems for people, effects land productivity, causes soil erosion, diminishes wildlife habitat amount and contribute to fragmentation of landscape.

6.4 Labour and Working Conditions (ESS-2)

The Labour and Working conditions for this project is associated with three categories of project workers: direct workers (hired by project), contracted workers (including migrant workers) and primary supply workers (those providing goods and materials). The risks include inadequate worker accommodation; non-payment of wages and other benefits (e.g. compensation, maternity benefits, leave, insurance, etc.); discrimination at employment (e.g. abrupt termination of the employment, working conditions, wages or benefits etc.); child labour; forced labour; human trafficking; occupational health and safety (OHS) issues, including workplace accident and work related diseases (e.g.allergies, respiratory problems, musculo-skeletal disorder); grievances related to workers and GBV. The contracted workers

are more susceptible to such risks.

6.5 Resource Efficiency and Pollution Prevention Management (ESS-3)

Landscape aesthetic, air and noise pollution and pollution of water sources can be moderate or substantial also at the operation stages. There is a need in special policies and control to minimize negative impacts of pollution on communities.

6.5.1 Construction stage

Landslides, Slope Destabilization and Soil Erosion

Krishnabhir and Jogimara are among the most landslide prone areas along the alignment. Major mass movements along the road alignment have been found at Krishnabhir (69+000), Jogimara (75+500), between Phurke Khola and Malekhu (54+500) and in other locations. These slides were activated 10 to 20 years ago; currently, slides are passive, however, they can be reactivated again any time due to activation of the thrust, heavy precipitation or earthquake. Activation of the slides blocked the road traffic many times in the past also. The Krishnabhir landslide occur in the Galyang Formation; the Jogimara slide is seen in the rocks of the Lakharpata Formation; whereas the Malekhu slide is found in the quartzite. The Malekhu slide is attributed to slope, weathering and fractured rocks and activation of the MT. Along the road alignment, the failures of joint are controlled by construction of wall on hillside. However, there is possibility of mass failure during extension of the road alignment into the wider lanes. After extension of the road, there is high possibility of cut slope failures in the rocks as well as soil erosion. The section wise landslide and erosion prone areas after road excavation works are as illustrated in the **Table 0-5**.

Table 0-5: Highly Landslide Prone Area

Sn.	Chainage		Length (m)	Soil/Rock Type	Landslide Hazard
	From	To			
Nagdhunga Naubise Section					
1	0+000	0+200	200	Boulder Mixed soil	High
2	0+200	0+250	50	Hard Rock	High
3	0+250	0+850	600	Hard Rock	High
4	0+850	3+360	510	90 % Weathered Rock, 10 % Hard Rock	High
5	3+360	5+200	840	90 % Weathered Rock, 10 % Hard Rock	High
9	6+900	7+350	450	90 % Boulder Mixed soil, 10 % Weathered Rock	High
10	7+350	7+580	230	Weathered Rock	High
Naubise Baireni Section					
13	11+080	11+200	0+120	60 %Soil, 40 % boulder mixed soil	High
14	11+200	11+800	0+600	70 %Weathered Rock, 30 % Hard rock	High
15	11+800	12+220	0+420	Boulder mixed soil	High
Baireni Bishaltar Section					
39	30+080	30+200	0+120	Soil	High
40	30+200	30+780	0+580	80 % Weathered Rock, 20 % Hard Rock	High
45	33+320	33+860	0+540	Soil	High
52	42+000	42+790	0+790	60 % Hard Rock, 40 % Weathered Rock	High
56	46+100	46+900	0+800	Weathered Rock	High
Bishaltar Mugling Section					
71	56+630	56+900	0+270	Soil	High
72	56+900	58+000	1+100	80 % Weathered Rock, 20 % Hard Rock	High

Sn.	Chainage		Length (m)	Soil/Rock Type	Landslide Hazard
	From	To			
73	58+000	58+365	0+365	80 % Weathered Rock, 20 % boulder mixed soil	High
76	59+820	60+865	1+045	Weathered Rock	High
80	62+350	68+000	5+650	90 % Hard Rock, 10 % Weathered Rock	High
81	68+000	68+800	0+800	boulder mixed soil	High
82	68+800	71+200	2+400	Hard Rock	High
83	71+200	72+100	0+900	Soil	High
84	72+100	73+250	1+150	80 % Hard Rock, 20 % Weathered Rock	High
92	78+675	80+260	1+585	Hard Rock	High
93	80+260	80+560	0+300	Boulder mixed soil	High
94	80+560	81+060	0+500	Hard Rock	High

Source: Draft Detail Design of Improvement of Nagdhunga-Naubise-Mugling Road and Bridges, 2018

Impact due to disposal of spoil and other construction materials

Unmanaged disposal of spoil may cause blockage of natural drainage systems, loss of organic fertile top soil and farmlands, loss of crops and forest, and water logging. It is estimated that a total of 1,534,908 m³ of spoil material will be generated and 633,143 m³ will be reused whereas 901,765 m³ of spoil material required to be disposed safely. If this spoil is not properly disposed, significant negative impacts are anticipated on public health and safety along with landslide and slope instability and impacts on aesthetics of the landscape.

Table 0-6: Estimated volume of spoil for the disposal

SN	Road Section	Length (Km)	Cut Vol. (m ³)	Fill Vol. (m ³)	Cumulative Vol. (m ³)	Reusable Vol. (m ³)	Disposable Vol. (m ³)
1.	Nagdhunga -Naubise (0+00~12+400)	12.4	31,994	9,330	22,664	5,651	17,013
2.	Naubise - Baireni (0+00~24+200)	24.2	91,901	31,635	60,266	15,067	45,199
3.	Baireni -Bishaltar (24.20~53+00)	28.8	139,174	17,872	121,302	30,326	90,976
4.	Bishaltar -Mugling (53+00~82+400)	29.4	102,899	19,300	83,599	20,900	62,699
Total		94.8	365,968	78,137	287,831	71,944	215,887

Source: Detail design for the improvement of Kathmandu (Nagdhunga)-Naubise-Mugling Road and Bridges. Draft Design Report (Volume I-Main Report).

Landscape disturbance and river bank instability

Excavation for the foundation of the bridge will cause landscape disturbance land instability, soil erosion and landslides may occur along the banks and approach road. As the project area is located at hilly terrain the excavation work is likely to disturb slope stability. Disturbance to landscape and instability of banks are likely in all proposed bridges along the existing NNM.

Quarry and extraction of river bed materials

Boulders, gravels and sands are likely to be extracted from the river near to the bridge construction site by the all package contractors during the time of excavation for bridge foundation and other construction works.

Soil erosion due to construction and excavation of approach road

Excavation and construction of approach road and side structures will disturb the landscape and soil erosion. Roadside slopes may trigger landslide during the excavation.

Change in river regime

The river diversion works will be done for the construction of the pier foundation. The increase in the sedimentation and change morphology of the river is likely with the river diversion.

Water pollution

The direct disposal of construction material into water bodies (Khahare, Chiraundi, Gomati, and Hugdi streams) may also lead to further adverse impacts by increasing the sedimentation of the water and its ecosystem.

Noise pollution and vibration

The implementation of project will not add remarkable amount of noises in the project area as the project is only about upgrading the road and not a new construction. Nonetheless, movement of vehicles from construction activities will be the major sources of noise and vibration during construction phase.

6.5.2 Impacts at the Operation Stage

Noise pollution and vibration

The project will not add remarkable amount of noises in the project area during operation. However, frequent movement of vehicles, especially heavy trucks, may cause noise and vibration.

6.6 Community Health and Safety (ESS-4)

Community Health and Safety in the road construction and operation projects depends on efficient traffic management, traffic and road safety, flow of ecosystem services, community exposure to health issues and labour influx, hazardous materials, emergency preparedness and response, and GBV. Efficient traffic management is very important during the time of construction, when some sections of the road can be blocked for the upgrading work. Blockage of the road can also affect traffic and road safety, especially in highly populated sections of the highway. Presence of outside labour force can cause negative impact on environment and local communities and should be managed to prevent conflict situations, including GBV. It is expected that most serious risks and impacts for community health and safety can be exposed during construction time. The highest risk is associated with traffic management and traffic and road safety. Traffic management will remain a high importance issue also during a time of operations and will depend on both coordinated management plan and well-established road infrastructure. All other risks and impacts will be substantial and moderate and mostly will be observed during time of construction.

Impacts from stockpiling and transportation of construction materials

Stockpiling of construction materials and aggregates as well as excavated material if piled haphazardly along the existing alignment as well as at the valley side will be washed out

affecting downhills, the Trishuli River and cultivated lands. It is likely that significant amount of construction materials (444,000 m³) will be collected from the Trishuli river bank alone. Stockpiling along the existing road and near settlement and urban areas will provide discomfort to the local inhabitants with the dust pollution. Further, haphazard storage along the urban settlements may also lead to accidents. Such impact is likely all along the highway alignment and especially along the existing urban settlements such as at Khanikhola, Naubise, Dharke, Mahadevbesi, Galchi, Baireni, Majhimtar, Malekhu, Chumlingtar, Phisling, Ramailodanda, Kurintar, and Mugling. These materials may be washed away by monsoon rain, causing water pollution to existing natural drainages and along the Trishuli River. The unnecessary piling of construction materials would disturb the scenic beauty and topography of the local environment. Similarly, surrounding crops and ground vegetation may be damaged due to haphazard disposal of these materials. All lands to be used for stockpiling during the construction will be limited in the public land.

Impacts due to establishment of construction camps

Approximately 12 ha of land will be acquired temporarily for the establishment of labour camps and Contractor's camp at the vicinity of the project area. However, the land acquired for the establishment of labour camp and camp for contractor will not be acquired for the overall duration of project construction period. Siting of camp will cause encroachment of agriculture land and alteration of drainage, solid waste and waste water problems. Impacts anticipated from construction camp establishment and operation include disposal of solid waste (organic waste, plastic and metal scrap, domestic effluent, etc.), competition on public facilities (drinking water sources, health facilities, schools, etc.), impairment of aesthetic value of the landscape (loss of vegetation, compaction and contamination of soil and land), poor sanitation (unhygienic latrine, poor drainage facility), transmission of communicable diseases (sexually transmitted diseases, vector borne diseases, etc.), poor water supply, use of alcohols, gambling and conflict with local communities. Probable locations for campsite are Ch. 01+900, 03+400, 07+100, 09+200, 10+950, 14+800, 28+500 and 35+900. Camp-site results in change of land use due to setting up of construction camp and waste generation during the construction. Contractor is required to properly remove all temporary structures built for operation of construction and workers camps. While doing so, the land will be brought back to original state.

All lands to be used construction camps will be limited in the public land. Hence, there will be minimal impact on private land. The necessary permission will be taken from local government or concerned authority before taking the land for intended purpose. The public land so used will be reclaimed to its original state after completion of construction activities as per land reclamation/rehabilitation plan

Obstruction to natural drainage pattern

Haphazard disposal of spoil and other construction materials into the natural drainage will prevent the natural flow of the drainage-triggering landslide and mass wasting at the downstream. Blockage of natural drainage path during construction or maintenance, for example, by environmentally hazardous disposal of spoil materials, may generate water depletion, water logging, a concentration of water flow as well as increase the speed of flow, which will be erosive in nature. Water channels, side drains, and culverts will be disturbed or

filled with construction debris and silt during the time of construction. Diversion as well as overloading existing drains results change in water flowing rendering scouring, gullying, bank cutting and soil erosion along the banks of natural drainages within the highway. The dramatic final effect of these incremental impacts usually cumulates in massive landslides, which in turn can cause slope instability and landslides. In absence of proper water management, a concentrated flow can lead to scouring, gullying and soil erosion at downstream land, which in turn can cause slope instability and trigger landslides. The effects of disruption can extend well beyond the immediate vicinity of a road or point sources of any immediate impact.

Table 0-7: List of existing bridges along the NNM highway

S.N.	Name of Bridge	Chainage
1.	Khatripauwa	4+139
2.	Naubise Khola Bridge	12+449
3.	Ganesh Khola Bridge	15+465
4.	Sopyang Khola Bridge	17+596
5.	Juge khola bridge	
6.	Agara Khola	23+380
7.	Khahare Khola	24+876
8.	Fedi Khola	26+953
9.	Dangdunge Khola bridge	27+235
10.	Khese Khola Bridge	30+665
11.	Machedi Khola Bridge	31+984
12.	Gardo Khola Bridge	35+628
13.	Jundi Khola Bridge	37+489
14.	Charaundi Khola Bridge	38+988
15.	Belkhu khola Bridge (Photo)	41+303
16.	Pokhare khola Bridge (Photo)	45+655
17.	Galaudi Khola Bridge	48+816
18.	Soti Khola Bridge	50+884
19.	Malekhu Khola Bridge	55+879
20.	Gomati Khola Bridge	62+442
21.	Charaundi Bridge (Photo- Soil and Sand extraction)	67+746
22.	Khatauti Bridge	70+686
23.	Hugdi Khola Bridge	74+206
24.	Mowa Khola Bridge (Photo)	78+387
25.	Dahaki Khola Bridge	84+844
26.	Bargang Khola Bridge	85+775
27.	Nagdi Khola Bridge	92+682

Source: Field Survey, 2017

Impact due to operation of borrow pits and quarries

Operation of borrows areas and quarries will cause some adverse impacts if left un-rehabilitated. It may pose risk to people, particularly children and animals of accidentally falling into it as well as become potential breeding ground for mosquitoes and vector born disease with the accumulation of stagnant water into it. Illegal quarrying will lead to unstable soil condition; destroy the landscape of the terrain, air and noise pollution. Quarry material will be sourced from existing licensed quarries. The dredging and use of dredged material, if involved, may have its impact in terms of localized sedimentation level increase and dispersion of pollutants present in the dredged material in the river water. Probable sources for

construction materials are located along the road alignment (borrow pits - Ch. 9+500, 14+200, 19+300, 27+400 31+200, 37+100, 42+500, 47+800, 53+400, 58+300, 64+300, 69+200, 74+500, 79+700, 85+500, 92+300, 99+700, 104+500, 109+800, X=565760, Y=3080662; X=575092, Y=3175020; X=616575, Y=3067747; X=568277, Y=3077149. X=617857, Y=3066820). Quarry of hill slopes is also likely during the time of construction; where further landslide may trigger due to over excavation of hill slopes.

Table 0-8: Quarry along NNM

SN	Chainage	Clay %	Silt %	Sand %	Grave l %	NM C	SG	MD D	OM C %	CBR %
1	9+500	0	9.4	18.6	72	23.64	2.62	21.6	7.3	7.1
2	14+200	0	20	20.6	59.4	9.13	2.66	21.5	5.5	35.5
3	19+300	0	55	14.9	30.1	18.93	2.64	18.9	7.9	7.7
4	27+400	0	71.2	19.9	8.9	10.99	2.68	19.1	10.9	8.5
5	31+200	0	37.3	59.5	3.2	14	2.65	21.5	5.9	13.3
6	37+100	2	22.3	33.6	42.1	21.1	2.54	18.8	11.5	5.8
7	42+500	0	21.6	23.7	54.7	4.01	2.67	21.3	6.2	16
8	47+800	0	13.2	51.2	35.6	4.63	2.67	21.4	7.4	11.4
9	53+400	0	33.6	59.2	7.2	6.75	2.67	21.6	5.3	12.4
10	58+300	0	41.2	57.4	1.3	9.07	2.68	20.9	7.3	8.7
11	64+300	0	28.2	54.5	17.2	11.28	2.68	21.4	6.4	11.3
12	69+200	0	15.2	31.7	53.1	5.02	2.69	21.9	6.5	34.2
13	74+500	0	6.9	92.2	0.9	12.25	2.66	19.1	10.8	8.6
14	79+700	0	30.1	62	7.9	6.45	2.68	19.9	9.2	12.2
15	85+500	0	17.1	36.5	46.4	5.36	2.67	21.9	7.7	10.2
16	92+300	0	22	40.5	37.5	6.22	2.67	21.7	6.5	23.2
17	99+700	0	23.2	57.4	19.5	6.11	2.69	21.4	6.4	13
18	104+500	0	10.8	33.2	56	2.56	2.67	21.9	5.6	31
19	109+800	0	25.3	39.2	35.5	7.89	2.69	21.8	6.7	23.4
20	X=565760, Y=3080662	0	24.3	33.6	42.1	2.99	2.67	21.7	7.1	7.2
21	X=575092, Y=3175020	0	38.6	29	32.2	11.88	2.68	19.5	11.1	8.1
22	X=616575, Y=3067747	0	81.5	17.9	0.6	34.79	2.6	20.6	8.4	11.8
23	X=568277, Y=3077149	0	73.5	13.7	12.7	29.82	2.62	18.5	11.6	10
24	X=617857, Y=3066820	0	57.8	24.4	17.8	33.74	2.61	18.8	11.8	12

Source: Detail design for the improvement of Kathmandu (Nagdhunga)-Naubise-Mugling Road and Bridges. Draft Design Report (Volume I-Main Report).

Impact from Stone Crushing Plants

Operation of Stone crushing plant will have noise pollution at vicinity. Number of crusher plant locations has been identified within the direct impact area; however, the operation of such plants will have dust, air, noise pollution at the vicinity of the proposed location. Excessive noise and dust from the plant will create disturbance to nearby settlements, schools, health posts, etc. is likely during the construction. Significant number of stone crushing plants are established all along the Trishuli River and are under operation, making Trishuli River water muddy with the direct disposal of effluent from such plants operating at the banks of the river.

Health and sanitation: chances of increase in transmission of disease from migrant workforce

During construction, non-local workers of contractor are likely to produce impact upon health and sanitation of the area. Impact due to unawareness, open defecation and direct disposal of wastes into the ambient environment by the non-local labours could produce significant impact upon the health of the locals. If sanitation issues will not address properly, there is likely spreading and emergence of disease among the labour in camp as well.

Traffic safety

As the construction of new bridges are just close to the downstream of existing bridges. Impact upon existing traffic is likely with the construction activities and plying of construction vehicle, storage of construction materials nearby to the existing highway.

Occupational health and safety (OHS)

During construction period, workers could be exposed to various health risks and hazards. The labours could encounter injuries and accidents due to lack of adequate safety measures. Proper instructions and handling training should be given to the workers before handling risky heavy equipment and at the mean time proper safety practices be made in order to escape any kind of possible mishaps during the construction phase. Typical health hazards could be encountered during rock cutting, slope cutting, working in bridge over river, equipment handling, river training, etc. Other possible health impacts are respiratory and eye diseases due to exposure to dust, and smoke. Similarly, unhygienic sanitary condition e.g. lacking of latrines and washing facilities and unsafe water location increases the chances of additional and often endemic diseases like diarrhea, dysentery and cholera.

Regarding the OHS of project workers, the project involves upgrading the road to 2-lane Asian Highway standard and therefore doesn't require for opening of tracks and hence no blasting will be employed. All the road upgrading works will be done with the use of mechanical equipment. The same will apply for the quarry works.

Safety of pedestrians with the plying of vehicles

Pedestrians along the bridge and approach roads will be vulnerable to accidents.

Disposal and construction waste management

The impact due to the haphazard disposal of spoil or construction wastes materials is likely, if there no proper management of construction waste. Approximately; 12000 cubic meters cum of cutting material will be generated from the excavation for approach road and foundations.

Transportation and stockpiling of construction materials

Transportation and stockpiling of construction materials are likely to be carried out on the public land near the riverbank close to the bridge. Minimum pollution and disturbance is likely due to frequent travelling of heavy vehicles during the transportation of construction materials at the project area.

Impacts associated with labour camp operation

Establishment of camps near the bank of the river is likely. Waste from the camps will be generated at the vicinity of camp location. Kitchen wastes, liquid wastes from temporary latrines, solid wastes, and rubbish are likely to be generated with the operation.

Spillage of chemical

Spillage are likely but at a low level during the operation of machines and vehicles for materials transport, for excavation. Also, there are chances of diesel spillage due to accidents of vehicle and during transportation of construction materials.

6.7 Land Acquisition, Restrictions of Land Use and Involuntary Resettlement (ESS5)

All lands to be used temporarily during construction such as for storage of construction materials, labour camps, crusher plants, stockpiling etc. will be located in public lands with permission from local government or concerned authority before using the land for intended purpose. The public land so used will be restored to its original state after completion of construction activities as per land restoration and rehabilitation plan.

6.7.1 Impacts at Construction Stage

Loss of Land and Assets

The NNM road upgrading works will have some significant negative impacts on land and assets loss. The major likely affected assets include private land and structures. Out of total families to be affected by the project (78), 68 households (87.18%) are likely to be affected by losing private structures and remaining 10 households (12.82) are likely to be affected by losing their private land. Project affected private structures are located at Naubise, Dharke, Koirale, Machhedikhola, Gardokhola, Maheshdobhan, Chiraudikhola, Poharekhola, Malekhu, Gomatikhola, Benighat, Charaudi, Khatautikhola, Hugdi, Mauwakhola, and Kuringhat.

Project Affected Private Structures

A total of 76 private structures attributing to 68 HHs along the NNM road section need to be acquired for the road construction and improvement works. The affected structures include 35 number of residential cum trade structures followed by residential structure (26 no), trade structure (13) and other structures (2). Here other structures include biogas plant cum toilet and cattle shed. Most of the affected structures are semi-modern and hut types.

Project Affected Private Land

As stated earlier, out of total project affected HHs (78), 10 of them will be directly affected by losing their private land. A small fraction of private land from the affected HHs (10 HHs) is required by the NNM road upgrading and improvement works. A total area of 0.2 ha private land needs to be acquired for the construction and improvement of NNM. The compensation at the market rate is likely be provided to the project affected private land. The private lands to be acquired for the NNM road upgrading are spatially distributed at 11 parcels. These affected HHs (10 no) are solely dependent on the lands to be acquired for their subsistence and they are likely to be impacted by losing their means of livelihoods through land acquisition.

Construction-Induced Impact

During construction phase, there may occur additional impact (loss of structure) due to vibration, back cutting, damage of crops due to deposition of construction material and waste generated from construction activities. The procedure for construction induced impacts will be followed by: inventory, assessment and measurement, CDC meeting with determination of compensation replacement value. The RAP provides procedures to follow in the case of construction-induced impacts, including the provision of compensation.

Project Affected Households Losing Residence and/or Businesses

Out of total 78 project affected HHs, 68 HHs have been identified to be affected by losing housing structures and remaining 10 HHs will be affected by losing their private lands outside the 50m ROW. Out of the total 78 project affected HHs, 57 HHs will be physically or economically displaced, with 23 HHs losing residences and 34 will lose residence and small business structures, and the remaining 11 HHs losing business structures only.

Project Affected Trade Losing HHs

Out of total private structure losing HHs (68), 48 belong to trade losing HHs along the NNM road alignment. The trades likely to be lost include small businesses like tea-shops, grocery, hotel enterprises and others alike. These small entrepreneurs and the salary-based workers involved in these businesses are likely to be impacted through upgrading the NNM road alignment.

Project Affected Public Structures

A total of 9 public structures are likely to be affected by upgrading NNM road. Out of this, 3 belong to temples, 2 public toilets, 2 public tap, 1 community building (study center) and waiting shed. Likewise, 1161 electric poles and numbers of drinking water supply pipes will be affected by the intervention of the project requiring relocation and rehabilitation. Due to damage of these public infrastructures, local communities will be impacted from access to public services.

Temporary Acquisition of Land

Temporary use of land will be required during road construction for contractor's campsites, labor force campsites, quarry sites, crusher plant and stock piling yard etc. Public land will be used for this purpose as much as possible. In case of unavailability of the public land, private land has to be acquired. The likely impact in acquiring private land will have adverse impact on the land losing HHs requiring compensation of the land and the crops.

Acquisition of land and structures for four new bridges

About 0.2 ha of additional land at Kahare, Chiraudi, Gomati and Hugdi area will be required for construction of four new bridges in the existing Naubise-Mugling road section. The construction of new bridges private and public structures will affect 4, 28 and 4 numbers of private structures at Chiraudi khola, Hugdi and Gomati Khola respectively. Total 36 private belongs to 34 HHs and 2 public structures will be affected during the construction of new bridges.

Conflict and disturbance due to non-local labour

Conflict between non-local labour and local people and with other construction crew members could be existed. The conflict might also be existed while hiring local people in the Project. This also could lengthen the construction period of the Project.

Disturbance in movement of local inhabitants

Movement of locals will be affected during the time of construction inhabited close to the proposed bridge locations.

Loss of utilities

Some utilities such as electric poles are likely to be affected with the construction of new proposed bridges. Approximately 3 poles are likely to be affected at each bridge construction site. In total, 10 electric poles are likely to be affected with the construction of new proposed bridges.

6.8 Biodiversity Conservation and Sustainable Management of Living Natural Resources (ESS-6)

ESS-6 in the current project covers forest and aquatic habitats, threatened and endangered wildlife, wildlife disturbance and poaching, and wildlife movement. The project will have generic impacts on the living natural resources along NNM corridor. The road corridor was built more than 40 years ago, human settlements, population growth and development already impacted the wildlife and biodiversity in the project area. During ESIA study, a few while critically endangered and endangered species of animals and plants were recorded in the project zone of influence (i.e., 50-m ROW, 300-m direct impact area from the center of the road, 2-km radius indirect impact area) these were all recorded outside the ROW and direct impact area and mainly within the 2-km indirect impact area along remaining forest patches near mountain streams and rivers. The project is not expected to adversely affect these species since they are not within the physical footprint of the project nor within the ROW and direct impact area. The project will only involve minimal forest clearance involving a total of 52 trees and some poles scattered in the entire NNM road corridor. There are no protected areas, wetlands, wildlife migration corridors and hotspots recorded within the zone of influence. Although, the project still can apply mitigation hierarchy in such places as speed limit, especially at night time. The most prominent impact on wildlife and other living resources may be exposed during construction period as disturbance and poaching; these risks should be adequately responded in mitigation plans.

6.8.1 Impacts at the Construction Stage

Construction serve as barrier to movement of migratory aquatic species

The construction of bridge foundation may serve as a barrier to the movement of migratory aquatic species. And the temporary diversion will also serve as a barrier to the movement of fishes.

Likely damage of aquatic habitats and animal due to extraction of sand and gravel from river

Sand and gravel extraction, initiated during construction, is a main cause for loss of habitats including spawning grounds, and feeding grounds of aquatic life (fish/ aquatic insects/ phytoplankton/ zooplanktons). The changes in river morphology, longitudinal profile and depth and velocity of water flow may also lead to adverse impacts on the aquatic life.

Use of fuel wood by the construction workers in construction activities

The constructions workers living in the camps are likely to use fuel wood for the cooking and also to some extent the use of fuel wood is likely in winter season for heating purpose.

Degradation in fish population due to construction workers involve in fishing

There may be degradation in the fish population if the construction workers will involve in fishing. If such activity occurs, then impact will be till few hundred meters upstream and downstream of the bridge location.

6.8.2 Impact at the Operation Stage

Impact on growth of the natural forest and vegetation

Undesired cumulative and induced impacts on the growth of the natural forest and vegetation may include accelerated logging, illegal extraction of timber and other forest products existed near to the proposed bridge construction site.

Impact upon aquatic life due to vehicle drop and spillage of oil and diesel in the river due to accident

Around 16 globally threatened fish species may be found in the Trishuli River. Their spawning sites might be impacted during bridge construction. The accidental spillage and discharge of harmful chemicals in river is likely due to the vehicle drop in the river. The impact upon aquatic system is likely for few hundred meters downstream from the proposed bridge site.

6.9 Indigenous People (ESS-7)

There are six indigenous peoples (IP) communities in the project area namely Newar, Gurung, Magar, Tamang, Chepang and Bhujel. These IP communities are located outside the ROW where the project interventions will take place. The project will not cause any impacts to their land, will not cause the relocation of any of the IP communities, and will not cause impacts to cultural heritage of the IP communities. The potential impacts and risks to these communities relate to labour influx, GBV and traffic safety. Therefore, according to the requirements of free, prior and informed consent (FPIC) under ESS7, FPIC is not required under this project component. An Indigenous Peoples Development Plan (IDPD) has been prepared to address any impacts to, and to promote project benefits for, the IP communities.

6.10 Cultural Heritage (ESS8)

ESS8 sets out general provisions on risks and impacts to tangible and intangible cultural heritage. During the ESIA, no archeologically and historically tangible heritages such as monasteries, or ancient monuments were found along the road alignment, and there will

otherwise be no impacts to tangible or intangible cultural project under the NNM Project. There are three small temples/shrines within the ROW, however they are newly constructed by the families along the right of way, and as advised during stakeholder consultations, are not of cultural importance or significance. They will be relocated to the nearby public land in consultation with the respective families along the right of way, as outlined in the RAP. A Chance-finds procedures has been included in the NNM Road Environmental and Social Management Plan (ESMP) which will be followed if, during construction, there are any chance finds. Chance find procedures will also be included in the bidding documents, in the contractor contract and in the contractor's ESMP (C-ESMP).

Chapter 7: Environmental and Social Management Measures

The road improvement works will be done within the existing ROW with minimal vegetation clearance and additional land acquisition. Mitigation measures include restitution for evaluated risks and impacts based on the mitigation hierarchy (MH) (**Figure 0-1**).

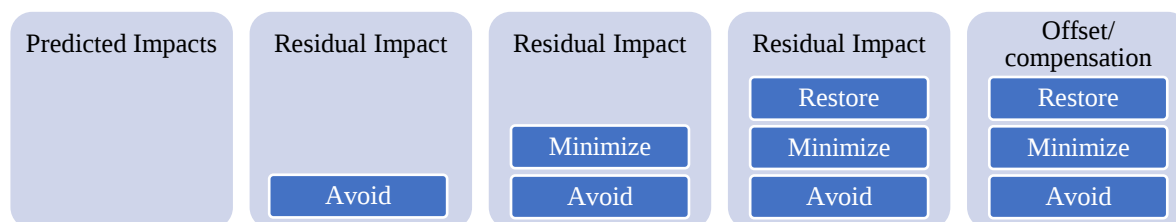


Figure 0-1: Mitigation Hierarchy and its application principles (adapted from BBOP, 2009)

7.1 Application of the Mitigation Hierarchy in the NNM road

Mitigation measures proposed herein are the result of an iterative process that took place between the environmental, biological and socio-economic and cultural environment impacts prediction.

Avoidance- Analysis of alternatives, Community involvement, “No go areas”, Good construction practices, Timing of construction (avoiding of breeding seasons), Regular, timely maintenance. In the case of NNM, this is avoidance to build 4-lane highway, taking into account the fragile physical conditions and threat of landslides.

Minimizing- Community involvement, Impact identification, Project design with incorporated MH, Good construction practices, Integration of new improved technologies, Regular monitoring, Maintenance practices, Community involvement

Mitigation/Rehabilitation - Proposed targeted measures, Community involvement, Good construction practices, Monitoring

Compensation or offsets - Create compensation plan, habitat management plan, Implemented compensation plans (RAPs), establishment of tree nurseries, Arboriculture along the road.

7.2 Plan for Beneficial Impact Augmentation Measures:

The following matrix presents Environmental and Social Management Plan for augmentation measures for the beneficial impacts undertaken.

Table 0-1: Benefits augmentation and enhancement measures

Activities/ Impact/ Issue	Augmentation and enhancement measures	Responsible agency	Verification method
Construction phase			
Physical environment			
Improved road infrastructure	Construction of roadside centre and facilities	Construction contractor, proponent – DCID, DOR	Site visits, stakeholder consultations
Biological environment			
Road signs and compensatory tree nurseries	Placing of speed-limit signs and establishment of tree nurseries	Construction contractor, proponent - DCID, DOR	Site visit and monitoring, stakeholder consultations
Socio-economic and cultural environment			
Employment generation	Preferences to employ local workers	Construction contractor, Proponent - DCID, DOR	Site visits, interactions with locals

Activities/ Impact/ Issue	Augmentation and enhancement measures	Responsible agency	Verification method
Technical skills and know-how	Awareness and on-job training	Construction contractor, proponent – DCID, DOR	Site visits, training manuals
New income generation	New job and business opportunities	Local municipalities and communities	Monitoring and evaluation of project area
Operation phase			
Physical environment			
Improved road maintenance	Upgraded bio-engineering structure, stabilized slopes	DOR's respective Divisional Road Offices (DRO)	Site visit and monitoring, interactions with local stakeholders
Improved transportation and transport efficiency	Smooth transport operations, established road furniture in place	DOR's respective Divisional Road Offices (DRO)	Site visits, monitoring, interactions with locals
During operation phase number of vehicles will be increased however, as projected in detailed GHG calculation, emission will be reduced due to improved road efficiency.	Local communities and other road users	DOR's respective Divisional Road Offices (DRO)	Arboriculture will be carried out to further improve the air quality. Regular emission tests Control of congestions
Improved access to services	Maintenance and operations of service centres, toilets, etc.	DOR's respective Divisional Road Offices (DRO)	Site visits, monitoring, interactions with service center staff
Biological environment			
Operations of tree nurseries and green zones	Maintenance of tree nurseries and green zones along the road	Proponent – DCID, DOR, CFUGs	Monitoring and interaction with CFUGs
Socio-economic and cultural environment			
Transport and road safety	Maintenance of road furniture, awareness raising	Construction contractor, Proponent – DCID, DOR	Site visits, monitoring and interactions with local stakeholders
Efficient transportation	Better access to social services, enhanced market cooperation opportunities, linkage to other districts	Construction contractor, Proponent – DCID, DOR	Site visits, monitoring and interactions with local stakeholders
Continued employment generation	Improved transportation and service centres, women and gender specific benefits	Local municipalities and other local stakeholders	Site visits, monitoring and interactions with local stakeholders and authorities
New income generation opportunities	Enhanced and diversified local economy, benefits for tourism and other businesses, gender specific benefits	Local municipalities and other stakeholder groups	Site visits, monitoring and interactions with local stakeholders and authorities
Increase in land value	Enhance in living standards and life style, alleviation of poverty	Local municipalities and other stakeholder groups	Site visits, monitoring and interactions with local stakeholders and authorities

7.3 Plan for Adverse Impact Mitigation Measures

Proposed mitigation measures for identified adverse impacts are presented below. They are divided on two sections – mitigation measures for generic impacts and mitigation measures for site-specific impacts. Most of the proposed mitigation measures were considered to be the civil Engineering, presented in the Project costs and also have been briefly underlined in the

following Matrix. They highlight activities to avoid negative impacts, when possible, provide recommendations to reduce and minimize impacts during pre-construction, construction and operation stages, underline opportunities for compensation, remediation and offset the adverse impacts of project implementation.

Table 0-2: Matrix of generic impacts and mitigation measures along NNM road and its management in accordance with WB ESF

Generic risks and impacts	Sensitive receptors	Location (Chainage)	Mitigation measures for generic risks and impacts
Pre-construction Stage			
Erosion or mass wasting resulted from site preparation	Agricultural fields and soils Physical and biological environment Local communities Landscape aesthetics	Along NNM	Erosion control plan with bioengineering and reinforcement structures will be implemented and monitored Proper restoration of affected landscape
Landscape aesthetic	Flora & Fauna and Local community	Along NNM, disturbed sites	Develop a spoil disposal management plan and stockpiling plan to minimize the impact during construction and rehabilitate landscape after construction as per above mentioned plan. Relocation and restoration of all affected utilities taking the community into confidence with meaningful consultation.
Construction Stage			
Greenhouse Gas (GHG) Emission	Local communities and other road users	Along NNM	Recommendations for fuel efficient machinery Compensatory plantations (1:25) as per GoN's requirement
Air and Noise Pollution and vibration impact The movement of vehicle, construction activities will be the major sources of noise during construction	Local communities, residential areas especially schools, hospitals. etc	Along NNM right of as appropriate	Develop an Air and Noise Quality Management Plan to minimize vehicle emissions, manage fugitive dust, noise and vibration, especially in proximity of community places. Barricade of construction area Dust masks available to labour workers, sprinkling of water along the dusty road during road excavation twice a day. Manage and avoid direct disposal of effluent from batching plant.
Solid waste management	Landscape aesthetic Local communities Forest and aquatic habitat Wildlife Road users	Along NNM	Develop a Solid Waste Management Plan to manage solid wastes during road construction and operations. Ensure appropriate disposal sites for muck and rock cuttings as well as proper management of solid and hazardous waste. Coordination with local urban and rural municipalities
Impact due to Quarrying of construction materials	Local communities	Shown in Map	- Contractors will be prohibited from opening new areas along Trishuli River for extracting and/or sourcing sands, gravels, stones and boulders. They will also be prohibited from extracting and/or sourcing materials in sections of the Trishuli river that remain in relatively good natural conditions and areas that support fish of conservation importance such as the Golden Mahseer. - regularly monitor material extraction to ensure proper implementation

Generic risks and impacts	Sensitive receptors	Location (Chainage)	Mitigation measures for generic risks and impacts
			of the Materials Sourcing Plans. • Contractor will not be allowed to extract, source or collect sand, gravel and boulders within 5-10 m distance of the left embankment of the Trishuli River. Not more than a depth of 1m of excavation will be allowed while mining. • Most part of the road alignment is located along the Trishuli river. During the construction, series of swamps will be constructed along the river bank to fetch water for construction away from water line to avoid impact to migratory fish and spawning grounds. • The Forest Users Groups of community forests adjoining Trishuli River will be made aware for not allowing excess mining in their corresponding reaches of Trishuli River. They will also be mobilized in the monitoring of contractors. • All contractors will be required to submit their Construction Materials Sourcing Plans to the PIU, CSC and the World Bank for prior approval before carrying out material extraction. No material extraction will be done by any of the Contractors until the Materials Sourcing Plan is approved by the PIU, CSC and the World Bank. • The PIU and CSC will Implementation of compensatory plantation program in coordination with the District Forest Office, respective Rural Municipalities/Municipalities and Community Forest Users Groups.
Impact on fish population	Commonly available <i>Cyprinid</i> (such as silver carp) species, catfish and other fish species occurring in rivers	Perennial Water-bodies along the NNM where bridge construction and improvement is planned	• Contractors will be prohibited from opening new areas along Trishuli River for extracting and/or sourcing sands, gravels, stones and boulders. They will also be prohibited from extracting and/or sourcing materials in sections of the Trishuli river that remain in relatively good natural conditions and areas that support healthy fish population. • Require contractors to implement measures such as installation of silt trap, check dams, gabions, etc. • All contractors will be required to submit their Construction Materials Sourcing Plans to the PIU, CSC and the World Bank for prior approval before carrying out material extraction. No material extraction will be done by any of the Contractors until the Materials Sourcing Plan is

Generic risks and impacts	Sensitive receptors	Location (Chainage)	Mitigation measures for generic risks and impacts
			approved by the PIU, CSC and the World Bank. • The PIU and CSC will regularly monitor material extraction to ensure proper implementation of the Materials Sourcing Plans.
Disturbance and poaching of wildlife	Wildlife Local communities	Around camp-sites	• Instructions and orientation to workers; • Enforcement and control of Anti-poaching regulations; • Awareness campaigns; Planning of rural development • Proper camp waste (Solid and Effluent) management
Impact on wildlife movement	Small vertebrates (snakes, lizards, amphibians) Monkeys and other road-attracted animals	Forest areas (large forest patches)	• Established speed limitation; • Installation of signages in appropriate locations; • Awareness to the drivers;
Working conditions	Construction and labour campsites Local and outside employees Work force Local community	Construction sites	• Require compliance with WBG guidance on Worker Accommodations for contracted workers. • Compliance with national and international labour regulations and WB guidance on Worker Accommodation for EPC and contracted workers. • Labour Management Procedure (LMP). • Established complaint mechanisms (GRM) • Provide workers transportation to and from the project sites. • Implement “Zero harm” policy at the project sites. • Adopt safety measures for workers like shinning jackets (aprons), boots, gloves, helmet etc.
Human Trafficking	Construction and labour campsites Local and outside employees Labour force, mostly female workers Local community	Campsites and construction sites Settlements of local communities	• Vigilance from law enforcement authority and compliance with the labour laws. • Display of hoarding boards about anti trafficking • Community orientation focusing young women and girls. • Establish Worker Camp Operations Guidelines • Worker Code of Conduct to avoid issues of GBV Action Plan • Establish compliant mechanisms.
Worker accommodations	Labour campsites Local community	Campsites and construction sites	• Labour camp management plan in compliance with prevailing GoN’s labour act/ regulation and as per WB ESS 2.
Child and Forced	Children under 14-years old	Campsites and construction sites	• Provision in contract document, prohibiting child labour in compliance

Generic risks and impacts	Sensitive receptors	Location (Chainage)	Mitigation measures for generic risks and impacts
Labour	Laborers Construction and labour campsites Local community		- with the GoN's Act related to Children (2075), - Labour Management Procedure (LMP) - Information dissemination on avoidance of child and forced labourers
Potential hazards caused by bitumen and other toxic chemicals	Flora and Fauna Local communities Workers and campsites Travelling passengers	Along NNM Construction sites and camps	- Develop a Hazardous Materials Management Plan to manage hazardous material use, storage, transport, and disposal. - Handling chemicals properly. Storage of chemicals 100 meters away from any water sources.
Pollution of water resources	Flora & Fauna Quality of drinking water Ecosystem services Wellbeing of local communities	All rivers and rivulets	- Develop a Water Quality Management Plan. - Acquired consent with the locals in order to use available water sources. - Proper drainage structures, construction of Soak pit or retention lagoon before discharging waste water in to main water body, management of garbage and debris. - Awareness to local communities and construction workers
Community Exposure to Health Issues and Labor Influx:	Local communities, especially women Labour force	Labour camps Construction sites Major market places Major settlements (Mugling, Maleku, Naubise, etc.)	- Implement the Labor Management Procedures developed by the project; - Community awareness and sensitization with emphasis to women and young girls. - Promote health seeking behaviours. - Identify areas along the access road prone to landslides and provide appropriate engineering controls. - Adopt a Worker Code of Conduct that establishes how workers should interact with local communities. - Adopt a Grievance Mechanism to allow local residents to file complaints. - Strengthening and collaboration with the local health facility and onsite primary health care facility or surveillances - Waste management plan.
Construction-induced Impacts to nearby structures	Local communities	Along the right of way	- Baseline survey of the structures by the contractors before the construction started - Create awareness on accessing project level GRM - If damage complains are received, CSC will investigate and measure the damage. CSC will verify the implementation of measures

Generic risks and impacts	Sensitive receptors	Location (Chainage)	Mitigation measures for generic risks and impacts
			implemented by the contractors Contractors will implement the measure proposed by the CSC
Ecosystem Services	Local communities Forest and aquatic habitats Wildlife Watershed	Quarry sites Borrow pits Construction sites Labour camps Major settlement areas	- Establish Worker Camp Operations Guidelines and Worker Code of Conduct to prevent impact on exploitation of natural resources. Economic diversification programs. - Identify and evaluate Project effects on ecosystem services and develop mitigation measures for any significant impacts
Occupational Health and Safety	Local and outside employees, including labours of quarry sites and construction materials Local community	Along NNM and construction sites and labour camps	- Implement OHS requirements in the Labor Management Procedures; - Include provision in EPC contract requiring H&S Plan, Operational guideline, appropriate staffing, and reporting requirements for the EPC. - Enhance capacity of labourers and staffs and stakeholders including local health institutions. Trained managers and responsible personnel - Emergency Management Plan - Accident and Disease notification and management plan - OHS monitoring, inspection and performance audit framework. - Appropriate staffing, and reporting requirements for the EPC, contracted workers, and supply chain workers.
Land use change and loss of productive topsoil	Local communities Biodiversity (threat of invasive plant species exposure) Forest and water-users and farmers Local entrepreneurs	Along NNM	- Preservation of topsoil and rehabilitation after construction; re-plantation, selected construction time to avoid severe impact on agriculture. - Improvement of land use and top soil
Impact on tangible and intangible heritage	Local communities Indigenous communities	N/A	Assessment of ESS-8 during field studies confirmed that no any tangible/ intangible archeologically important heritage will be impacted. In case of chance finding, the procedure will be followed.
Operation Stage			
Cumulative Impacts	Ecosystem services and land use Forest and aquatic habitats, wildlife movement corridors Human well-being, residential areas	Along NNM	- Planning of regional and local development and land use - Afforestation programmes - Implementation of Wildlife Friendly Roads across DoR's portfolio - Coordinated and collaborative development projects - Cooperation and information dissemination among interested stakeholders about climate change

Generic risks and impacts	Sensitive receptors	Location (Chainage)	Mitigation measures for generic risks and impacts
			Stakeholder engagement in accordance with SEP
Traffic related accidents and community health and safety	Local communities and other road users Motorists and pedestrians Wildlife Travelling passengers Project labourers and road workers (operations and maintenance)	Dense settlements such as Naubise, Khanikhola, Dharke, Gajuri, Malekhu etc. Local roads (primary supply sites and labour camp sites)	- Road safety audits were conducted in NNM road during the feasibility stage and during the detailed design stage. - The detailed design of NNM road improvements integrates the findings and recommendations of the road safety audits undertaken in multiple stages - Road safety will also be undertaken post completion works - Road safety awareness - Speed control and regulations (especially in populated areas, near schools and other public places). - Road crossing infrastructures incorporating principal of universal access. - Speed control mechanisms at place such as zebra cross, speed breakers, speed limits at crowded places etc. - Establishment of traffic signals, GPS tracking and CC cameras for speed control for public buses plying the highway. - Vehicle maintenance and inspection. Control loud horns to avoid sound pollution. - Training of first-aid services in the case of accident. - Manage temporary bypass while constructing the road. - Road safety awareness trainings to general public. - Capacity enhancement for traffic police and locals. - Animal signs (monkeys) in the forested places with speed control on specific distance (5-10 km)
Exclusion of vulnerable and disadvantaged groups from benefits	Vulnerable and disadvantaged groups	Settlements and HHs of vulnerable and disadvantaged groups	- Public awareness, work with local municipalities and governments, facilitating access to benefits - Implementation of mitigation measures prescribed in Indigenous People's Development Plan (IPDP) and ESMP
Noise pollution: The increased number of heavy vehicles plying in the Highway and the increased	Flora & Fauna Local communities Road users Road labours and other workers	Along NNM	- Implementation of No Blowing of Horn Zones particularly in settlement areas - Installation of Signages - Monitoring noise level maintained at national standard

Generic risks and impacts	Sensitive receptors	Location (Chainage)	Mitigation measures for generic risks and impacts
commercial and industrial activities			Planting of trees along the RoW as noise absorbers
Gender Based Violence (GBV) (Sexual Exploitation and Abuse (SEA) and Sexual Harrassment (SH))	Female workers. – workers Women (especially young women) of the local community		- Community sensitization. - Socio-economic development of women. - Orientation to labour force. - Code and conduct to guide the workers on how to relate with the community. - Orientation of Supervision Consultant, and Contractors on GBV - Mapping of GBV service providers for prevention and response. - Develop and implement a GBV Action Plan.

Table 0-3: Site-specific impacts and mitigation measures along NNM road and its management in accordance with WB ESF

Site-specific risks and impacts	Sensitive receptors	Location (Chainage)	Site-specific mitigation measures
Pre-construction Stage			
Landslides, Slope Destabilization and Soil Erosion	Road Water bodies Local communities Road users/travelling passengers Wildlife and forest habitats	Major mass movements along the road alignment are known: Nagdhunga-Naubise Package 1 (0+000 to 12+260) Naubise-Malekhu Bridge Package 2 (0+000 to 43+542) Malekhu Bridge-Mugling Package 3 (43+542 to 82+403)	- Implementation of Bioengineering and retaining structures specifically RCC Modified Wall, Geo-Grid Wall and Semi-Flexible 3D Galvanized Steel Mat. Other measures such as terracing and weep holes to maintain sub-surface drainages etc. will also be implemented - Avoid haphazard excavation of slopes. - Construction of check dams on existing natural drainages.
Impact on Forest habitat, including	Wildlife Local communities CFUGs	52 trees ¹⁷ and 2253 poles along the RoW will be cut down, mostly in the community forests.	Compensatory plantation (1:25 as per GoN's requirement) for each felled tree; selection of native trees, establishment of nurseries etc.

¹⁷ The number of trees may increase due the growth of pole into tree size during the project implementation period. The compensatory plantation will incorporate such change in number.

Site-specific risks and impacts	Sensitive receptors	Location (Chainage)	Site-specific mitigation measures
Loss of private land	• Project affected HHs (10 HHs). • 4 HHs comprises to Janajatis and 6 HHs belongs to Brahmin communities. • 11 parcels and 2092.09 square meter of land • About 0.32 ha of cultivated land is likely to be affected permanently, which will decrease the production of agricultural products with estimated loss of approximately, 1.2 tons	Locations: Naubise and Benighat. Chainages: 2+270; 2+280; 2+300; 3+310; 3+330; 3+340; 3+350; 50+160; 50+170; 50+180 and 50+190.	• Prepare and implement a Resettlement Action Plan (RAP) in accordance with national legislation and World Bank ESS 5
Loss of private structures	68 households are likely to lose 76 private structures (35 HHs losing residence cum trade structures; 26 HHs losing residential structures; 13 losing trade structures and 2 HHs losing other structures.	• Locations: Naubise, Dharke, Machhedikhola, Gardokhola, Chiradikhola, Pokharekhola, Malekhu, Gomatikhola, Benighat, Charaudi, Khataudikhola, Hugdi, Mauwakhola, and Kuringhat along NNM road alignment. • Chainages: 00+200; 02+900, 910, 920, 930, 960, ; 12+300; 19+450, 500, 550; 23+220; 25+00; 26+600;; 33+300; 45+200; 50+100; 51+150; 55+350; 55+355; 55+360; 55+365; 55+370; 55+375; 55+380; 55+385; 55+390; 55+395; 55+400; 55+405; 55+410; 55+415; 55+420; 55+425; 55+550; 58+400; 61+900; 62+00; 62+050; 62+050; 62+100;, 62+120; 62+160; 62+180; 66+100; 73+530; 73+540; 73+570, 580 and 590.	• Prepare and implement a Resettlement Action Plan (RAP) in accordance with national legislation and World Bank ESS 5
Project Affected	• Out of 78 project affected HHs,	• Locations: Machhedikhola,	• Implementation of the ESMP.

Site-specific risks and impacts	Sensitive receptors	Location (Chainage)	Site-specific mitigation measures
vulnerable HHs	6 HHs belong to vulnerable category. • Out of total vulnerable HHs (16), 4 women headed HHs and 2 HHs comprise Dalits. • Out of total women headed HHs (4), 3 belong to Brahmins and 1 belongs to Chhetri.	Gomatikhola, Hugdi and Kuringhat • Chainages: 19+500, 550; 25+00; 50+100; 61+900; 62+100 and 73+540.	• Relocation, rehabilitation and restoration. • Provide livelihood restoration training and additional support to such project affected vulnerable HHs including the women of project affected HHs.
Project Affected IP HHs	• Out of 78 project affected HHs, 23 HHs belong to vulnerable category.	• Locations: Machhedikhola, Gomatikhola, Hugdi and Kuringhat	• Prepare and implement IPDP in accordance with ESS 5
Loss of Community /Public Infrastructures	• A total of 9 public structures will be affected by upgrading NNM road. • Out of this, 3 belong to temples, 2 public toilets, 2 public tap, 1 community building (study center) and waiting shed. • 1161 electric poles are likely to be affected. • Community drinking water supply pipes damaged • 1'' dia. pipe: GI-0.64 and PVC-34.5 • 0.5'' dia. pipe: GI-0 and PVC-2 • 1.5'' dia. pipe: GI-0 and PVC-0.8 • 2'' dia.pipe: GI-0 and PVC-5.62	Location: Koirale; Maheshdobhan; Malekhu; Benighat, Charaudi and Hugdi. Chainage: 12+300; 25+00; 44+050; 50+900; 50+950; 51+150; 55+380 and 61+850. Locations: Nagdhunga to Naubise; Naubise – Baireni; Baireni to Bishaltar; and Bishaltar to Mugling. Chainage: 0+000-12+200; 0+000-24+200; 24+200-3+000; and 53+000-82+000. Location: Nagdhunga to Naubise; Naubise – Baireni; Baireni to Bishaltar; and Bishaltar to Mugling. Chainage: 0+000~ 12+200; 0+000~24+200; 24+200-3+00; and 53+000~82+000.	• Relocation, rehabilitation and restoration. • Relocation of electric poles, water supply pipes, irrigation canals etc.
Construction Stage			
Impact due to operation of borrow pits	Local communities, including children Project labours	Ch. 9+500, 14+200, 19+300, 27+400 31+200, 37+100, 42+500, 47+800, 53+400, 58+300, 64+300, 69+200,	• Avoid haphazard quarry along the riverbank and hills. Permanent barricade at quarry location for safety, established safety signage boards, and installed noise barrier.

Site-specific risks and impacts	Sensitive receptors	Location (Chainage)	Site-specific mitigation measures
	Wildlife	74+500, 79+700, 85+500, 92+300, 99+700, 104+500, 109+800, X=565760, Y=3080662; X=575092, Y=3175020; X=616575, Y=3067747; X=568277, Y=3077149. X=617857, Y=3066820).	Prepared borrow pit operation plan and obtained approval from supervision engineers prior to operation of quarry.
Impact due to quarrying of construction materials	Local communities Landscape Water Fish and other aquatic animals	The risks related to uncontrolled extraction of river bed materials from Trishuli River and other water bodies. Most part of the road alignment is located along the Trishuli river.	- Contractor will not be allowed to collect sand, gravel and boulders within 5-10 m distance of the right embankment of the Trishuli River. Not more than a depth of 1m of excavation will be allowed while mining. The project authority and the Environmental consultant will regularly monitor this. - During the construction, siltation measures such as silt traps, gabions will be constructed along the river banks. - The Forest Users Groups of community forests adjoining Trishuli River will be made aware for not allowing excess mining in their corresponding reaches of Trishuli River. - Implementation of plantation program on the right bank of Trishuli River in coordination with the District Forest Office, respective RM/M and Community Forest Users Groups - Implementation of site restoration plan - All contractors will be required to submit their Construction Materials Sourcing Plans to the PIU, CSC and the World Bank for prior approval before carrying out material extraction. No material extraction will be done by any of the Contractors until the Materials Sourcing Plan is approved by the PIU, CSC and the World Bank. - The PIU and CSC will regularly monitor material extraction to ensure proper implementation of the Materials Sourcing Plans.
Impact from Stone Crushing Plants producing dust, air, noise pollution and causing adverse	Road users and workers Local communities Wildlife	At certain strategic locations along the road alignment. Place the chainage for location.	- Operational Plans in place prior to operation - Avoid establishment onear schools and settlements.

Site-specific risks and impacts	Sensitive receptors	Location (Chainage)	Site-specific mitigation measures
impact at the vicinity			
Impacts from stockpiling and transportation of construction materials affecting downhill	Trishuli River, Mahesh khola and other streams Cultivated lands Local communities	Place the chainage for location.	Stockpile materials covered with tarpaulin, sprinkling of water carried out near and around the stockpile to avoid erosion; proper barricade and security guard for the area.
Operation Stage			
Instability of the hill slopes and landslides	Road Water bodies Local communities Road users/travelling passengers	Krishnabhir and Jogimara area including other impact area along the alignment are Simle, after Belkhu khola at Adamghat vegetated area of 850 meters, 1300m at Phurke khola at Dhading bridge junction, about 1200 meters along the Huilingtar area – same location at the construction	- Monitoring and management of landslide-prone areas - Bio-engineering and slope protection and maintenance works

7.4 Environmental and Social Management Plan (ESMP)

The ESMP provides a description of the various environment and social management measures and their implementation arrangements during Construction & Operation Phases. The ESMP and responsibilities for its implementation have been described below.

Referencing to the potential negative impacts of the project as described in Tables 7.2 and 7.3, the identified compensation, mitigation and enhancement measures during the pre-construction stage will be implemented by Project Implementation Unit (PMU) and by Contractor as follows:

Pre-construction Activities by Contractor

The Contractor after mobilization at the pre-construction stage will be responsible for logistic, counting planning and site preparation to construction. The Contractor activities include review of contract packages for civil works implementation and development of work plan, following to legislative provisions and existing practices. Along with other preparation activities (such as procurement of equipment for road works, etc.), the Contractor will prepare

- i. Erosion control plan with bioengineering and reinforcement structures;
- ii. A stockpiling and excavation management plan to minimize effect during construction and rehabilitate landscape after construction;
- iii. Labor camp management plan in line with LMP;
- iv. Code of Conduct for workers;
- v. Occupational Health & Safety (OHS) Plan,
- vi. Community health and safety management plan
- vii. Water and Waste Management Plan
- viii. Pollution prevention management plan
- ix. Traffic/ Road Safety Management Plan,
- x. Quarry/ borrow area operation and rehabilitation plan,
- xi. Site Restoration Plans in accordance with GoN and WB' Guideline
- xii. Construction management plan with proper schedule
- xiii. Emergency preparedness management plan
- xiv. Gender Based Violence (GBV) action plan
- xv. Project information sharing and communication plan

The Contractor will be also responsible to identify and select of material resources (quarry and borrow materials, water, sand) and debris disposal locations, based on recommendations of PIU (DoR) as well as planning of traffic diversions and detours during construction time. All prepared plans will be reviewed and approved by CSC, PIU (DoR) and the World Bank prior to start of construction works.

Disruption to road traffic and other access routes will be minimized in consultation with local authorities and representatives. Contractor will be responsible to prepare and update traffic management plans prior to the construction activities. Contractor will follow local laws and regulations as per DoR.

Contractor will comply with IFC Accommodation Guideline 2009 (Workers' accommodation: processes and standards; A guidance notes by IFC and the EBRD for the establishment of constructed related camps for labour and engineers.

7.3.1 Construction Stage Activities by Contractor

Construction stage activities will require careful management of generic and site-specific environmental impacts. They will include (i) Implementation of site-specific mitigation measures as recommended; (ii) Monitoring the quality of environmental parameters along the construction sites (air, noise, water and soil). The Contractor's environmental and Social responsibilities will be prescribed in the Tender Documents and later in documents on the award of the Contract. They would include the need to adhere the social and environmental clauses in the Contract and the measures outlined in the ESMP.

The Contractor will comply with all statutory requirements, environmental and Social regulations and environmental quality standards as stated in the Environment Protection Act, 2019 of GoN; for any work in the community forests (CFs) adhere to the Forest Act, 2019 and rules prescribed by the CFs' authorities, GoN and Nepal environmental guidelines relevant to the project and the updated ESMP. Necessary permissions for contractor personnel to enter community forests must be obtained either from MoFE or from Community Forest User Groups. Contractor shall bear all costs associated with environmental pollution avoidance and environmental mitigation, including clean-up operations, if necessary, within community forest areas.

Following the developed recommendations, the Contractor will employ local labour for the works to the maximum possible extent. No children under age of 14 should be employed and children between 14 and 18 should not be engaged in hazardous works, in compliance with the labour rules in Nepal. All construction sites will be maintained in clean and safe conditions, providing appropriate facilities for temporary storage of all wastes before transportation and disposal. All generated wastes will be disposed in environmentally acceptable manner, including consideration of the nature and location of disposal sites with least environmental impact. Precautionary measures should be taken, when handling and storing fuels and lubricants, to avoid causing environmental pollution, including establishment of contingency plans for clean up in the case of spillage.

Adequate supply of water for drinking and washing purposes will be provided for all site personnel. Drinking water quality should comply with GoN standards and WHO guideline value. Adequate sanitation facilities shall be provided on all construction sites, contractor's office(s) etc., when established. Disposal from all sanitary systems shall be undertaken to avoid causing environmental pollution. Wastewater should be routed through suitable sanitary facilities and soak ways, without contaminating either ground or surface water or causing a health risk.

7.3.2 Operation Stage Activities by PIU

Monitoring and maintenance of the environmental and social attributes will be conducted by PIU (DoR) and Contractor in the manner outlined in the monitoring plan under supervision of the responsible engineer.

- i. The proponent will carry out regular maintenance work of road and bridges when and where necessary. Periodic maintenance will be carried out to maintain road clean and safe, especially prior to and post monsoon season.
- ii. Length man will be recruited in every kilometer along the new and existing alignment to maintain road clean and maintain roadside drainage in working condition.
- iii. The proponent together with other stakeholder such as community forest user groups, forest area office and Division Forest Office will carry out monitoring of plants planted as compensation.
- iv. Proponent will maintain and renovate all roadside furniture regularly to provide roadside services and facilities.
- v. Proponent will carry out regular monitoring of traffic flow and regular maintenance of traffic signals as well as install Surveillance cameras for regular monitoring and will maintain safety along the road alignment.

Table 0-4 and **Table 0-5** below present the Environmental and Social Management Plan and Environmental Monitoring Plan respectively.

Table 0-4: Environmental and Social Management Plan

Impacts	Mitigation Measures	Responsible Agency
Pre-construction stage		
Erosion or mass wasting resulted from site preparation, Landscape aesthetic, Slope Destabilization and Soil Erosion	• Implementation of Bioengineering and retaining structures and slope protection works such as RCC Modified Wall, Geo-Grid Wall, Semi-Flexible 3D Galvanized Steel Mat, terracing and weep holes to maintain sub-surface drainages etc. • Planning the works and not undertaking it during the rainy season. • Develop a spoil disposal management plan and stockpiling plan to minimize the impact during construction and rehabilitate landscape after construction as per above mentioned plan. • Construction of check dams, silt traps, gabions on existing natural drainages.	DCID-DoR, CSC and CC
Impact on Forest due to tree felling	• Compensatory plantation (1:25 as per GoN's requirement) for each felled tree; selection of native trees, establishment of nurseries etc.	DCID-DoR, CSC, CC and DFO
Loss of private land	• Prepare and implement a Resettlement Action Plan (RAP) in accordance with national legislation and World Bank ESS 5	DCID-DoR
Loss of private structures	• Prepare and implement a Resettlement Action Plan (RAP) in accordance with national legislation and World Bank ESS 5	DCID-DoR
Project Affected vulnerable HHs	• Implementation of the ESMP • Implementation of relocation, rehabilitation and restoration measures. • Provide livelihood restoration training and additional support to such project affected vulnerable HHs including the women of project affected HHs.	DCID-DoR
IP communities in project area	• Prepare and implement an IPDP in accordance with ESS 7	DCID-DoR
Loss of Community /Public Infrastructures	• Relocation, rehabilitation and restoration according to the RAP. • Relocation of electric poles, water supply pipes, irrigation canals etc.	DCID-DoR
Construction Stage		
Greenhouse Gas (GHG) Emission reduction	• Require use of fuel efficient machinery and equipment in the bidding documents and contractors contract. • Arboriculture along the alignment for carbon sequestration • Compensatory plantation (1:25 as per GoN's requirement)	DCID-DoR, CSC, CFUGs
Air, Noise and vibration impact	• Develop an Air and Noise Quality Management Plan to minimize vehicle emissions, manage fugitive dust, noise and vibration, especially in proximity of	DCID-DoR, CSC

Impacts	Mitigation Measures	Responsible Agency
	community places. • Barricade of construction area • Dust masks available to labour workers, sprinkling of water along the dusty road during road excavation on a regular basis as per the requirement. • Manage and avoid direct disposal of effluent from batching plant.	
Solid waste management	• Develop a Solid Waste Management Plan to manage solid wastes during road construction and operations. Ensure appropriate disposal sites for muck and rock cuttings as well as proper management of solid and hazardous waste.	DCID-DoR, CSC
Impact due to Quarrying of construction materials	• Contractors will be prohibited from opening new areas along Trishuli River for extracting and/or sourcing sands, gravels, stones and boulders. They will also be prohibited from extracting and/or sourcing materials in sections of the Trishuli river that remain in relatively good natural conditions and areas that support fish of conservation importance such as the Golden Mahseer. • Contractors will not be allowed to collect sand, gravel and boulders within 5-10 m distance of the left embankment of the Trishuli River. Not more than a depth of 1m of excavation will be allowed while mining. The PCU, CSC and the Environmental consultant will regularly monitor this. • All contractors will be required to submit their Construction Materials Sourcing Plans to the PIU, CSC and the World Bank for prior approval before carrying out material extraction. No material extraction will be done by any of the Contractors until the Materials Sourcing Plan is approved by the PIU, CSC and the World Bank. • The PIU and CSC will regularly monitor material extraction to ensure proper implementation of the Materials Sourcing Plans. • Most part of the road alignment is located along the Trishuli river. During the construction, series of small ponds will be constructed along the river bank to fetch water for construction away from water line to avoid impact to migratory fish and spawning grounds. • The Forest Users Groups of community forests adjoining Trishuli River will be made aware for not allowing excess mining in their corresponding reaches of Trishuli River. They will also be mobilized in monitoring contractors extracting materials in Trishuli River.	DCID-DoR, CSC

Impacts	Mitigation Measures	Responsible Agency
	Implementation of compensatory plantation program in coordination with the District Forest Office, respective Rural Municipalities/Municipalities and Community Forest Users Groups.	
Disturbance and poaching of wildlife	- Instructions and orientation to workers; - Enforcement and control of Anti-poaching code of conduct and regulations; - Awareness campaigns; Planning of rural development	DCID-DoR, CSC, CC
Working conditions & Worker accommodations of Construction Workforce	- Compliance with GoN's labour law, rules & regulation and WB ESS 2 - Implementation of Labour Management Procedure (LMP). - Established of GRM for workers. - Provide workers transportation to and from the project sites. - Implement "Zero harm" policy at the project sites. - Adopt safety measures for workers like shinning jackets (aprons), boots, gloves, helmet etc.	DCID-DoR, CSC. CC
Human Trafficking	- Vigilance from law enforcement authority and compliance with the labour laws. - Display of hoarding boards about anti trafficking - Community orientation focusing young women and girls. - Establish Worker Camp Operations Guidelines - Compliance with GBV Action Plan - Establish compliant mechanisms.	DCID-DoR, CSC. CC
Child and Forced Labour	- Provision in contract document, prohibiting child labour in compliance with the GoN's Act related to Children (2075), - Labour Management Procedure (LMP) - Information dissemination on avoidance of child and forced labourers	DCID-DoR, CSC. CC
Potential hazards caused by bitumen and other toxic chemicals	- Develop a Hazardous Materials Management Plan to manage hazardous material use, storage, transport, and disposal. - Handling chemicals properly. Storage of chemicals 100 meters away from any water sources.	DCID-DoR, CSC. CC
Pollution of water resources	- Develop a Water Quality Management Plan. - Proper drainage structures, construction of Soak pit or retention lagoon before discharging waste water into main water body, management of garbage and debris.	DCID-DoR, CSC. CC

Impacts	Mitigation Measures	Responsible Agency
Community Health & Safety	• Awareness to local communities and construction workers • Community awareness and sensitization with emphasis to women and young girls. • Promote health seeking behaviors. • Identify areas along the access road prone to landslides and provide appropriate engineering controls. • Adopt Workers' Code of Conduct to interact with local communities. • Adopt a GRM to allow local residents to file complaints. • Strengthening and collaboration with the local health facility and onsite primary health care facility or surveillances • Waste management plan. • Construction of road crossings and other road infrastructures on the principle of universal access.	DCID-DoR, CSC. CC, Local Authorities
Construction-induced impacts to nearby structures	• Baseline survey of the structures by the contractors before the construction started • Create awareness on accessing project level GRM • If damage complaints are received, CSC will investigate and measure the damage. CSC will verify the implementation of measures implemented by the contractors • Contractors will implement the measures proposed by the CSC	DCID-DoR, CSC. CC
Occupational Health and Safety	• Include provision in the contract requiring H&S Plan, Operational guideline, appropriate staffing, and reporting requirements • Enhance capacity of workers and stakeholders including local health institutions. • Training of managers and responsible personnel • Emergency Management Plan • Incident/Accident Reporting Mechanism to be established and operationalized • Communicable disease outbreak notification and management plan • OHS monitoring, inspection and performance audit plan.	DCID-DoR, CSC. CC
Impact on tangible and intangible heritage	• Assessment of ESS-8 during field studies confirmed that no any tangible/ intangible archeologically important heritage will be impacted. In case of chance finding, the procedure will be followed.	DCID-DoR, CSC, CC, Department of Archaeology

Impacts	Mitigation Measures	Responsible Agency
	Establishment of chance find mechanism	
Operation Phase		
Cumulative Impacts	- Coordinated planning of regional & local development and land use - Implementation Of Afforestation programmes - Coordinated and collaborative development projects - Cooperation and information dissemination among interested stakeholders about climate change - Stakeholder engagement in accordance with SEP - Implementation of wildlife-friendly roads across DoR portfolio	DCID-DoR, CSC, CC
Traffic Safety During Operation	- Road safety audits were conducted in NNM road during the feasibility stage and during the detailed design stage and detailed design of NNM road improvements integrates the findings and recommendations of the road safety audits undertaken in multiple stages. - Road safety will also be undertaken post completion works. - Speed control and regulations (especially in populated areas, near schools and other public places). - Road crossing infrastructures incorporating principal of universal access. - Establishment of traffic signals, GPS tracking and surveillance cameras for speed control for vehicles plying the highway. - Vehicle maintenance and inspection. - Installation of “No Horn” signages - Establishment of Sick Bays for vehicles - Training of first-aid services in the case of accident. - Road safety awareness trainings to general public. - Capacity enhancement to traffic police, adjoining local community and road users.	DCID-DoR, Local Youth clubs, mother groups, Traffic Police
Exclusion of vulnerable and disadvantaged groups from benefits	- Public awareness, work with local municipalities and governments, facilitating access to benefits - Mitigation measures prescribed in Indigenous People’s Development Plan (IPDP) and ESMP	DCID-DoR

Impacts	Mitigation Measures	Responsible Agency
Noise pollution: The increased number of heavy vehicles plying in the Highway and the increased commercial and industrial activities	• Implementation of No Horn Zones particularly in settlement areas • Installation of Signages • Monitoring noise level maintained at national standard • Arboriculture along the RoW as noise absorbers	DCID-DoR, CFUGs, Traffic Police
Gender Based Violence (GBV) (SEA and SH)	• Community sensitization. • Socio-economic development of women. • Orientation to labour force. • Code and conduct to guide the workers on how to relate with the community. • Orientation of Supervision Consultant, and Contractors on GBV • Mapping of GBV service providers for prevention and response. • Develop and implement a GBV Action Plan.	DCID-DoR, Local Youth clubs, mother groups, Police, Chief District Officers

Table 0-5: Environmental and Social Monitoring Plan

E&S components	Monitoring parameters	Monitoring Agency	Timeline
Physical Environment			
Air quality	Ambient air quality: TSP and PM ₁₀	DoR, DCID, CSC, GESU	Baseline information during preconstruction stage and during construction stage once in every month
Water quality	Turbidity, Conductivity, pH and Colour will be conducted at site with the help of portable kits, effluents from construction camps /sites/ waste from batching plants etc.	DoR, DCID, CSC, GESU	Baseline information during preconstruction stage of nearby water bodies and during construction stage once in every month
Noise	Noise level at regular interval: assessment and interpretation for L _{max} , L _{min} , L _{eq} , L ₅ , L ₁₀ , L ₅₀ , L ₉₀ and L ₉₅ parameters.	DoR, DCID, CSC, GESU	Baseline information during preconstruction stage and during construction stage once in every month
Spoil/Muck/ disposal	Disposal of Spoil/Muck at designated sites	DoR, DCID, CSC, GESU	Daily during the construction stage
Stockpiling of construction Materials	Stockpiling of construction materials at designated sites Covering of Stockpiles with tarpaulin sheets	DoR, DCID, CSC, GESU	Daily during the construction stage
Slope stability	Presence of landslides, gully formations due to runoff	DoR, DCID, CSC, GESU	Daily during the construction stage

E&S components	Monitoring parameters	Monitoring Agency	Timeline
Operation of Borrow pits/ Quarry sites/ Stone crushing plants	Quantity of extracted material, restoration of borrow pit areas, Grievance Redressal of the locals	DoR, DCID, CSC, GESU	Daily during the construction stage
Extraction of river bed materials	Distance of extraction sites from the river banks (5-10 m) Depth of the ditch for excavation (1m)	DoR, DCID, CSC, GESU	Daily during the construction stage
Obstruction of drainage	Roadside drainage discharge, water impounding area during rain, water logging	DoR, DCID, CSC, GESU	Daily during the construction stage
Hazardous wastes, bitumen/asphalt	List of chemicals, storage, and handling practice. Records of accident/ spillage of chemicals, surface and groundwater contamination	DoR, DCID, CSC, GESU	Daily during the construction stage
Biological Environment			
Number of felled trees	Statistics of removed and planted trees, nurseries and plantations	DoR, DCID, CSC, GESU, Divisional Forest Office (DFO)	During the time of tree felling on daily basis
Compensatory Plantation	Compliance with compensatory plantation plan	DoR, DCID, CSC, GESU, Divisional Forest Office (DFO)	Plantation time during monsoon (before and after carrying out the plantation)
Fire-hazard	Project management checklists, site monitoring, fire-extinguishers in labour camps	DoR, DCID, CSC, GESU	Daily during the construction stage
Social Environment			
Community Health and safety	Nuisance to adjoining communities from the construction related works, grievances due to annoyance from the construction related works.	DoR, DCID, CSC, GESU-DoR	Daily during the construction stage
Establishment of camps	Compliance with Camp management plan of contractor	DoR, DCID, CSC, GESU-DoR	Daily during the construction stage
Property/land acquisition/compensation and rehabilitation	Implementation of compensation and rehabilitation measures provided by the RAP, including compliance with construction-induced impact procedures	DoR, DCID, CSC, GESU-DoR	During the preconstruction and construction stage
Indigenous Peoples	Compliance with IDPD	DoR, DCID, CSC, GESU-DoR	Daily during the construction stage
Safety of workers	Accident Group Insurance of Workers, provision of personal protective equipment/ Use of ear muffs and other personal protective equipment by the workers	DoR, DCID, CSC, GESU-DoR	Daily during the construction stage
Road safety	Traffic Signals, no horn signs, road signals and markings, speed control and GPS-tracking	DoR, DCID, CSC, GESU-DoR	Daily during the construction stage

E&S components	Monitoring parameters	Monitoring Agency	Timeline
Grievance Redressal	Management of Grievance Redress Mechanism	DoR, DCID, CSC, GESU-DoR	During the construction stage
Traffic Management	Compliance with Traffic Management Plan	DoR, DCID, CSC, GESU-DoR, Traffic Police, Respective Chief District Officers	Daily during the construction stage
Gender-based violence and human trafficking	Living status of women and vulnerable households after the implementation of project	DoR, DCID, CSC, GESU-DoR	Daily during the construction stage
Stakeholder engagement	Compliance with SEP	DoR, DCID, CSC, GESU-DoR	During the preconstruction and construction stage

The cost of Environmental and Social Management Plan is given in the table below.

Table 0-6: Estimated cost for ESMP¹⁸ and RAP

S.N.	Particulars	Total Cost (NPR)	Total Cost (USD)
1.	Cost of compensatory plantation and nursery establishment and trainings	22,175,113	194,110
2.	Relocation of electric poles	67,550,000	591,299
3.	Relocation of water supply pipes	1,862,400	16,303
5.	Bioengineering	49,219,137	430,840
6.	Stakeholder consultations, engagement, orientation on transportation and traffic safety for schoolchildren of schools along the project site and for women's group.	900,000	7,878
7.	Income generation trainings focusing indigenous groups	360,000	3151
8.	Income generation trainings focusing vulnerable groups	1,380,000	1,2080
9.	Women empowerment training for community	1,000,000	8754
10.	Compensation and resettlement costs	226,786,077	1,985,172
Total Environmental and Social Mitigation Cost		371,232,727	3,249,587

Note: 1 USD = NPR 114.24 (Selling price determined by Nepal Rastra Bank, on February 6, 2020)

¹⁸ Excludes measures that will be undertaken by the contractors.

Chapter 8: Analysis of Alternatives

8.1 Introduction

Analysis of alternatives has been considered for the proposed widening/upgradation of this corridor based on the principle of mitigation hierarchy for management of E&S risks and impacts. The designs have been considered with safety considerations, geometric improvements and current and future traffic projections. The aspects considered for the analysis of alternatives included Topography, Destabilization of slopes, Hydrological conditions, Road Safety, Availability of construction materials, Type and number of bridges, Seismic Hazard, Resources required, Physical Structures and Infrastructures in the Physical aspects, Loss of Forest Trees, Forest Land, Grazing areas, Habitat loss and fragmentation, Impact on Wildlife, Damage to Aquatic Habitat, Increase in Poaching, Forest dependents and forest users, Impact on Buffer zone, GHG in Biological aspects and Total Households affected, Total Population affected, HHs of indigenous people, Market places and urban areas, Cultural and Community Resources, Land acquisition, Land required for the construction, Agricultural land, Public acceptance in the Social and Cultural aspects. Mitigation hierarchy principles were applied to explore predicted impacts and suggest the most suitable solutions including avoiding of adverse impacts of landslides in the case of widening highway, minimizing adverse impacts of linear structures during construction and operation stages, rehabilitating wildlife habitats through establishment of new forest plantations and compensating lost land and property through associated plans and programs.

Alternative analysis was conducted at the feasibility (design) stage, which allowed to prevent impact on environmentally sensitive areas adjacent to the road. Besides, construction of new alignment on the right bank of Trishuli River also providing multiple benefits to local communities.

8.2 Basis of Selection of the Road Alignments

The environmental and social screening and initial analysis of alternative sections of the feasibility report was reviewed and an independent assessment of the adequacy of consideration of environmental and social aspects in the selection of the preferred road and bridge improvement alternatives was done. Public consultations were carried out at different locations to understand the views of the local community on social and environmental benefits and adverse impacts of improving the road section with due consideration to all alternatives. Data of the existing physical structures and infrastructures, existing environmental features including drainage system, land stability, landslide prone areas, and other environmental aspects were collected and topographical maps were studied.

The alternative routes identified and studied focus on major two options as 2-Lane Option and 4-Lane Option, including existing road upgrading and new road. Six options, considered in the feasibility study by the feasibility consultant, are presented below in the following

Table 0-1.

Table 0-1: Alternative Alignments Considered

Alternative 1	Improvement of existing road to 2-Lane standards with curve improvement and additional 2 bridges at Khatripauwa and Naubise and 4-lanes in Urban Areas.
Alternative 2	Improvement of existing road to 2-Lane standards with curve improvement and Tunnel Bypass and 4-lanes in Selected Urban Areas.
Alternative 3	Improvement of existing road to 2-Lane standards with curvment improvement and construction of additional 2-lane new alignment from Sisnekhola-Dharke and 4-lanes in Selected Urban Areas.
Alternative 4	Minor improvement and 2-Lane standards new lane Sisnekhola-Dharke; construction of 4-lanes from Dharke to Benighat; improvement of existing road from Benighat to Mugling into 2-lanes and 2-lane new alignment on right bank of Trishuli River from Benighat to Kurintar.
Alternative 5	Improvement of existing road from Nagdhunga to Dharke into 2-Lane standards with curvment improvement and Tunnel Bypass and construction of additional 2-lane new alignment from Sisnekhola-Dharke; 4-lanes from Dharke to Benighat; improvement of existing road from Benighat to Mugling into 2-lanes and 2-lane new alignment on right bank of Trishuli River from Benighat to Kurintar.
Alternative 6	Improvement of existing road from Nagdhunga to Mugling into 2-Lane Asian Highway standards with additional 2 bridges at Khatripauwa and Naubise

The improvement options are elaborated in **Table 0-2**.

Table 0-2: Road Improvement Options

Lane	Option	Brief Description of Option	Brief Description of Sub-option		Brief Description of Sub-option	
2 Lane option	Option 1	Section 1: Minor Improvement of Nagdhunga – Naubise Road	- No new alignment - New Bridge 1 at Khatripauwa - New Bridge 2 at Naubise	Option 1-a except at difficult areas	- No new alignment - New Bridge 1 at Khatripauwa - New Bridge 2 at Naubise	Option 1-b Through-out length
		Section 2: Improvement of Naubise – Mugling Road to 2 Lane.	- No new alignment - Narrow Carriageway width at steep areas		- No new alignment 7m carriageway width throughout length	
	Option 2	Section 1: Improvement of Nagdhunga – Naubise Road with Tunnel/By pass	- No new alignment - Tunnel 1 = 100m Cut&Cover - Tunnel 2 = 410m - Bypass 1 = 770m Khani Khola - Bypass 2 = 596m, Naubise	Option 2-a except at difficult areas	- No new alignment - Tunnel 1 = 100m Cut&Cover - Tunnel 2 = 410m - Bypass 1 = 770m Khani Khola - Bypass 2 = 596m, Naubise	Option 2-b Through-out length
		Section 2: Improvement of Naubise – Mugling Road to 2 Lane.	- No new alignment - Narrow Carriageway width at steep areas		- No new alignment 7m carriageway width throughout length	
	Option 3	Section 1: New Alignment from Sisne Khola to Dharke	2 Lane, New align. L= 11.97 km - Tunnel L = 140m	Option 3-a except at difficult areas	2 Lane, New align. L= 11.97 km - Tunnel L = 140m	Option 3-b Through-out length
		Section 2: Improvement of Naubise – Mugling Road to 2 Lane	- No new alignment - Narrow Carriageway width at steep areas		- No new alignment 7m carriageway width throughout length	
4 Lane option	Option 4	Section 1: Minor Improvement of Existing Nagdhunga – Naubise Road and 2 lane new Road from Sisne Khola to Dharke	- No new alignment - New Bridge 1 at Khatripauwa - New Bridge 2 at Naubise 2 Lane, New align. L= 11.97 km, Tunnel L = 140m			No Sub-option
		Section 2: Improvement of Naubise – Benighat to 4 Lane, Benighat to Mugling to 2 lane and New Alignment from Benighat to Kurintar 2 lane	- Naubise ~ Benighat - 4 Lane, L=52.92 km, except at difficult areas - Benighat ~ Kurintar - 2 Lane, New align. L= 19.87 km, Rt. Bank of Trishuli River			
	Option 5	Section 1: Improvement of Nagdhunga – Naubise Road with Tunnel/Bypass and lane new Road from Sisne Khola to Dharke	2 - No new alignment - Tunnel 1 = 100m Cut&Cover, Tunnel 2 = 410m - Bypass 1 = 770m Khani Khola, Bypass 2 = 596m, Naubise	No Sub-option		
		Section 2: Improvement of Naubise – Benighat to 4 Lane, Benighat to Mugling to 2 lanes and New Alignment from Benighat to Kurintar 2 lane	- Naubise ~ Benighat - 4 Lane, L=52.92 km, except at difficult areas - Benighat ~ Kurintar - 2 Lane, New align. L= 19.87 km, Rt. Bank of Trishuli River			
2 Lane option	Option 6	Section 1: Improvement of Naubise – Mugling Road to 2 Lane Asian Highway Standard	7m carriageway width throughout lengthwith a shoulder of 1 to 2.5 m			No Sub-option

8.2.1 Comparative Assessment of Alternative Alignments

Alternatives 1 and 2

The first 2 alternative options 1 and 2 are improvement of existing highway with additional bridges and improvements in selected urban areas and tunnel with 410 m and bypass with 770m. The proposed tunnel and bypasses are within short distance of 13 km between Nagdhunga and Naubisein order to minimize curves and avoid time duration. However, the proposal of avoiding curves and time limit within the short distance does not reduce travel time significantly. Approximately 3,206 private structures, 107 public structures, 3,356 public & private land owners will be affected. The compensation cost of the affected cultivated land after the alignment egress from tunnel at Khanikholawill be necessary. In overall scenario, the implementation of option 1 and 2 will have very less significant environment and social impact upon topography, unstable slopes, and existing hydrology.

Road safety will be enhanced especially in urban areas along the existing highway, however the safety along the rest of the sections will not change significantly. The impact for the extraction of construction materials will have minimal effects that could be mitigated by applying mitigation measures such as river draining works, bank protection, etc. along the Trishuli River, Mahesh Khola and other small tributaries. There will be less impact on infrastructures and cultural structures. Loss of forest will be minimal and there will not be any fragmentation of forest and habitats as well as buffer zone. The loss of carbon stock will not be significant as loss forest will be low. Land acquisition will be required in bypass proposed and along the proposed tunnel bypass alignment, which is only within the first 13 km of the existing highway. Separate grazing area along the existing alignment does not exist. The practice of grazing by the inhabitants is only within the community forest existing along the highway. No any remarkable impact on HHs of indigenous people as there is very small population of indigenous people, inhabiting areas along the existing highway. Further, the land required for the construction will be within the existing right of way and there will not be required any acquisition of new land along the existing highway.

Alternative 3

Implementation of alternative option 3 will have more or less the same impact as mentioned for alternative options 1 and 2. But the construction of additional 2-lane new alignment of approximately 11 km from Sisnekhola-Dharke will have additional impact with its implementation. Compensation of private lands along the alignment will be required. Approximately 3,288 private structures, 110 public structures, 3,614 public & private land owners will be affected by alternative 3. Besides, approximately 52 hectares of cultivated land area is existed with the 50 m RoW along the proposed Sisnekhola-Dharke alignment. Compensation of standing crops will also be required for the affected cultivated land. Moreover, compensation will be required for the affected number of trees; as 3,500-meter length of Nisakot community forest (CF) existing along the alignment. The alignment avoids the steep gradient of Naubise-Nagdhunga section, which is used by a maximum numbers of loaded freight vehicles traveling towards Kathmandu. The proposed section will further require slope

protection works as a mitigation measure along the Nisakot CF area; the area is situated with the first 5 km along the proposed alignment from Sisnekhola.

Alternatives 4 and 5

Both alternatives 4 and 5 are 4-lane options, requiring more excavations of existing highway especially from Dharke to Benighat, existing two-lane requiring mitigation measures for stabilization of hill slopes and disposal of excavated materials including substantial loss of forest area and also requiring compensation for the acquisition of land and structures. Further, excavation of proposed new 20 km 2-lane road from Benighat to Kurintar will have severe impact on environment and society, requiring compensation to cultivated land, mitigation for the stabilization of hill slopes, avoiding fragmentation of forest and cultivation land, compensation to physical cultural structures and infrastructures along the proposed alignment. Extraction of construction materials to meet the demand for the construction of these options might go beyond the river corridor, especially for the construction of proposed new Sisnekhola-Dharke and Benighat-Kurintar road alignment. Construction materials should be acquired only from the approved quarry sites, which have received environmental clearance certificate from authorized agency. Substantial number of small and big bridges will be required along the both proposed new alignments, which could not be avoided as the proposed alignments pass through several natural drainages. Bank protection along the river banks, both at upstream and downstream, will be required at the location of proposed bridges as preventive mitigation measure. These new alignments at the other bank of river are supposed to avoid disturbance to traffic movement on existing highway during excavation for expansion; and to avoid landslides likely to occur from excavation along the existing road alignment where historical landslides at as Kirshnavir and Jogimara were existed. Numbers of community forests along the Benighat-Kurintar new proposed alignment shall also be required. Further, substantial disposal sites will also be required for the implementation of these proposed options as there will be 2 tunnels proposed, one along Sisnekhola-Dharke section and another is at Khanikhola section along existing highway will generate substantial number of tipping materials to be disposed. Approximately 3,494 private structures, 137 public structures, 4,089 public & private land owners within the 25 meters of ROW are likely to be affected by proposed alternative.

Alternative 6

Improvement of existing road from Nagdhunga to Mugling into 2-lane standards with additional 2 bridges at Khatripauwa and Naubise has been proposed as 6th alternative. As the option is to upgrade the existing highway into 2 lane standards, impact upon each and every aspect will be less in comparison to alternative option 4 and 5. Alternative 6 has moderate impact on environment and also can meet the traffic demand as therefore was considered the best option.

In assessing the six alternatives, the first three alternatives would have less impacts on the environment but would have more social impacts specifically on land acquisition in urban areas. They would also entail lower costs for construction, however, they would not adequately address the problems of road congestion. The fourth and fifth alternatives were recognized to pose more physical, biological and socio-economic impacts. Accordingly, the sixth alternative

was chosen for the ESIA as it minimizes impacts on environment. In this updated ESIA, the sixth alternative has been studied without the two new bypass sections as the GoN has decided to drop the bypasses from the improvement works along NNM road to further reduce land acquisition and social impacts.

8.3 Alternative Time Schedule for Construction

During rainy season, the earthworks and excavation of fragile area will be strictly restricted. Construction works will be executed employing local people as far as possible, whereas population dependent on agriculture will not be affected with the highway construction. Seasonal calendar will be taken into account to manage construction works avoiding implication for agricultural practices at local level. Bridge foundation works at Mahesh-khola and Trishuli Rivers will be avoided during rainy season, especially from June to September when high flood and inundation at the riverbanks are likely. Such foundation excavation work will be carried out in dry seasons only. Site clearance works and affected tree felling will be carried out during dry seasons also. The maximum temperature of the district is ranges between 25 to 35°C and minimum temperature ranges between 0 to 3°C. Therefore, surface pavement will be carried out during warmest period of the year, in August and September, rainy days will be avoided to perform such work.

The overall construction and excavation period will be scheduled from May to September, which could be the most favourable period for project area to provide substantial contribution by the local inhabitants as well.

Chapter 9: Key Measures and Actions for the Environmental and Social Commitment Plan

The Environmental and Social Commitment Plan (ESCP) is a document reflecting the commitment of MoPIT and DoR to meet ESS requirements of the ESF for the SRCTIP project. The project has three components: (1) Trade facilitation (2) Regional Connectivity Improvement and (3) Institutional Strengthening. The MoPIT-DoR is key implementing agency for last two components and the first one trade component will be taken care by the MoICS. The WB monitors the effective implementation during execution of the project. The ESCP is a living document which will be revised based on the requirements and prevailing conditions. The ESCP broadly covers the key actions with time frame that are mentioned below. The time frames along with the responsibilities have been reflected in the ESCP.

- Assessment and management of environmental and social risks through management tools and instruments.
- Land acquisition, resettlement and rehabilitation along with IP/IPDP preparation
- Develop various plans such as LMP, SEP, TMP, OHS plan etc.
- Obtaining permits/clearances of tree felling, relocation of public utilities.
- Carry out safeguard audit in the middle of project and after completion of the project
- E&S Staffing and Training to be provided for capacity support of relevant stakeholders.
- Strengthen and Management of grievances redress mechanism
- Monitoring and reporting Future studies, assessments, plans, etc.
- Reporting of incidents and accidents.

9.1 Environment and Social Commitment Plan (ESCP) Monitoring and Reporting

The ESCP requires compliance with all provisions of such plans or other documents required for the project implementation. The monitoring of Environment and Social Commitment Plan (ESCP) is categorized into two parts, one is regular reporting and another is notification of incidents and accidents of the project.

The regular monitoring is a part of general monitoring applied during regular implementation of the project. In the basic component of the SRCTIP project.

The key highlights of ESCP are as follows:

- i. The Government of Nepal (GoN) will implement the Nepal Strategic Road Connectivity and Trade Improvement Project (SRCTIP) (the **Project**) with the involvement of the Ministry Physical Infrastructure and Transport (MoPIT) and the Department of Roads (DoR). The World Bank (WB) will provide financing (IDA Credit) to GoN for the Project.
- ii. GoN will implement material measures and actions so that the Project is implemented in accordance with the Environmental and Social Standards (ESSs). This

Environmental and Social Commitment Plan (**ESCP**) sets out material measures and actions, any specific documents or plans, as well as the timing for each of these.

- iii. GoN will also comply with the provisions of any other E&S documents required under the ESF and referred to in this ESCP, such as Environmental and Social Impact Assessment(ESIA), Environment and Social Assessment (ESA), Environment and Social Management Plan (ESMP), Resettlement Policy Framework (RPF), Resettlement Action Plan (RAP), Indigenous People's Development Plan (IPDP), Indigenous Peoples' Planning Framework (IPPF), Labor Management Procedures (LMP) and Stakeholder Engagement Plans (SEP), and the timelines specified in those E&S documents.
- iv. GoN is responsible for compliance with all requirements of the ESCP even when implementation of specific measures and actions is conducted by the MoPIT.
- v. Implementation of the material measures and actions set out in this ESCP will be monitored and reported to the WB by the GoN as required by the ESCP and the conditions of the legal agreement, and the WB will monitor and assess progress and completion of the material measures and actions throughout implementation of the Project.
- vi. As agreed by the WB and GoN this ESCP may be revised from time to time during Project implementation, to reflect adaptive management of project changes and unforeseen circumstances or in response to assessment of Project performance conducted under the ESCP itself. In such circumstances, GoN or MoPIT will agree to the changes with the WB and will update the ESCP to reflect such changes. Agreement on changes to the ESCP will be documented through the exchange of letters signed between the WB and the GoN or MoPIT. The GoN or MoPIT will promptly disclose the updated ESCP.
- vii. Where Project changes, unforeseen circumstances, or Project performance result in changes to the risks and impacts during Project implementation, the GoN shall provide additional funds (to MoPIT-DoR), if needed, to implement actions and measures to address such risks and impacts, which may include environmental, health, and safety impacts, labor influx, gender-based violence etc.

9.2 Environment and Social Standards (ESS) Standards and Compliance

As per the new Environment and Social Standards of the World Bank, there are 10 standards which have the separate compliance as follows:

- i. Assessment and Management of Environmental and Social Risks and Impacts
- ii. Labour and Working Conditions
- iii. Resource Efficiency and Pollution Prevention and Management
- iv. Community Health and Safety
- v. Land Acquisition, Restriction on Land Uses and Involuntary Resettlement
- vi. Biodiversity Conservation and Sustainable Management of Living and Natural Resources

- vii. Indigenous People
- viii. Cultural Heritage
- ix. Financial Intermediation
- x. Stakeholder Engagements

Key measures and time frames required for the project to meet the requirements of the ESSs will include the following:

Before appraisal completion, complete preparation and disclosure of

- Environmental and Social Impact Assessment Report of this corridor
- Environmental and Social Management Plan including GBV Plan
- Stakeholder Engagement Plan for the overall project
- Resettlement Policy Framework for the overall project to guide the preparation of corridor specific RAPs
- Resettlement Action Plan for NNM Road
- Indigenous Peoples Development Plan
- Labor Management Procedures

During Implementation

- E&S Staffing of the DoR-DCIC PCU
- Contractors' ESMP
- Trainings and capacity building

MoPIT will implement material measures and actions through DOR-DCID to implement the project complying with the World Bank's Environmental and Social Standards (ESSs) under the World Bank's Environmental and Social Framework (ESF). DoR-DCID will establish and maintain an E&S organizational structure with qualified staffs to support management of E&S risks including, at least, one Environmental Expert and one Social Expert. The Environment and Social Commitment Plan (ESCP) requires compliance with the provisions set out in the Environmental Impact Assessments, Environmental and Social Management Framework (ESMF), Stakeholder Engagement Plan (SEP), Labour Management Procedures (LMP), RAP, Resettlement Policy Framework, IPDP and Indigenous People's Planning Framework, as identified and developed for the Project.

Implementation of the material measures and actions set out in this ESCP will be monitored and reported to the Bank by DOR as specified in the ESCP and the Bank will monitor and assess progress and completion of the material measures and actions throughout implementation of the Project. If required, ESCP may be revised and updated during Project implementation, to reflect adaptive management of Project changes and unforeseen circumstances or in response to assessment of Project performance conducted under the ESCP itself. The MoPIT is responsible for compliance with all requirements of the ESCP during implementation of specific measures and actions is conducted by the DOR-DCID. Number of

key measures and actions will have to be incorporated into the ESCP which is elaborated in the following sections.

The proponent will comply with the WB ESSs to manage the risks and impacts of a project, and improve their environmental and social performance, through a risk and outcomes-based approach.

Chapter 10: Institutional Arrangements

The full ESIA of NNM road is under review at MoFE and is expected to be approved soon. Once the ESIA is approved, the construction can start directly as some of the permits are acquired before commencing the ESIA while rest are acquired during the ESIA.

Institutional arrangements are intended to meet the requirement of World Bank ESS that in turn will make sure that the National laws are not violated during the pre-construction, construction and operational (defect liability period) stages of the project.

10.1 Institutions and their Roles in E&S Risk Management of Roads and Bridges Project

The principal responsibility for the development and implementation of national road projects in Nepal is vested in the Department of Roads (DoR) of the Ministry of Physical Infrastructure and Transport (MoPIT). DoR is also thus directly responsible for managing the E&S risks of individual projects under the program, i.e., from assessment, mitigation planning, implementation to monitoring. It is also DoR's responsibility to access or involve the services of other agencies and authorities.

10.1.1 Department of Roads

DoR has five (5) deputy directorships /branches that develop and implement projects. These are: (1) the Policy and Design Branch, which develops and implements all GoN-funded roads; (2) the Bridges Branch, which is in charge of the development of bridges; (3) the Maintenance Branch, which is in charge of the repair and rehabilitation of roads and bridges; (4) the Development Cooperation Implementation Division, which handles donor-funded projects; and, (5) the ADB Deputy Directorate, which handles all roads and bridges projects funded by ADB. To implement a project, a project office (PO) or project management unit (PMU) in the case of donor-funded projects is usually created within these branches. To facilitate field implementation, DoR also maintains 33 Divisional Road Offices (DROs).

10.1.2 Project Office/Project Management Office (PO/PMU)

For purely government-funded projects, the PO usually requests the services of the GESU to undertake the preparation of EIA or IEE and carry the project through the process of review and approval by the MoPIT in the case of IEE or MoFE in the case of EIAs. After approval, the PO is then responsible for the implementation of the EMPs/ESMPs on the ground as well as to undertake land/ROW clearance/acquisition, following the standard government process, without the benefit of a RAP. For donor-funded projects, the Project Management Units (PMU), which are organized according to specifications agreed with the donor, usually prepare their own ESIAs, RAPs and other E&S Risk Management Plans by hiring their own consultants. PMU show ever would often seek GESU's involvement to fulfil legal requirements, particularly in bringing the IEE/ESIA through the formal review-approval process with MoPIT and MoFE and, depending on the specifications agreed with the donor, the PMUs may tap GESU to undertake the EIA/IEE preparation process for their projects and/or provide compliance monitoring and audit in the field.

10.1.3 Geo-Environment and Social Unit (GESU).

The focal point for the E&S risk management at DoR is GESU. GESU is currently under the Planning and Design Deputy Director General (DDG). GESU provides advisory services to units of DoR on geological, environmental and social safeguards matters. Its main role is to prepare IEEs and EIAs for the DoR projects and have the map proved by the MoPIT in the case of IEEs and by the MoFE in the case of EIAs. Because of this role, GESU interacts with the Environment Unit of MoPIT as well as that of MoFE. For some donor-funded projects, the GESU also undertakes compliance monitoring and auditing of projects, and as result also interacts with Project Management Units (PMUs). The role of the GESU is very important not only in social analysis and ensuring stakeholders' participation in the planning and implementation process, but also for improved efficiency, effectiveness and sustainability of the projects. Although, the need for right of way acquisition is identified in EIA/ESIA, GESU is not normally involved in the land acquisition, and hence, rarely if at all interacts with the land agencies. Sometimes, RAPs from donor-funded project are submitted to the GESU for review.

10.1.4 Divisional Offices of DoR

DoR has 4 Federal Road Monitoring Units which are geographically situated and 33 Divisional Offices. These offices will serve as the home base for Federal Government's road project implementation where coordination of the local government agencies and field offices of other line agencies will occur, particularly for RoW/land acquisition.

10.1.5 Ministry of Physical Infrastructure and Transport (MoPIT)

MoPIT is the mother agency of the DoR and is mandated by the EP Act to review and approve IEEs for projects in public works and transport sector. It also reviews and endorses EIA reports for review and approval of the MoFE. The Ministry will also be the one to authorize the Project Management Office (PMU) to initiate preliminary action for land acquisition. This function is handled by the Environment and Social section under the Planning, Monitoring and Evaluation Division.

10.1.6 EIA Unit under Ministry of Forest and Environment (MoFE)

This unit is tasks to undertake review and approve EIAs. It is reporting directly to the Ministry and not part of the Department of Environment. This unit convenes and engages multidisciplinary team to constitute the EIA Review Committee for each EIA submitted from approval. The EIA approvals typically include conditions which the project must comply or implement in addition to the EMP/ESMP.

10.1.7 Environmental Impact and Compliance Monitoring Unit under Department of Environment's Environmental (DoE)

The DoE serves under MoFE. The DoE has six (6) branches: (1) Administration Planning and Promotion; (2) Environmental Pollution Control and Monitoring; (3) Environmental Impact Assessment and Monitoring; and, (4) Environmental Impact Compliance; (5) Economic Administration Branch; and (6) Laboratory Branch. The EIA and Monitoring branch is the

one involved in compliance monitoring of projects based on the ESMP and the EIA approval conditions set by MoFE EIA unit while the Environmental Pollution Control and Monitoring is the one responsible for enforcing air quality, water quality and emissions and effluents standards. Note that the EIA and Monitoring Branch is different from the EIA unit of MoFE whose responsibilities are to review and recommend approval of EIAs.

10.1.8 Department of Forestry and Soil Conservation (DoFSC)

DoFSC under the MoFE reviews and approves applications for RoW of road sections falling within areas classified as public forest. The DoFSC imposes conditions on the acquisition of right of way on forest lands, such as replacement of cut trees. After complying with the requirements, the ownership of right of way is transferred to the concerned agency (for roads: MoPIT).

10.1.9 Department of National Parks and Wildlife Conservation (DNPWC)

DNPWC under MoFE reviews and approves sections of roads within Parks and protected areas.

10.1.10 Department of Labour and Occupational Safety (DoLOS)

DoLOS under the Ministry of Labour and Social Security is currently not involved in the E&S risk management (i.e. it has no role in the EIA process) of development projects. Its role is mainly on the regulatory side. It can formulate and issue policies, rules and standards for OHS consistent with the law. As such, it can occasionally conduct monitoring and audit of workplaces, construction sites and offices of contractors and project management. It can also provide an expert review of the occupational and community health and safety aspects of the IEE/EIA or the ESMP.

10.1.11 Ministry of Federal Affairs and General Administration

The Ministry of Federal Affairs and General Administration (MoFAGA) is the governmental body of Nepal mainly responsible for delivering critical services to the citizens and maintaining security in the nation. It is in charge of eminent domain land acquisition i.e. the implementation of the Land Acquisition Act which it delegates to the local governments.

10.1.12 District Coordination Committees (DCC).

DCCs can regulate soil and water conservation activities. DCCs are also responsible for reviewing applications of eminent domain land acquisitions and confirming public use. It will be responsible for the issuance of land acquisition notice; the formation of Compensation Fixing Committee which would determine fair compensation; finalize the list of land owners to receive compensation; and receives grievances for submission to the Ministry of Home Affairs.

10.1.13 Municipalities and Rural Municipalities (Gaunpalikas)

There are now a total of 293 municipalities or cities and 460 rural municipalities or Gaunpalikas, formerly Village Development Committees (VDCs). The respective Municipality can regulate soil and water conservation activities that support to stabilize the road slopes and minimize likely adverse impacts on the road and by the road (DoR (2018) and

development plans for the indigenous people. The municipalities are responsible to conduct public hearings of the EIA results and based on it endorse the project. The MoFE will not approve EIAs without the endorsement of municipalities.

10.1.14 Department of Local Infrastructure (DoLI)

DoLI is a department under the Ministry of Federal Affairs and General Administration, is responsible for assisting local governments in the Districts in the engineering aspects of civil construction.

10.1.15 Department of Archaeology

It regulates all archaeological activities in the country as per the provision of the Ancient Monument Preservation Act (1956). The department is also charged with protection, preservation and management of the World Cultural Heritage Sites and maintains an inventory of the cultural heritage sites.

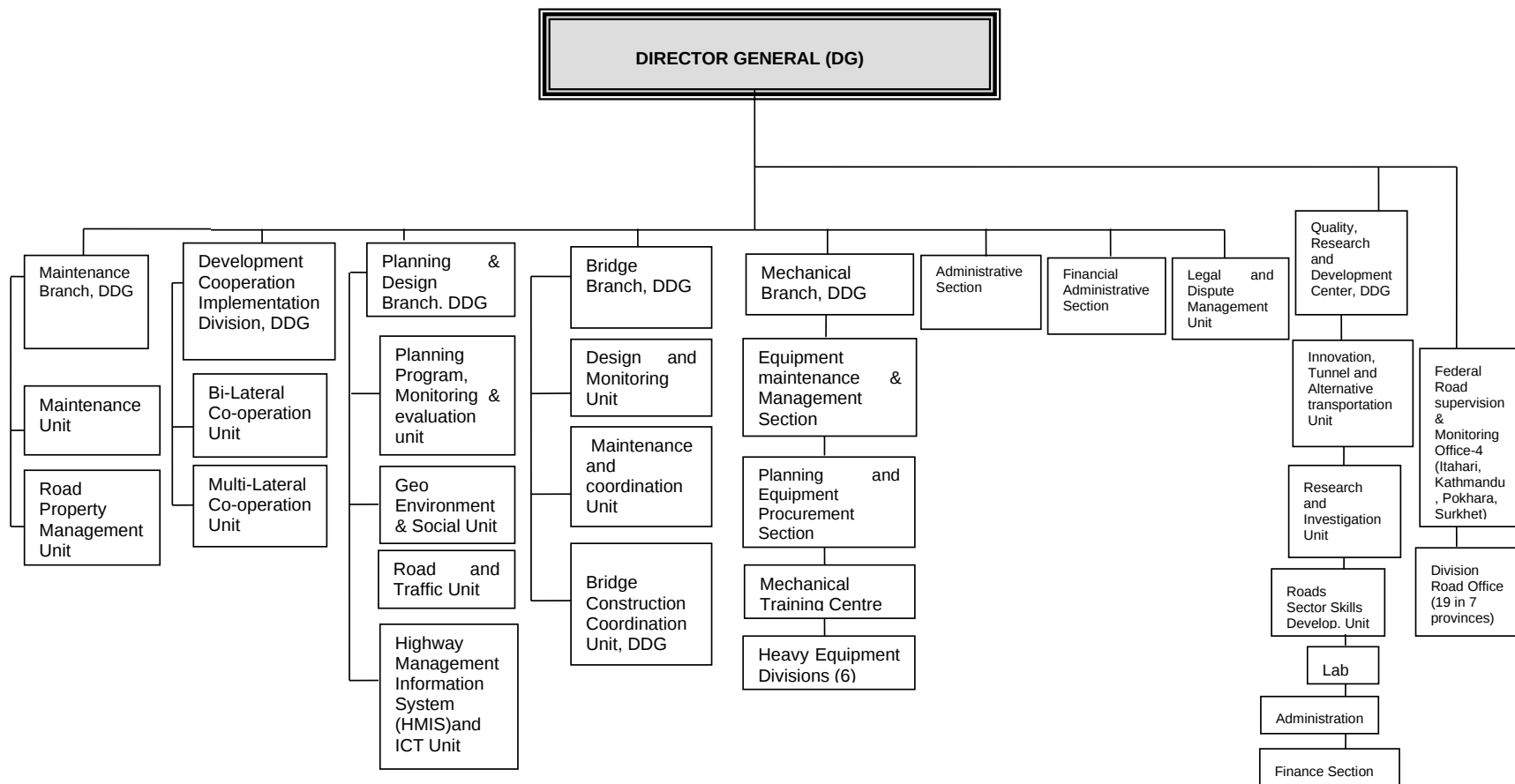


Figure 0-1: Organizational Chart of the Department of Roads and the embedding of the Geo-Environment & Social Unit

10.2 Implementation Arrangement of ESMP

The environmental management framework during construction is based on and integral with the overall project management framework for the project.

The project will be implemented by (DOR as the Executing Agency. The World Bank will be as a financial institution of the investment. DCID of DOR is the Implementing Agency (IA) for NNM Road and Bridge Project. Upon completion of the NNM Road improvement, DCID-DOR will carry out the operation, management, and maintenance.

The DoR-DCID prepares and implements the ESIA/ESMP, which has to be reviewed and approved by the World Bank as the financing agency of the project. The contractor will be required to prepare and implement the C-ESMP which will be reviewed and approved by the CSC, DCID, GESU and the WB. The implementation of the C-ESMP by the contractor will be supervised, monitored and reported by the CSC.

Overall responsibility of environmental management of the NNM upgrading works lies with the DCID-DOR with the support from GESU-DOR. Tentative staffing of CSC team **Error! Reference source not found.** will include a Highway engineer as a Team Leader, an Environmental Safeguard Specialist and a Social Safeguard Specialist along with the environmental and social monitors who will be responsible for monitoring day to day activities at construction sites. The roles and responsibilities for different agencies are summarized in **Table 0-1.**

Table 0-1: Environmental and social management responsibilities

Organizations	Responsibilities	Schedule
Executing Agency (Ministry of Physical Infrastructure and Transport)	-Review of the project design, construction and operation activities against approved ESIA and EMP measures and national environmental standards.	At least once a year during construction
	-Auditing of project general performance during operation phases	Every two years in the operation stage.
Ministry of Forest and Environment	-Approving ESIA and EMP measures, following national environmental standards and license conditions.	Prior to construction
Community Forest User Groups	-Approval of permits for pre-construction activities and permit for staff to enter the community forest. -Approval of permits for construction activities and works in the community forest. -Provide recommendation letter to ESIA document	Prior to construction
Implementing Agencies: Department of Roads; Development Cooperation Implementation Divisions (DCID), construction, operation and maintenance of the NNM	-Ensure that the ESIA and EMP measures are incorporated in the final project design and bidding document.	Prior to contract award.
	-Assist contractors in acquire necessary permits and approval for project construction and operation.	Before construction.
	-Ensure that the project construction activities are in accordance with the EMP and other GON legislative requirements.	During construction.
	-Implementation of repair and maintenance of project components including environmental safeguards	During operation.
	-Monitoring and record keeping regarding environmental measures and impacts	During operation
	-Ensure public consultation, participation and involvement in all phase of project implementation	Project period

Organizations	Responsibilities	Schedule
Ministry of Forestry and Environment	-Provide permits for admission and the construction works, including operation of quarry/borrow sites and watershed activities in community forest.	Prior to, and during construction
Project Management and Construction Supervision Consultant (CSC)	-Oversee environmental mitigation measures as per ESIA and ESMP are incorporated into the final design. Update the ESMP as required during detailed design.	During final design
	-Supervision and impact and compliance monitoring of the construction contractor's activities and environmental mitigation measures as per ESMP and provisions of inspection reports.	As per ESMP
	Conduct environmental monitoring and prepare periodic monitoring reports for submission to WB and DOR.	As per ESMP
	-Assist IA in the implementation and supervision of environmental compensation and enhancement programs and their monitoring and auditing.	As per ESMP
	-Ensure all the plans prepared as required and as mentioned in ESIA in order to safeguard environment of the community forests and other forests	Prior to construction
	-Ensure public participation and involvement in project construction	Construction period
	-Ensure construction contractors follow worker's safety rules and regulations	Construction period
Geo-Environment and Social Unit (GESU), DOR	Monitor support and supervise SC to achieve its responsibilities. Responsible to handle all the environmental, social and resettlement issues supporting SC.	Prior to construction and during Construction and operation period
Construction Contractor	-Acquire necessary permits and approval for project construction, entrance to community forest area.	Before construction.
	-Prepare a detailed Construction ESMP (CESMP/ESMAP) before construction and get it approved from DOR. -Implement mitigation measures as specified in the CESMP/ESMAP updated by the DOR as necessary during detailed design.	As per ESMP during construction
	-Monitoring and record keeping of environmental mitigation measures	As per ESMP during construction
	-Implementation of the corrective actions as recommended by the supervising consultants	As per ESMP during construction
	-Ensure public participation and involvement in project construction	Construction stage
Independent Environment Monitoring Consultant	- Review safeguards documents including ESIA and ESMP and request changes if and when required	Project Period
	- Oversee and periodically monitor Contractor's implementation of the ESMP and review control procedures carried out by DOR FCB and GESU.	Project Period
	-Review environmental impacts of project interventions and monitor progress with regards to environmental targets and indicators	Project Period
	Review reports and report to EA through the PEMU/Project Director on ESMP efficiency, contractors' performance and announce corrections needed	Project Period
CBOs, Municipality and DCC	-Monitor that the environmental mitigation measures and enhancement measures are implemented in all stages of the project as per ESMP.	Project Period

10.3 Acquisition of Permits and Clearances

The permit and clearance are important part of the project. The table 3 summarizes the status of clearances and no-objection certificates needed to obtain for implementation of the construction works.

Table 0-2: Status of permits and clearances

Agency or group	Purpose and status	Responsible party	Timeframe
Government of Nepal	Construction and upgrades of the strategic road from Kathmandu to Mugling has to be accepted as National Priority Project.	GoN/WB	Signing of loan agreement
Ministry of Forest and Environment (MoFE)	Approval of application for initiating an ESIA. Status: Application Letter sent by MoPIT to MoFE. Issue permission letter to Department of National Parks and Wildlife Conservation for initiating construction works upon approval of EIA. Status: To be issued 1. Approval of Scoping Report including ToR for ESIA. Status: To be obtained. 2. Approval of ESIA. Status: To be obtained.	IA MoFE/IA	Prior to forward Scoping Report to MOFE. 1. Prior to GoN EIA process 2. Prior to construction
Nepal Electricity Authority	Permission to relocate affected electric poles along the alignment Status: To be obtained.	IA	Prior to construction
Department of Culture	Clearance for works close to and at cultural and religious sites. Status: To be obtained.	IA	Prior to construction
Private property and Land owners	Acquisition of land. Status: To be obtained.	IA	Prior to construction

Note: IA: Implementing Agency.

MoPIT as executing agency is the umbrella agency undertaking the planning and construction of the roads at central level whereas DoR is functioning as implementing agency for the sector wide road programs. The deputy directorships/branches of DoR develop and implement projects. A project implementing unit, headed by project manager is established for all subprojects of road development. A project implementing unit, headed by project manager is established for all subprojects of road development. All aspect relating to resettlement and land acquisition activities will be addressed in close consultation and collaboration of the GESU of DoR. MoPIT is responsible for the review of scoping documents and the approval of ToR for EIAs. MoPIT reserves the right to supervise all the project related activities that are likely to have impacts on social and environmental sectors. However, recently new EPA has introduced SEA process as legal instruments to address the social impact issues within and beyond the project. Furthermore, the MoFE has the responsibility for all forestry management aspects for any road, which passes through forest land. MoFE has to be consulted and involved during IEE/EIA studies to obtain prior approval and to ask corrective and compensatory measures during the construction stage as well.

Table 0-3: Institutional Mandate and Responsibility in Road Development Projects

Sn	Name	Mandate	Project Responsibility
1	Ministry of Physical Infrastructure and Transport (MoPIT)	Enhance the economic and social development of country by linking various geographical and economic regions through the national strategic transport network. Provide guidance to the road sectors, formulate and harmonize plans, policies and plans, bring effectiveness of infrastructural services; enforce their implementation, manage human resources, do annual planning and budgeting, conduct monitoring and submit reports.	Transport and transit management and its operation related plans, policies and programs; its implementation; monitoring and evaluation; inspection. Coordinate with project on safeguard issues Conduct environmental monitoring from central level.
2	Department of Roads	Defines specifications for road development and design	Monitoring and control of project implementation
3	Development Cooperation Implementation Division (DCID)	Department under DoR responsible to execute project	Ultimate responsibility for the supervision of proposed road upgrading including environmental safeguards fully respected. Executing role
4	Geo-Environment and social unit (GESU)	Unit under Department of road responsible for reviewing IEE, EIA, ESIA and monitoring of implementation phase	Review, comment, and forward IEE ToR and Report for review for approval to Ministry of environment, monitor project implementation
5	Department of Transport Management	Department is under MoPIT: Design the road signs and regulation of traffic, drivers and vehicles	Registration of vehicles, driving licenses, insurance, control for public transport
6	Road Board Nepal (RBN) was established under the Roads Board Act 2058 (2002)	Providing sustainable fund for planned maintenance of the roads. Make effective repair and maintenance work of the roads, reduce vehicle operating costs. Collecting road tolls, fuel levy and vehicle registration fees.	Sets quality standards, monitors implementation of standards and sanctions penalties in case of violations of standards.
7	Ministry of Forest and Environment (MoFE)	Mandated to formulate and implement environmental policies, plans and programs at national level	Facilitate when needed on environmental safeguards, Review, EIA and Approve EIA
8	Survey Department of the Ministry of Land Reform, Cooperatives and Poverty Alleviation	Preparation of land database and provide land rights to individual, Preparation of Administrative and Land resource maps and coordination of surveying, mapping and GIS activities in Nepal with other agencies	
9	Department of Land Management and Archive	Deliver better services to the general public on land ownership administration and safeguard land ownership records help increase productivity and alleviate poverty by protecting access to land among stakeholders	Land acquisition and land ownership issues may be settled from Department
10	Nepal Electricity Authority	NEA is to generate, transmit and distribute adequate, reliable and affordable power by planning,	Transmission and distribution/ end users poles and wires to be managed in the roads sector

Sn	Name	Mandate	Project Responsibility
		constructing, operating and maintaining all generation, transmission and distribution facilities	
11	Department of Labour	Enforce the labour laws including occupational health and safety. Its role is mainly on the regulatory side and can formulate and issue policies, rules and standards for OHS consistent with the law.	Labour related grievances to be resolved through department
12	World Bank	Role in decision making for the execution of work	Responsible for overseeing DoR's project design, implementation management in accordance with their grant / loan conditions including environmental safeguards adequately addressed, and respected it during proposed road upgrading works.

10.4 Safeguard Capacity and Staffing Techniques

DOR-DCID has the responsibility to manage the implementation and monitoring of safeguard compliance in NNM Road through the proper safeguard staffing. Also, it is responsibility of DOR-DCID to enhance the capacity of staff for assessing, managing and monitoring of environmental and social risk and impacts associated with the project activities.

For the safeguard capacity enhancement during design, implementation and monitoring, the management of environmental and social risk is associated with the following aspects:

- The capacity of project designers and the safeguard implementers in terms of their knowledge, skills, available time, institutional process and available resources
- Challenges related with the design and civil works
- Vulnerability and risk to the local community in relation with the environment and social safeguard measures.

Project technicalities and the project situation are the major influential factors for the safeguard design and implementation, but enhancement of institutional capacity is vital factor for handling the safeguard requirements. The following staffing plan including administrative and technical E&S staff for the PMU and GESU will be arranged:

- One Social Management Advisor based at GESU to take the lead in preparing and reviewing RAPs and IPDPs; and in developing TOR templates, review guidelines, audit checklists and protocols;
- One Environmental Management Advisor also based at GESU to contribute to the development of manuals, protocols, checklists and templates, on occupational health and safety; and, review OSH and aspects of the EIA and ESMP;
- One Social Safeguards expert to be based at PMU;
- One Environmental Safeguard Specialist to be based at PMU;
- One Health & Safety Specialist to be based at PMU;
- One Gender Specialist to be based at PMU;
- One Administrative Staff at GESU to supplement existing administrative staff

Table 0-4: Staffing Plan for DoR GESU and PMU

Title	Expertise	Office	Start of Engagement	Length of Engagement	Indicative Year 1 Cost (USD)
Social Risk Management Advisor	ESS1 (social aspects), ESS2, ESS4, ESS5, ESS7, ESS8, ESS10	GESU	2-months prior to start of program	6 months spread to 18 months period	50,000
Environmental Risk Management Advisor	ESS1 (environmental aspects), ESS2, ESS3, ESS4, ESS6,	GESU	2-months prior to start of program	6 months spread to 18 months period	50,000
Social Safeguards Specialist	Social Development specialist	PMU	Start of program	Full time up to the close of the program	12,000
Environmental Specialist	Environmental Specialist	PMU	Start of program	Full time up to the close of the program	12,000
Health & Safety Specialist	Occupational and Community Health and Safety	PMU	Start of program	Full time up to the close of the program	12,000
Gender Specialist	Gender, GBV	PMU	Start of program	Full time up to the close of the program	12,000

References

1. Anon, 1990. Methods for Stream Habitat Surveys: Aquatic Inventories Project. Natural Production Program: Oregon Department of Fish and Wildlife, 1990.
2. Arévalo E and Newhard A. 2011. Traffic noise affects forest bird species in a protected tropical forest. *International Journal of Tropical Biology* 59 (2): 969-980
3. Bibby CJ, Burgess ND, Hil DA, and Mustoe S. 2000. Bird census techniques. Second Edition. Great Britain: Academic Press.
4. Budha, P.B., 2016. Field Guide to Freshwater Molluscs of Kailali, Far Western Nepal. Published by Central Department of Zoology, Kirtipur, Kathmandu, Nepal, 2016.
5. Chaturvedi, A.N., Khanna, L.S., 1982. Forest Mensuration. International Book Distributors, Dehra Dun, India, pp 408
6. Dhital, R.R. and Jha, D.K., 2002. Fish fauna of the Narayani River system and their impact on the fishermen community Nepal. In Petr, T. and Swar, D.B. (eds), Cold water fisheries in the trans-Himalaya countries. FAO Fisheries Technical Paper. No. 421 Rome, FAO. 2002. P. 119.
7. DoR (2017). *Feasibility study for improvement of Kathmandu (Nagdhunga)-Naubise-Mugling Road and Bridges*, Final Feasibility Report, Department of Roads Foreign Cooperation Branch, Ministry of Physical Infrastructure and Transport, Government of Nepal.
8. DoR (2017). *Feasibility study for improvement of Kathmandu (Nagdhunga)-Naubise-Mugling Road and Bridges*, Final Feasibility Report, Department of Roads Foreign Cooperation Branch, Ministry of Physical Infrastructure and Transport, Government of Nepal.
9. Environment Protection Rules, 1997
10. Environmental Protection Act, 1997
11. ERM, 2016. Feasibility Study of Kathmandu-Naubise-Muglin Road, Environmental Assessment Report.
12. FAO, 2000. Carbon sequestration options under the clean development mechanism to address land degradation. *World Soil Resources Reports* 92
13. FSRO, 1967. Tree Volume Tables for Nepal. FSRO Publication No 3, Forest Survey and Research Office, Kathmandu.
14. GoN 2000. Guideline for Inventory of Community Forests. Ministry of Forests and Soil Conservation, Department of Forests, Community and Private Forest Division, Kathmandu Nepal
15. Grimmett R, Inskipp C, and Inskipp T. 2000. Birds of Nepal. Helm Field Guide. Oxford University Press, India.
16. Grimmett R, Inskipp C, Inskipp T, and Baral HS. 2016. Birds of Nepal (Revised edition). Helm Field Guide. Prakash Books, New Delhi.
17. Inskipp C, Baral HS, Phuyal S, Bhatt TR, Katiwada M, Inskipp T, Khatiwada A, Gurung S, Singh PB, Murray L, Poudyal L and Amin R. 2016. The State of Nepal's Bird: The national red list series. Zoological Society of London.
18. IPCC (2013). *Climate Change 2013: The Physical Science Basis*, Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.
19. IUCN. 2017. The IUCN Red List of Threatened Species. <http://www.iucnredlist.org/>.
20. Kociolek AV, Clevenger AP, Clair CC, and Proppe DS. 2011. Effects of Road Networks on Bird Populations. *Conservation Biology* 25: 241–249.
21. Mishra, B.K., & Herath, B. (2015). Assessment of Future Floods in the Bagmati River Basin of Nepal Using Bias-Corrected Daily GCM Precipitation Data, *Journal of Hydrologic Engineering*, 20 (8).
22. MoFSC, 2017. Methodology for EIA studies to adopt for Projects of National Interest – 2074. Ministry of Forests and Soil Conservation, Kathmandu.
23. MoSTE (2014). *Nepal Climate Change Program (CCP) Results Management Framework (RMF) 2013-2020*, Ministry of Science, Technology and Environment.
24. NCVST (2009). *Vulnerability through the eyes of vulnerable: Climate change induced uncertainties and Nepal's Development Predicaments*, Institute for Social and Environmental Transition-Nepal (ISET-N, Kathmandu) and Institute for Social and Environmental Transition (ISET, Boulder, Colorado) for Nepal Climate Vulnerability Study Team (NCVST) Kathmandu.
25. Negi, J.D.S., Manhas, R.K., Chauhan, P.S., 2003. Carbon allocation in different components of some tree species of India: a new approach for carbon estimation. *CurrSci India* 85 (11): 1528-1531
26. Nepal, S. (2016). Impacts of climate change on the hydrological regime of the Koshi river basin in the Himalayan region, *Journal of Hydro-environment Research*, 10, pp 76-89.

27. Nepal, S., Shrestha, A.B. (2015). Impact of climate change on the hydrological regime of the Indus, Ganges and Brahmaputra river basins: a review of the literature, *International Journal of Water Resources Development*, Routledge, 31, pp 201-218.
28. Ng, H.H., 2006. The identity of *Pseudecheneis sulcata* (McClelland, 1842), with description of two new species of rheophilic catfish (Teleostei; Sisoridae) from Nepal and China. *Sootaxa* 1254: 45-68.
29. Oli, K.P., 1996. Environmental study of Nepal's Begnas and Rupa lakes, IUCN, Nepal. PP.156
30. Rai, A.K., 2011. Fish, Fisheries and Farmers in Nepal. Published by Resources Himalaya Foundation, Kathmandu, Nepal, 2011.
31. Reijnen R. and Foppen R. 1994. The effects of car traffic on breeding bird populations in woodland: 1. Evidence of reduced habitat quality for willow warblers (*Phylloscopus trochilus*) breeding close to a highway. *Journal of Applied Ecology* 31:85-94
32. Shah, K.B. and Tiwari, S., (2004). Herpatofauna of Nepal: A conservation Companion. IUCN-The World Conservation Union, Nepal. VIII+237 pp.
33. Sharma, E.R. and Pukkala, T. 1990. Volume Tables for Forest Trees of Nepal. Publication no. 48. Ministry of Forests and Soil Conservation, Forest Survey and Statistics Division, HMG/ Nepal.
34. Sharma, R.P., 2003. Relationship between tree dimensions and biomass, sapwood area, leaf area and leaf area index in *Alnus nepalensis* D. Don in Nepal, Agricultural University of Norway (NLH), Aas
35. Shrestha, T.K., (1990a). Resource Ecology of the Himalayan Waters, Curriculum Development Centre, Tribhuvan University, Nepal, pp. 61-109
36. Shrestha, T.K., 1990. Rare fishes of Himalayan waters of Nepal. *Journal of Fish Biology*, 37(sA), pp.213-216.
37. Shrestha, T.K., 2008. Ichthyology of Nepal: A Study of Fishes of the Himalayan Water. Published by Himalayan Ecosphere, Kathmandu, Nepal, 2008.
38. Tamrakar, P. R., 2000. Biomass and volume tables with species description for community forest management. Tree Improvement and Silvicultural Component, NARMSAP, Kathmandu.
39. Thomas L, Buckland ST, Burnham KP, Anderson DR, Laake JL, Borchers DL, and Strindberg S. 2002. Distance sampling. In El-Shaarawi AH, Piegorisch WW, (Eds). *Encyclopedia of Environmetrics*, John Wiley & Sons, Ltd, Chichester. Urfi AJ, Sen M, Kalam A, and Meganathan T. 2005. Counting birds in India: methodologies and trends. *Current Science* 89 (12): 1997-2003. Viviroli, D., Archer, D.R., Buytaert, W., Fowler, H.J., Greenwood, G.B., Hamlet, A.F., et al. (2011). Climate change and mountain water resources: Overview and recommendations for research, management and policy, *Hydrology and Earth System Sciences*, 15, pp 471-504.
40. TISC/GON (2002). Forest and Vegetation Types of Nepal. TISC Document Series No. 104. Ministry of Forests and Soil Conservation, HMG/Nepal. Natural Resource Management Sector Assistance Programme (NARMSAP). Tree Improvement and Silviculture Component
41. Tiwari, A et al., (2019). Plant endemism in the Nepal Himalayas and phytogeographical implications, *Plant Diversity*, [https:// doi.org/10.1016/j.pld.2019.04.004](https://doi.org/10.1016/j.pld.2019.04.004)
42. Transportation Research Board and National Research Council. 2005. *Assessing and Managing the Ecological Impacts of Paved Roads*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/11535>

Annexes

Annex 1: Project Description

Annex 1.1: Flood Estimation for Drainage Structures

i) Existing Road Alignment

Taking 100 years return period, DoR (2017) estimated the design flood discharge passing through the existing bridges using rational formula and were compared with flood discharge estimated using several rational/empirical methods.

Table 0-1: Design flood estimation for existing bridges in the existing road alignment (cumecs)

SN	Bridge Name	Chainage (km)	Catchment Area, km ²	WECS/DHM 1990	Sharma & Adhikari (2004)	PCJ (1996)	Modified Dicken's Formula	Rational Method
1	Khatripauwa	4+139	0.8	22	17	10	4	13
2	Naubise	12+449	16.1	118	153	92	83	176
3	Ganesh	2+965	4.0	48	57	36	22	57
4	Sopyang	5+096	6.0	61	75	47	32	70
5	AgraKhola	10+923	111.8	470	618	410	473	495
6	Khahare	12+376	1.6	29	29	21	9	26
7	Phedi	14+453	3.1	41	46	63	17	50
8	Dangdunge	14+735	7.9	73	91	117	42	86
9	Kheste	18+165	22.8	150	197	257	114	165
10	Machedi	19+484	1.3	27	25	31	7	25
11	Gardo	23+128	4.8	53	64	85	26	80
12	Jundi	24+989	2.5	36	40	54	14	39
13	Chiraudi	26+488	12.0	96	124	152	63	100
14	Belkhu	28+803	88.0	395	520	653	383	424
15	Pokhare	33+155	5.3	57	69	92	29	64
16	Galaudi	36+316	19.7	135	177	228	99	150
17	Soti	38+384	1.7	30	30	39	9	32
18	Malekhu	43+379	101.5	438	576	711	434	435
19	Gomati	49+942	8.0	74	93	119	43	95
20	Charaudi	55+246	46.6	249	329	439	217	311
21	Khatauti	58+186	6.8	66	83	109	37	96
22	Hugdi	61+706	53.1	274	362	459	244	303
23	Mowa	65+887	9.6	83	105	120	51	101
24	Dahaki	72+344	1.0	24	21	23	5	17
25	Barbang	73+275	5.8	60	73	92	1	63
26	Nagdi	80+182	6.8	66	82	102	37	69

Note: For Khatripauwa and Naubise Bridges, 0+000 is at Nagdhunga while for rest of the bridges, 0+000 is at Naubise

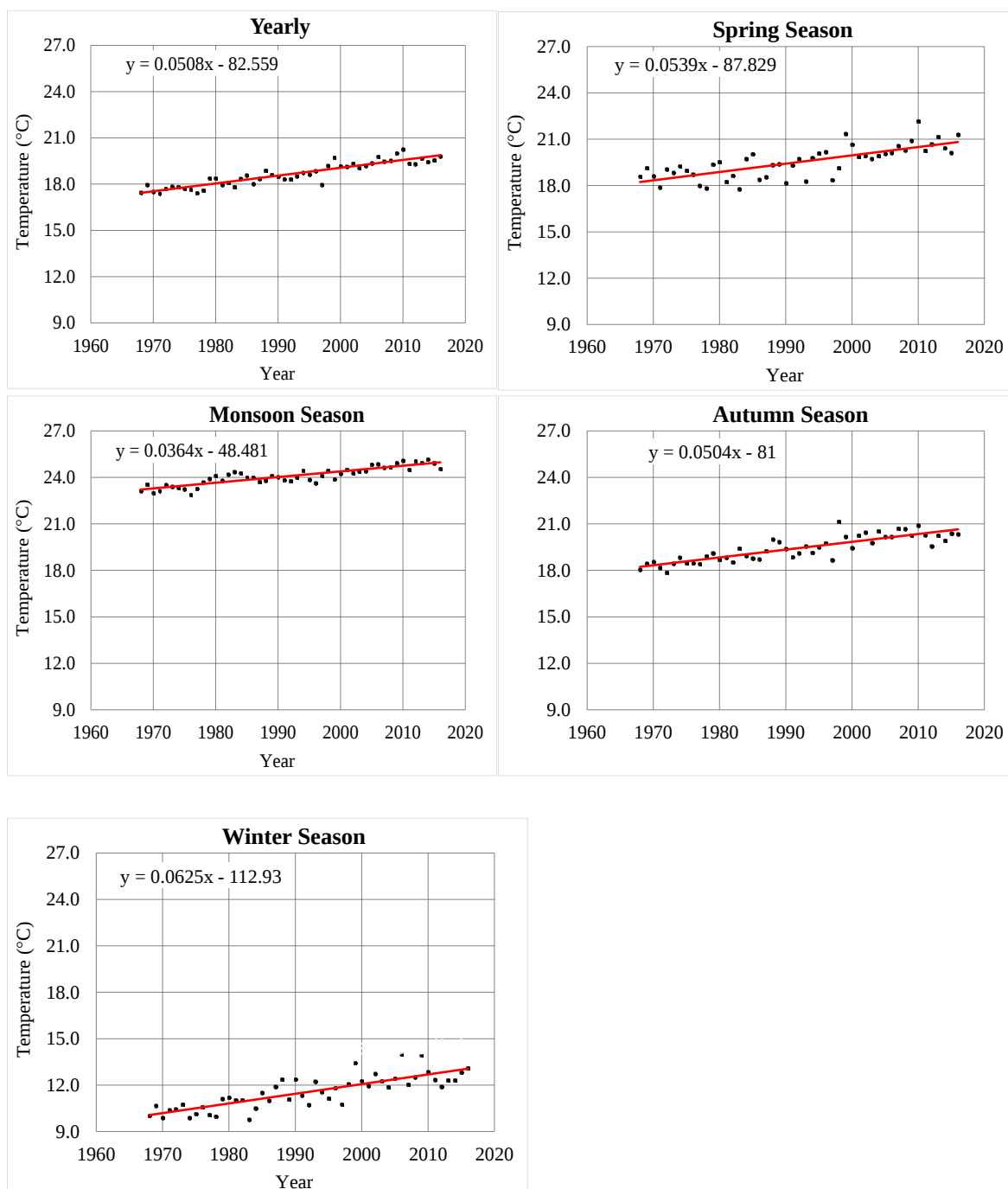
Source: DoR (2017)

Cross drains will be designed for 50 years return period flood (DoR, 2017). Using rational formula for discharge estimation of cross drains, this study pointed out the necessity of new crossing structures along with replacing of existing culverts which are inadequate to pass design discharge.

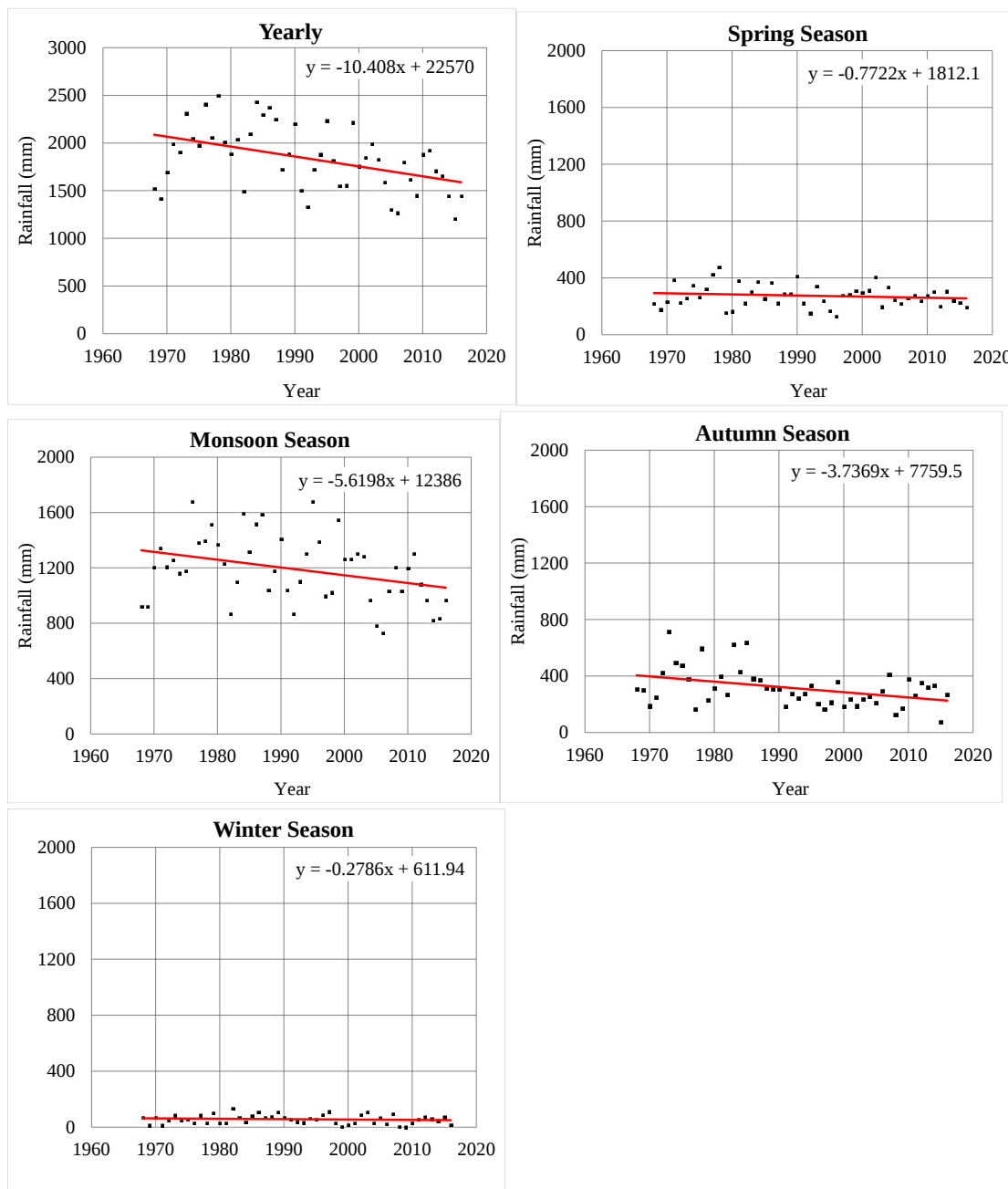
DoR (2017) also found that the existing side drains are more or less adequate for 25 years return period flood but might to be increased for increased return period of flood. In any case during the improvement works, these side drains will be dismantled and the new side drains will be constructed.

Annex 2: Baseline Information

Annex 2.1: Annual, Spring, Monsoon, Autumn and Winter Patterns of Temperature



Annex 2.2: Annual, spring, monsoon, autumn and winter patterns of rainfall in the study area



Annex-2.3: Trishuli River, Discharge in cumecs

Station Name: Betrawati (Station No.: 447) Latitude: 27°58' Longitude: 85°11'

Year	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Jan	49.1	47	53.3	42	48.5	49	45.8	52.4	52.5	51.9	50.8	55.3	57.7
Feb	46.9	43.6	42.8	38.2	42.1	45.7	40.3	38.8	50.7	51	45.8	49.6	48.4
Mar	51.2	45.4	43.4	38.8	43	62.5	42	39.7	58.4	50.4	44.3	51.1	49.7
Apr	58	61.3	54.7	60.3	56.1	82.7	44.2	39.9	62.2	63.3	58.1	66.4	62.7
May	86.4	166	105	84.8	93.3	89.7	77.2	113	69.5	78.5	82.5	108	142
Jun	204	337	198	262	274	212	165	283	141	293	235	234	245
Jul	561	501	442	575	615	369	345	536	361	599	512	595	451
Aug	574	586	451	588	539	520	448	386	320	519	577	682	542
Sep	361	336	267	355	339	357	394	317	337	407	333	336	370
Oct	179	228	144	168	148	129	200	118	200	174	154	142	157
Nov	107	122	87.6	99.9	95.6	85.6	104	82.2	96.1	102	96.2	85.5	79.6
Dec	67	77.9	56	65.5	62.2	60.1	67	64.7	68.7	67.3	69.7	65.1	56.3
Yearly	195.4	212.6	162.1	198.1	196.3	171.9	164.4	172.6	151.4	204.7	188.2	205.8	188.5

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Jan	46.9	57.2	52.2	50.5	47	42.5	53	49.6	44.7	43.9	48.9	43.1	65.2
Feb	40.9	49.6	44.5	46.6	40.3	36.2	46.9	45.2	40.2	38	42	39	56.3
Mar	39.1	49.6	43.8	41.8	42.1	38.8	53.1	43.8	41.8	36.6	38.7	34.6	43.3
Apr	55.5	56.6	52	55.7	41.4	60.3	61.1	49	57.4	51.7	48.8	36.9	88.6
May	118	113	62.3	110	79.3	DNA	121	68.4	150	86	106	72.8	193
Jun	396	285	160	256	324	DNA	294	213	350	242	399	366	333
Jul	904	595	408	547	557	515	626	573	755	790	707	669	649
Aug	746	904	814	837	657	DNA	825	565	871	779	869	756	846
Sep	556	611	508	522	448	DNA	498	374	421	594	635	443	496
Oct	221	208	184	220	150	179	189	113	176	269	169	148	211
Nov	99.8	90.2	87.6	89.2	79.7	116	90.1	66.3	72.9	92.9	79.1	70.2	88
Dec	69.2	64.8	61	61.5	57.8	64.4	61.7	56.5	53.5	61.7	54.7	50.6	61.6
Yearly	274.4	257.0	206.5	236.4	210.3	-	243.2	184.7	252.8	257.1	266.4	227.4	260.9

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Jan	47.6	49.3	52.4	45.3	43.9	54.2	54.2	52	50	47.9	43.1	47.1	47.1
Feb	41.3	39	54.1	41.7	41.8	46.4	48.6	46.6	45.1	42.7	40.1	39.2	40.4
Mar	41.3	43.1	53.6	36.2	42.1	44.5	45.5	47.4	42.7	43.2	40.2	35.4	40.7
Apr	57.8	51.4	63.5	41.2	58.3	53.8	57.5	58.6	43.6	49.9	51.3	34.5	51.6
May	84.3	113	105	125	92.9	76.6	75.1	71.8	72.7	83.3	107	62.6	145
Jun	314	332	251	336	190	276	132	144	201	219	282	178	226
Jul	722	697	725	666	422	451	314	394	506	467	596	367	333
Aug	869	875	867	463	496	536	383	568	566	495	518	487	426
Sep	722	566	471	323	382	292	277	479	406	343	296	320	250
Oct	234	290	248	157	190	152	169	163	176	132	205	141	148
Nov	103	97.1	86.4	78.6	104	92.7	86.3	86.9	89.5	71.8	96.5	71.8	101
Dec	64.3	63.5	49.1	52.9	67.5	69.2	64.2	63.3	65.4	52.6	64.3	53.8	71.1
Yearly	275.1	268.0	252.2	197.2	177.5	178.7	142.2	181.2	188.7	170.6	195.0	153.1	156.7

Station Name: Kali Khola (Station No.: 449.91) Latitude: 27°50' Longitude: 84°33'

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Jan	DNA	DNA	177	183	174	161	172	172	178	175	170
Feb	156	DNA	153	150	148	131	138	126	155	155	151
Mar	158	119	171	148	161	115	128	98.7	137	150	142
Apr	162	167	191	187	229	173	184	121	221	201	174
May	275	677	379	257	549	376	445	247	471	226	385
Jun	1070	1900	1010	700	1230	1020	1590	767	969	887	1140
Jul	1980	2660	2360	2130	3100	3380	2680	1650	2730	3260	3140
Aug	2710	2750	3320	2090	3940	3000	3630	2200	3010	3720	3620
Sep	1970	1500	2050	1330	1810	2210	2440	1300	1500	2770	1930
Oct	DNA	648	787	520	779	1050	631	613	607	708	1020
Nov	DNA	415	395	295	398	416	332	333	319	359	371
Dec	DNA	237	259	257	266	247	205	228	220	214	244
Yearly	-	-	937.7	687.3	1065.3	1023.3	1047.9	654.6	876.4	1068.8	1040.6

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Jan	176	172	173	195	180	156	166	172	142	169	189
Feb	146	142	189	155	149	126	143	149	137	135	140
Mar	138	135	188	141	120	128	121	137	120	120	180
Apr	160	158	217	184	184	192	132	184	161	122	224
May	276	424	275	271	260	243	285	309	394	222	535
Jun	669	1010	1120	1630	509	603	1140	1150	1420	693	1090
Jul	2440	2430	2670	2940	1930	2680	3610	3060	3870	2440	1640
Aug	3150	2360	3260	4400	2660	3700	3430	3230	2870	3540	2480
Sep	1400	1940	2840	1420	1420	3320	2290	2380	1320	2140	1360
Oct	665	649	993	663	838	762	752	572	781	648	545
Nov	385	345	429	343	338	376	376	297	364	338	288
Dec	232	239	261	228	214	233	233	184	210	224	194
Yearly	819.8	833.7	1051.3	1047.5	733.5	1043.3	1056.5	985.3	982.4	899.3	738.8

Annex-2.4: Trishuli River, Maximum Instantaneous Discharge in cumecs

Station Name: Betrawati (Station No.: 447) Latitude: 27°58' Longitude: 85°11'

Year	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Discharge	935	924	935	941	895	851	740	955	2100	884	1090	953	724

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Discharge	1540	1160	1540	1980	1180	1820	2040	1060	1490	1440	1640	1430	1520

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Discharge	1490	1150	1380	1260	734	906	495	876	1140	970	1040	750	750

Station Name: Kali Khola (Station No.: 449.91) Latitude: 27°50' Longitude: 84°33'

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Discharge	5680	5680	7580	3630	9420	14000	9420	6020	7950	13700	9420

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Discharge	5320	5340	7860	10400	5060	7240	7340	6120	10200	7770	5280

Annex 2.5: Lithostratigraphy of Lesser Himalaya, Central Nepal

Group	Formation	Main Lithology	Thickness (m)	Age
Main Central Thrust (MCT)				
Kathmandu	Chadragiri (Ca)	Limestone	1000	Pre-Cambrian-Paleozoic
	Shiprin Khola (Sp)	Schist	1000	
	Udayapur		1500	
	Markhu (Mr)	Marble/schist	2000	
	Sorang Khola (Sk)	Schist/quartzite	1000	
	Tawa Khola (Ta)	Quartzite/schist	1000	
Main Central Thrust (MCT) or Mahabharat Thrust (MT)				
Midland	Robang (Rb)	Schist, quartzite, amphibolite,	1500	Paleozoic
	Galyang (Gl)	Slate/ Calcareous slate/limestone	2000	
	Sangram (Sg)	Shale/quartzite/limestone	1000	
	Lakharpata (Lk)	Limestone/dolomite	2000	
	Syangja (Sy)	Quartzite/shale	1000	
	Naudanda Quartzite (Nd)	Quartzite	400	Pre-Cambrian
	Ranimatta (Rm)	Phyllite/quartzite	3000	

Annex 2.6: Conversion of the maximum acceleration of the earthquake motion into the design seismic coefficient

There are several methods to convert the maximum acceleration of the earthquake motion into the design seismic coefficient. The Simplest Method has been applied in this study. The effective design seismic coefficient from the Simplest Method is determined by using the simplest method, the following equation:

$$A_{eff} = R \cdot A_{max} / 980$$

Where, A_{eff} is effective design seismic coefficient R =Reduction factor (empirical value $R=0.50-0.65$).

The basic horizontal seismic coefficient is considered to be 0.50. By using the above empirical method, the effective design coefficient according to the seismic design code of Nepal is given by the equation

$$A_{eff} = R \cdot A_{max} / 980$$

For the minimum acceleration of 300 gal, reduction factor of 0.50 the calculated effective design seismic coefficient is approximately 0.15. For the maximum acceleration of 350 gal, reduction factor of 0.50 the calculated effective design seismic coefficient is approximately 0.18. Hence, the design horizontal seismic coefficient ranges from 0.15 to 0.18g (calculated values).

Annex 2.7: National Ambient Air Quality Standards for Nepal, 2012

Parameters	Units	Averaging Time	Concentration in Ambient Air, maximum	Test Methods
TSP (Total Suspended Particulates)	$\mu\text{g}/\text{m}^3$	Annual -	-	
		24-hours*	230	High Volume Sampling and Gravimetric Analysis
PM ₁₀	$\mu\text{g}/\text{m}^3$	Annual	-	High Volume Sampler and Gravimetric Analysis, TOEM, Beta Attenuation
		24-hours*	120	
Sulphur Dioxide	$\mu\text{g}/\text{m}^3$	Annual**	50	Ultraviolet Fluorescence, Waste and Geake method
		24-hours*	70	Same as annual
Nitrogen Dioxide	$\mu\text{g}/\text{m}^3$	Annual	40	Chemi-luminescence
		24-hours*	80	Same as annual
Carbon Monoxide	$\mu\text{g}/\text{m}^3$	8 hours*	10,000	Non dispersive Infra-Red spectrophotometer (NDIR)
Lead	$\mu\text{g}/\text{m}^3$	Annual**	0.5	High volume sampling, followed by atomic absorption spectrometry.
Benzene	$\mu\text{g}/\text{m}^3$	Annual **	5	Gas chromatographic Technique
PM 2.5	$\mu\text{g}/\text{m}^3$	24-hours*	40	PM2.5 sampling gravimetric analysis
Ozone	$\mu\text{g}/\text{m}^3$	8 hours*	157	UV spectrophotometer

*24 and 8 hourly values shall be met 95% of the time in a year. 18 days per calendar year, the standard may be exceeded but not on two consecutive days.

** The above indicators are prepared by the 104 data taken yearly average in a fixed location in one week by observing two times in 24 hours.

Annex 2.8: Water Quality Test Results

Parameters	Units	NDWQS	Result																					
			Sisne Khola	Sikrey Khola	Khani Khola	Naubise Khola	100m Downstream of Dhumikhola and Rupsekhol (1236)	Maresh Khola	Agra Khola	Kheshe Khola	Belkhu Khola	Galaudi Khola	Malekhu Khola	Charaudi Khola	Hugdi Khola	Mauwa Khola	Barban Khola	Majhitar Across at Trisuli River	Pang Khola	Pasupati Khola	Kaudi Khola	Dhaubadi Khola	Lamu Khola	Near Shree Chandrodya H. S. School at Trisuli River
PHYSICAL																								
pH	-	6.5-8.5*	6.8	6.5	6.6	7	6.8	7.3	7.4	7.5	7.1	6.7	7	7.1	7.1	7	6.5	6.5	6.5	6.2	6.7	7	7	6.7
Temp.	°C	-	24.7	24.5	24.4	24.4	24.5	24.7	24.9	24.7	24.6	24	24.7	24.8	25.2	25.3	25	25	25	24.9	25	24.9	24.9	24.9
TDS	mg/l	1000	81	78	106	148	155	154	128	116	35	127	176	193	160	258	65	72	65	57	184	223	221	74
CHEMICAL																								
Ammonia	mg/l	1.5	0.03	<0.02	0.16	0.05	<0.02	0.06	0.25	0.03	0.11	0.03	0.11	0.09	0.02	0.14	<0.02	0.39	<0.02	0.02	0.09	0.18	0.06	0.34
Nitrate	mg/l as NO ₃	50	2.17	4	4.2	2.1	1.9	1.2	1.6	<0.02	0.12	0.2	0.1	0.49	0.44	1.4	0.46	2.8	0.46	3.4	0.46	2	1.3	1.8
Phosphate	mg/l	-	0.22	0.37	0.2	0.09	0.19	0.15	0.4	0.19	1.7	0.27	0.16	0.32	0.15	0.1	0.35	0.25	0.35	1.3	0.15	0.15	0.18	0.16
Sulphate	mg/l	250	<5.0	<5.0	<5	<5	<5	<5.0	<5	<5	<5	<5	<5	<5.0	<5.0	60.97	<5.0	74.2	<5	28.	57.7	57.7	63.5	<5.0
Sulphide	mg/l		1.5	1.5	0.75	1.5	1.8	1.1	1.8	1.8	2.6	1.1	2.6	3	1.5	2.2	1.5	1.8	1.5	2.2	1.8	1.8	1.1	2.6
DO	mg/l	-	7.1	7.4	7.2	7.5	7.2	7.3	7.6	7.1	7.1	7.3	7.1	7.3	7.2	7.1	7.4	7.2	7.1	7	7.4	7.1	7	7.2
BOD	mg/l	-	2.5	3	3.3	3.4	1.7	1.8	5.8	1.6	0.83	1.2	0.87	3	4.7	2.2	1.9	0.7	1.9	2.8	3	3.6	4.1	3.8
Total Hardness	mg/l as CaCO ₃	500	68	100	126	136	136	130	102	100	30	102	154	182	152	250	50	70	50	44	180	208	200	70
Calcium	mg/l as Ca ²⁺⁺	200	17.6	27.2	35.2	36.8	38.4	33.6	22.4	32	8	28	36	36.8	31.4	51.2	12	16	12	10.4	40.8	43.2	40.8	20.8
Mg	mg/l	-	5.8	7.8	9.2	10.7	9.7	11.2	11.2	4.8	2.4	7.8	15.5	21.8	18.4	29.6	4.8	7.3	4.8	4.4	18.9	24.3	23.8	4.4
Chloride	mg/l	250	1	<1.0	1	3	2	3	2	<1.0	<1.0	<1.0	<1.0	1.98	0.9	1.9	<1.0	<1.0	<1.0	1	1.98	2.9	4.9	2
Iron	mg/l	0.3 (3)	0.13	0.21	1.5	0.4	0.5	0.8	31.9	0.03	0.27	0.62	0.91	0.12	0.08	0.12	0.07	8.9	0.07	0.05	0.07	0.74	0.25	4.3
Fluoride	mg/l	0.5-1.5*	0.29	0.23	0.16	0.18	0.17	0.3	0.21	0.24	0.2	0.35	0.33	0.25	0.31	0.31	0.41	0.2	0.41	0.26	0.27	0.42	0.26	0.2
Chromium	mg/l	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Parameters	Units	NDW/QS	Result																					
			Sisne Khola	Sikrey Khola	Khani Khola	Naubise Khola	100m Downstream of Dhumkhola and Rupsekhol (1236)	Maresh Khola	Agra Khola	Kheste Khola	Bekhu Khola	Galaudi Khola	Malekhu Khola	Charaudi Khola	Hugdi Khola	Mauwa Khola	Barban Khola	Majhimtar Across at Trisuli River	Pang Khola	Pasupati Khola	Kaudi Khola	Dhaubadi Khola	Lamu Khola	Near Shree Chandrodya H. S. School at Trisuli River
Sodium	mg/l	-	3.8	3.3	3.1	2.1	2.2	6.7	5.8	6.8	4.5	8.7	3.9	3.3	2.2	3	8.6	3	8.6	7.3	3.4	5.5	3.7	3
Potassium	mg/l	-	1.6	1	1.1	1.2	1.33	2.8	4.5	2.7	1.6	2.7	3.5	3.06	1.7	3.7	1.6	6	1.6	1	1.7	2	1.6	4.1
Cadmium	mg/l	0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.01	<0.01	<0.01	<0.01	<0.01	<0.003	<0.003
Copper	mg/l	1	<0.01	0.05	0.02	0.08	<0.01	0.3	0.08	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	0.02	0.03	0.02
Lead	mg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Oil & Grease	mg/l	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
BACTERIOLOGICAL ANALYSIS																								
Total Coliform	CFU/100 ml	Nil	300	600	550	300	500	400	1000	1000	300	800	600	400	500	350	650	1000	650	500	Nil	450	500	550

Source: ESIA study, 2017

Annex 2.9: National Drinking Water Quality Standard 2006

Group	Parameter	Unit	Maximum Concentration Limits	Remarks
Physical	Turbidity	NTU	5(10)	
	pH	TCU	6.5-8.5*	
	Color		5(15)	
	Taste & Odor		No objectionable	
	Total Dissolved Solids	Milligram/Liter	1000	
	Electrical Conductivity	Micro-Siemens/Centimeter	1500	
Chemical	Iron	Milligram/Liter	0.3(3)	
	Manganese	Milligram/Liter	0.2	
	Arsenic	Milligram/Liter	0.05	
	Cadmium	Milligram/Liter	0.003	
	Chromium	Milligram/Liter	0.05	
	Cyanide	Milligram/Liter	0.07	
	Fluoride	Milligram/Liter	0.5-1.5*	
	Lead	Milligram/Liter	0.01	
	Ammonia	Milligram/Liter	1.5	
	Chloride	Milligram/Liter	250	
	Sulphate	Milligram/Liter	250	
	Nitrate	Milligram/Liter	50	
	Copper	Milligram/Liter	1	
	Total Hardness	Milligram/Liter	500	
	Calcium	Milligram/Liter	200	
	Zinc	Milligram/Liter	3	
	Mercury	Milligram/Liter	0.001	
	Aluminum	Milligram/Liter	0.2	
	Residual Chlorine	Milligram/Liter	0.1-0.2*	In chlorination System Only
Microscopic Organism	E.coli	MPN/100ml	0	
	Total coli form	MPN/100ml	0(In 95% Sample)	

Note: (*) Value Given in the bracket is applicable only if no alternative is available * Indicates minimum and maximum limits. Source: Nepal Gazetted Ashad 12, 2063 B.S.

Annex 2.10: Water and Effluent Quality Guidelines of the Country Are as Follows:

- Tolerance Limits for Different Industrial Effluents Discharged into Inland Surface Water; Source: Nepal Gazette, 30 April 2001 and 23 June 2003
- Generic Standard /Tolerance Limits for Different Industrial Effluents Discharged into Inland Surface Water; Nepal Gazette ,30 April 2001 and 23 June 2003
- Nepal Water Quality Guidelines for Irrigation Water; Department of Irrigation, Ground Water Project (Nepal Gazette (Number 10.16 June 2008))
- Nepal Water Quality Guidelines for Aquaculture; Department of Irrigation, Ground Water Project (Nepal Gazette (Number 10, 16 June 2008)).
- Nepal Water Quality Guidelines for Livestock Watering; Department of Irrigation, Ground Water Project (Nepal Gazette (Number 10, 16 June 2008)).
- Nepal Water Quality Guidelines for Recreation; Department of Irrigation, Ground Water Project (Nepal Gazette (Number 10, 16 June 2008)).
- Nepal Water Quality Guidelines for Industries; Department of Irrigation, Ground Water Project (Nepal Gazette (Number 10, 16 June 2008)).
- Nepal Water Quality Guidelines for the Protection of Aquatic Ecosystem; Department of Irrigation, Ground Water Project (Nepal Gazette (Number 10, 16 June 2008)).

Annex 2.11: Bird Species Recorded from Field Study and Literature Review

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migration status	Conservation Status	National Status
1	Black Francolin	<i>Francolinus francolinus</i>	Survey	Yes	Forest	Resident	LC	LC
2	Hill Partridge	<i>Arborophila torqueola</i>	Literature	No	Forest	Resident	LC	NT
3	Red Junglefowl	<i>Gallus gallus</i>	Survey	Yes	Forest	Resident	LC	LC
4	Kalij Pheasant	<i>Lophura leucomelanos</i>	Survey	Yes	Forest	Resident	LC	LC
5	Bar-headed Goose	<i>Anser indicus</i>	Literature	No	Wetland	Winter visitor	LC	NT
6	Ruddy Shelduck	<i>Tadorna ferruginea</i>	Literature	No	Wetland	Winter visitor	LC	NT
7	Gadwall	<i>Anas strepera</i>	Literature	No	Wetland	Winter visitor	LC	LC
8	Eurasian Wigeon	<i>Anas penelope</i>	Literature	No	Wetland	Winter visitor	LC	LC
9	Mallard	<i>Anas platyrhynchos</i>	Literature	No	Wetland	Winter visitor	LC	LC
10	Common Teal	<i>Anas crecca</i>	Literature	No	Wetland	Winter visitor	LC	LC
11	Red-crested Pochard	<i>Rhodonessa rufina</i>	Literature	No	Wetland	Winter visitor	LC	LC
12	Common Pochard	<i>Aythya ferina</i>	Literature	No	Wetland	Winter visitor	VU	NT
13	Ferruginous Pochard	<i>Aythya nyroca</i>	Literature	No	Wetland	Winter visitor	NT	VU
14	Common Merganser	<i>Mergus merganser</i>	Literature	No	Wetland	Winter visitor	LC	LC
15	Speckled Piculet	<i>Picumnus innominatus</i>	Literature	Yes	Forest	Resident	LC	LC
16	Rufous Woodpecker	<i>Celeus brachyurus</i>	Literature	Yes	Forest	Resident	LC	LC
17	Bay Woodpecker	<i>Blythipicus pyrrhotis</i>	Literature	Yes	Forest	Resident	LC	NT
18	Fulvous-breasted Woodpecker	<i>Dendrocopos macei</i>	Literature	Yes	Forest	Resident	LC	LC

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migratio n status	Conservati on Status	National Status
19	Crimson-breasted Woodpecker	<i>Dendrocopos cathpharius</i>	Literature	Yes	Forest	Resident	LC	LC
20	Lesser Yellownape	<i>Picus chlorolophus</i>	Literature	Yes	Forest	Resident	LC	LC
21	Greater Yellownape	<i>Picus flavinucha</i>	Literature	Yes	Forest	Resident	LC	LC
22	Grey-headed Woodpecker	<i>Picus canus</i>	Survey	Yes	Forest	Resident	LC	LC
23	Great Barbet	<i>Megalaima variens</i>	Survey	Yes	Forest	Resident	LC	LC
24	Lineated Barbet	<i>Megalaima lineata</i>	Survey	Yes	Forest	Resident	LC	LC
25	Golden-throated Barbet	<i>Megalaima franklinii</i>	Survey	Yes	Forest	Resident	LC	LC
26	Blue-throated Barbet	<i>Megalaima asiatica</i>	Survey	Yes	Forest	Resident	LC	LC
27	Coppersmith Barbet	<i>Megalaima haemacephala</i>	Survey	Yes	Forest	Resident	LC	LC
28	Common Hoopoe	<i>Upups epops</i>	Literature	No	Grassland	Resident	LC	LC
29	Chestnut-headed Bee-eater	<i>Merops leschenaultia</i>	Literature	No	Forest	Summer visitor	LC	LC
30	Green Bee-eater	<i>Merops orientalis</i>	Literature	No	Forest	Summer visitor	LC	LC
31	Common Kingfisher	<i>Alcedo atthis</i>	Survey	Yes	Wetland	Resident	LC	LC
32	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	Survey	Yes	Wetland	Resident	LC	LC
33	Crested Kingfisher	<i>Megaceryle lugubris</i>	Literature	Yes	Wetland	Resident	LC	LC
34	Pied Kingfisher	<i>Ceryle rudis</i>	Literature	Yes	Wetland	Resident	LC	LC
35	Large Hawk Cuckoo	<i>Hierococcyx sparverioides</i>	Literature	Yes	Forest	Resident	LC	LC
36	Common Hawk Cuckoo	<i>Hierococcyx varius</i>	Literature	Yes	Forest	Summer visitor	LC	LC
37	Indian Cuckoo	<i>Cuculus micropterus</i>	Literature	Yes	Forest	Summer visitor	LC	LC
38	Eurasian Cuckoo	<i>Cuculus canorus</i>	Literature	Yes	Forest	Summer visitor	LC	LC
39	Oriental Cuckoo	<i>Cuculus saturates</i>	Literature	Yes	Forest	Summer visitor	LC	LC
40	Lesser Cuckoo	<i>Cuculus poliocephalus</i>	Literature	Yes	Forest	Summer visitor	LC	LC
41	Grey-bellied Cuckoo	<i>Cacomantis passerines</i>	Literature	Yes	Forest	Summer visitor	LC	LC
42	Drongo Cuckoo	<i>Surniculus lugubris</i>	Literature	Yes	Forest	Summer visitor	LC	LC
43	Asian Koel	<i>Eudynamys scolopacae</i>	Literature	Yes	Forest	Resident	LC	LC
44	Sirkeer Malkoha	<i>Phaenicophaeus leschenaultia</i>	Survey	Yes	Forest	Resident	LC	LC
45	Green-billed Malkoha	<i>Phaenicophaeus stritis</i>	Survey	Yes	Forest	Resident	LC	LC
46	Greater Coucal	<i>Centropus sinensis</i>	Survey	Yes	Forest	Resident	LC	LC
47	Alexandrine Parakeet	<i>Psittacula eupatria</i>	Survey	Yes	Forest	Resident	LC	NT
48	Rose-ringed Parakeet	<i>Psittacula krameri</i>	Survey	Yes	Forest	Resident	LC	LC
49	Slaty-headed Parakeet	<i>Psittacula himalayana</i>	Literature	Yes	Forest	Resident	LC	LC
50	Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	Survey	Yes	Forest	Resident	LC	LC
51	Himalayan Swiftlet	<i>Collocalia brevirostris</i>	Literature	No	Forest	Resident	LC	LC
52	House Swift	<i>Apus nipalensis</i>	Survey	Yes	Settlement	Resident	LC	LC
53	Barn Owl	<i>Tyto alba</i>	Literature	Yes	Settlement	Resident	LC	VU
54	Brown Hawk Owl	<i>Ninox scutulata</i>	Literature	Yes	Forest	Resident	LC	LC

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migration status	Conservation Status	National Status
55	Collared Scops Owl	<i>Otus bakkamoena</i>	Literature	Yes	Forest	Resident	LC	LC
56	Eurasian Eagle Owl	<i>Bubo bubo</i>	Literature	Yes	Forest	Resident	LC	DD
57	Brown Wood Owl	<i>Strix leptogrammica</i>	Literature	Yes	Forest	Resident	LC	VU
58	Collared Owlet	<i>Glaucidium brodiei</i>	Literature	Yes	Forest	Resident	LC	LC
59	Asian Barred Owlet	<i>Glaucidium cuculoides</i>	Survey	Yes	Forest	Resident	LC	LC
60	Jungle Owlet	<i>Glaucidium radiatum</i>	Literature	Yes	Forest	Resident	LC	LC
61	Spotted Owlet	<i>Athene brama</i>	Survey	Yes	Forest	Resident	LC	LC
62	Rock Pigeon	<i>Columba livia</i>	Survey	Yes	Settlement	Resident	LC	LC
63	Speckled Wood Pigeon	<i>Columba hodgsonii</i>	Literature	Yes	Forest	Resident	LC	LC
64	Oriental Turtle Dove	<i>Streptopelia orientalis</i>	Survey	Yes	Forest	Resident	LC	LC
65	Spotted Dove	<i>Streptopelia chinensis</i>	Survey	Yes	Forest	Resident	LC	LC
66	Red Collared Dove	<i>Streptopelia tranquebarica</i>	Literature	Yes	Forest	Resident	LC	LC
67	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	Literature	Yes	Forest	Resident	LC	LC
68	Yellow-footed Green Pigeon	<i>Treron phaeoptera</i>	Survey	Yes	Forest	Resident	LC	LC
69	Wedge-tailed Green Pigeon	<i>Treron sphenurus</i>	Survey	Yes	Forest	Resident	LC	LC
70	White-breasted Waterhen	<i>Amauornis phoenicurus</i>	Literature	Yes	Wetland	Resident	LC	LC
71	Common Greenshank	<i>Tringa nebularia</i>	Survey	No	Wetland	Winter visitor	LC	LC
72	Common Sandpiper	<i>Actitis hypoleucos</i>	Survey	No	Wetland	Winter visitor	LC	LC
73	Little Stint	<i>Calidris minuta</i>	Literature	No	Wetland	Winter visitor	LC	LC
74	Ibisbill	<i>Ibidorhyncha struthersii</i>	Survey	No	Wetland	Resident	LC	EN
75	Little Ringed Plover	<i>Charadrius dubius</i>	Survey	No	Wetland	Resident	LC	LC
76	Northern Lapwing	<i>Vanellus vanellus</i>	Literature	No	Wetland	Winter visitor	NT	NT
77	River Lapwing	<i>Vanellus duvaucelii</i>	Survey	Yes	Wetland	Resident	NT	NT
78	Red-wattled Lapwing	<i>Vanellus indicus</i>	Survey	Yes	Wetland	Resident	LC	LC
79	Grey-headed Lapwing	<i>Vanellus cinereus</i>	Literature	No	Wetland	Winter visitor	LC	LC
80	Black-bellied Tern	<i>Sterna acuticauda</i>	Literature	No	Wetland	Summer visitor	EN	CR
81	Black Kite	<i>Milvus migrans</i>	Survey	Yes	Forest	Resident	LC	LC
82	Brahminy Kite	<i>Haliastur indus</i>	Literature	No	Forest	Resident	LC	CR
83	Egyptian Vulture	<i>Neophron percnopterus</i>	Survey	Yes	Forest	Resident	EN	VU
84	White-rumped Vulture	<i>Gyps bengalensis</i>	Survey	Yes	Forest	Resident	CR	CR
85	Himalayan Griffon	<i>Gyps himalayensis</i>	Survey	No	Forest	Resident	NT	VU
86	Cinereous Vulture	<i>Aegypius monachus</i>	Literature	No	Forest	Winter visitor	NT	EN
87	Red-headed Vulture	<i>Sarcogyps calvus</i>	Literature	Yes	Forest	Resident	CR	EN
88	Crested Serpent Eagle	<i>Spilornis cheela</i>	Survey	Yes	Forest	Resident	LC	LC
89	Black Eagle	<i>Ictinaetus malayensis</i>	Literature	Yes	Forest	Resident	LC	LC
90	Northern Goshawk	<i>Accipiter gentilis</i>	Literature	No	Forest	Winter visitor	LC	LC

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migratio n status	Conservati on Status	National Status
91	Shikra	<i>Accipiter badius</i>	Survey	Yes	Forest	Resident	LC	LC
92	Besra	<i>Accipiter virgatus</i>	Literature	Yes	Forest	Resident	LC	LC
93	Oriental Honey-buzzard	<i>Pernis ptilorhyncus</i>	Literature	No	Forest	Resident	LC	LC
94	Common Buzzard	<i>Buteo buteo</i>	Survey	No	Forest	Winter visitor	LC	LC
95	Long-legged Buzzard	<i>Buteo rufinus</i>	Survey	No	Forest	Winter visitor	LC	LC
96	Greater Spotted Eagle	<i>Aquila clanga</i>	Literature	No	Forest	Winter visitor	VU	VU
97	Steppe Eagle	<i>Aquila nipalensis</i>	Survey	No	Forest	Winter visitor	EN	LC
98	Bonelli's Eagle	<i>Hieraaetus fasciatus</i>	Literature	No	Forest	Winter visitor	LC	LC
99	Booted Eagle	<i>Hieraaetus pennatus</i>	Literature	No	Forest	Winter visitor	LC	LC
100	Mountain Hawk Eagle	<i>Nisaetus nipalensis</i>	Literature	No	Forest	Resident	LC	LC
101	Collared Falconet	<i>Microhierax caerulescens</i>	Literature	Yes	Forest	Resident	LC	LC
102	Common Kestrel	<i>Falco tinnunculus</i>	Survey	Yes	Forest	Resident	LC	LC
103	Eurasian Hobby	<i>Falco subbuteo</i>	Literature	No	Forest	Winter visitor	LC	LC
104	Peregrine Falcon	<i>Falco peregrinus</i>	Literature	Yes	Forest	Resident	LC	LC
105	Great Cormorant	<i>Phalacrocorax carbo</i>	Survey	No	Wetland	Winter visitor	LC	LC
106	Little Egret	<i>Egretta garzetta</i>	Survey	Yes	Wetland	Resident	LC	LC
107	Cattle Egret	<i>Bubulcus ibis</i>	Survey	Yes	Agriculture land	Resident	LC	LC
108	Grey Heron	<i>Ardea cinerea</i>	Literature	Yes	Wetland	Resident	LC	LC
109	Indian Pond Heron	<i>Ardeola grayii</i>	Survey	Yes	Wetland	Resident	LC	LC
110	Little Heron	<i>Butorides striatus</i>	Literature	Yes	Wetland	Summer visitor	LC	LC
111	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	Literature	Yes	Wetland	Summer visitor	LC	LC
112	Asian Woollyneck	<i>Ciconia episcopus</i>	Survey	Yes	Wetland	Resident	VU	NT
113	Indian Pitta	<i>Pitta brachyura</i>	Literature	Yes	Forest	Summer visitor	LC	LC
114	Long-tailed Broadbill	<i>Psarisomus dalhousiae</i>	Literature	Yes	Forest	Resident	LC	LC
115	Golden-fronted Leafbird	<i>Chloropsis aurifrons</i>	Literature	Yes	Forest	Resident	LC	LC
116	Orange-bellied Leafbird	<i>Chloropsis hardwickii</i>	Survey	Yes	Forest	Resident	LC	LC
117	Brown Shrike	<i>Lanius cristatus</i>	Literature	No	Forest	Winter visitor	LC	LC
118	Long-tailed Shrike	<i>Lanius schach</i>	Survey	Yes	Forest	Resident	LC	LC
119	Grey-backed Shrike	<i>Lanius tephronotus</i>	Survey	No	Forest	Winter visitor	LC	LC
120	Eurasian Jay	<i>Garrulus glandarius</i>	Literature	Yes	Forest	Resident	LC	LC
121	Black-headed Jay	<i>Garrulus lanceolatus</i>	Literature	Yes	Forest	Resident	LC	LC
122	Red-billed Blue Magpie	<i>Urocissa erythrorhyncha</i>	Survey	Yes	Forest	Resident	LC	LC
123	Common Green Magpie	<i>Cissa chinensis</i>	Literature	Yes	Forest	Resident	LC	LC
124	Rufous Treepie	<i>Dendrocitta vagabunda</i>	Survey	Yes	Forest	Resident	LC	LC
125	Grey Treepie	<i>Dendrocitta formosae</i>	Survey	Yes	Forest	Resident	LC	LC
126	House Crow	<i>Corvus splendens</i>	Survey	Yes	Forest	Resident	LC	LC

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migration status	Conservation Status	National Status
127	Large-billed Crow	<i>Corvus macrorhynchos</i>	Survey	Yes	Forest	Resident	LC	LC
128	Ashy Woodswallow	<i>Artamus fuscus</i>	Survey	Yes	Forest	Resident	LC	LC
129	Indian Golden Oriole	<i>Oriolus oriolus</i>	Literature	Yes	Forest	Summer visitor	LC	LC
130	Maroon Oriole	<i>Oriolus trailli</i>	Survey	Yes	Forest	Resident	LC	LC
131	Large Cuckooshrike	<i>Coracina macei</i>	Survey	Yes	Forest	Resident	LC	LC
132	Black-winged Cuckooshrike	<i>Coracina melaschistos</i>	Literature	Yes	Forest	Resident	LC	LC
133	Long-tailed Minivet	<i>Pericrocotus ethologus</i>	Survey	Yes	Forest	Resident	LC	LC
134	Scarlet Minivet	<i>Pericrocotus flammeus</i>	Survey	Yes	Forest	Resident	LC	LC
135	Bar-winged Flycatcher-shrike	<i>Hemipus picatus</i>	Survey	Yes	Forest	Resident	LC	LC
136	White-throated Fantail	<i>Rhipidura albicollis</i>	Survey	Yes	Forest	Resident	LC	LC
137	Yellow-bellied Fantail	<i>Rhipidura hypoxantha</i>	Literature	No	Forest	Resident	LC	LC
138	Black Drongo	<i>Dicrurus macrocercus</i>	Survey	Yes	Forest	Resident	LC	LC
139	Ashy Drongo	<i>Dicrurus leucophaeus</i>	Survey	Yes	Forest	Resident	LC	LC
140	Bronzed Drongo	<i>Dicrurus aeneus</i>	Survey	Yes	Forest	Resident	LC	LC
141	Lesser Racket-tailed Drongo	<i>Dicrurus remifer</i>	Literature	Yes	Forest	Resident	LC	LC
142	Spangled Drongo	<i>Dicrurus hottentottus</i>	Literature	Yes	Forest	Resident	LC	LC
143	Asian Paradise Flycatcher	<i>Terpsiphone paradise</i>	Literature	Yes	Forest	Summer visitor	LC	LC
144	Common Iora	<i>Aegithina tiphia</i>	Survey	Yes	Forest	Resident	LC	LC
145	Brown Dipper	<i>Cinclus pallasii</i>	Literature	Yes	Forest	Resident	LC	LC
146	Blue-capped Rock Thrush	<i>Monticola cinclorhynchus</i>	Literature	Yes	Forest	Summer visitor	LC	LC
147	Chestnut-bellied Rock Thrush	<i>Monticola rufiventris</i>	Survey	No	Forest	Resident	LC	LC
148	Blue Rock Thrush	<i>Monticola solitaries</i>	Literature	No	Forest	Resident	LC	LC
149	Blue Whistling Thrush	<i>Myophonus caeruleus</i>	Survey	Yes	Forest	Resident	LC	LC
150	Pied Thrush	<i>Zoothera wardii</i>	Literature	Yes	Forest	Summer visitor	LC	LC
151	Orange-headed Thrush	<i>Zoothera citrina</i>	Literature	Yes	Forest	Summer visitor	LC	LC
152	Scaly Thrush	<i>Zoothera dauma</i>	Literature	No	Forest	Winter visitor	LC	LC
153	White-collared Blackbird	<i>Turdus albocinctus</i>	Literature	No	Forest	Resident	LC	LC
154	Grey-winged Blackbird	<i>Turdus boulboul</i>	Survey	No	Forest	Resident	LC	LC
155	Dark-throated Thrush	<i>Turdus ruficollis</i>	Survey	No	Forest	Winter visitor	LC	LC
156	Dark-sided Flycatcher	<i>Muscicapa sibirica</i>	Literature	No	Forest	Summer visitor	LC	LC
157	Rufous-gorgeted Flycatcher	<i>Ficedula strophliata</i>	Survey	No	Forest	Resident	LC	LC
158	Taiga Flycatcher	<i>Ficedula albicilla</i>	Survey	No	Forest	Winter visitor	LC	LC
159	Ultramarine Flycatcher	<i>Ficedula supercilialis</i>	Literature	No	Forest	Summer visitor	LC	LC
160	Grey-headed Canary Flycatcher	<i>Culicicapa ceylonensis</i>	Survey	Yes	Forest	Resident	LC	LC
161	Verditer Flycatcher	<i>Eumyias thalassina</i>	Survey	Yes	Forest	Resident	LC	LC

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migratio n status	Conservati on Status	National Status
162	Small Niltava	<i>Niltava macgrigoriae</i>	Survey	Yes	Forest	Resident	LC	LC
163	Rufous-bellied Niltava	<i>Niltava sundara</i>	Literature	No	Forest	Resident	LC	LC
164	Blue-throated Flycatcher	<i>Cyornis rubeculoides</i>	Literature	No	Forest	Summer visitor	LC	LC
165	Siberian Rubythroat	<i>Luscinia calliope</i>	Literature	No	Forest	Winter visitor	LC	LC
166	White-tailed Rubythroat	<i>Luscinia pectoralis</i>	Literature	No	Forest	Resident	LC	LC
167	Bluethroat	<i>Luscinia svecica</i>	Literature	No	Forest	Winter visitor	LC	LC
168	Indian Blue Robin	<i>Luscinia brunnea</i>	Literature	No	Forest	Resident	LC	LC
169	Orange-flanked Bush Robin	<i>Tarsiger rufilatus</i>	Literature	No	Forest	Resident	LC	LC
170	Golden Bush Robin	<i>Tarsiger chrysaeus</i>	Literature	No	Forest	Resident	LC	LC
171	Oriental Magpie Robin	<i>Copsychus saularis</i>	Survey	Yes	Forest	Resident	LC	LC
172	White-tailed Robin	<i>Cinclidium leucurum</i>	Literature	No	Forest	Resident	LC	LC
173	Black Redstart	<i>Phoenicurus ochruros</i>	Survey	No	Forest	Resident	LC	LC
174	Hodgson's Redstart	<i>Phoenicurus hodgsoni</i>	Survey	No	Forest	Winter visitor	LC	LC
175	Blue-fronted Redstart	<i>Phoenicurus frontalis</i>	Survey	No	Forest	Resident	LC	LC
176	White-capped Water Redstart	<i>Chaimarrornis leucocephalus</i>	Survey	Yes	Wetland	Resident	LC	LC
177	Plumbeous Water Redstart	<i>Rhyacornis fuliginosus</i>	Survey	Yes	Wetland	Resident	LC	LC
178	Little Forktail	<i>Enicurus scouleri</i>	Literature	No	Wetland	Resident	LC	LC
179	Slaty-backed Forktail	<i>Enicurus schistaceus</i>	Survey	Yes	Wetland	Resident	LC	LC
180	Spotted Forktail	<i>Enicurus maculatus</i>	Survey	Yes	Wetland	Resident	LC	LC
181	Black-backed Forktail	<i>Enicurus immaculatus</i>	Survey	Yes	Wetland	Resident	LC	LC
182	Common Stonechat	<i>Saxicola torquata</i>	Survey	Yes	Grassland	Resident	LC	LC
183	Pied Bushchat	<i>Saxicola caprata</i>	Survey	Yes	Grassland	Resident	LC	LC
184	Grey Bushchat	<i>Saxicola ferrea</i>	Survey	No	Grassland	Resident	LC	LC
185	Chestnut-tailed Starling	<i>Sturnus malabaricus</i>	Survey	Yes	Forest	Resident	LC	LC
186	Brahminy Starling	<i>Sturnus pagodarum</i>	Literature	Yes	Forest	Resident	LC	LC
187	Common Myna	<i>Acridotheres tristis</i>	Survey	Yes	Settlement	Resident	LC	LC
188	Jungle Myna	<i>Acridotheres fuscus</i>	Survey	Yes	Settlement	Resident	LC	LC
189	Hill Myna	<i>Gracula religiosa</i>	Literature	Yes	Forest	Resident	LC	LC
190	Chestnut-bellied Nuthatch	<i>Sitta castanea</i>	Survey	Yes	Forest	Resident	LC	LC
191	Velvet-fronted Nuthatch	<i>Sitta frontalis</i>	Literature	Yes	Forest	Resident	LC	LC
192	White-tailed Nuthatch	<i>Sitta himalayensis</i>	Literature	No	Forest	Resident	LC	LC
193	Wallcreeper	<i>Tichodroma muraria</i>	Survey	No	Settlement	Winter visitor	LC	LC
194	Great Tit	<i>Parus major</i>	Survey	Yes	Forest	Resident	LC	LC
195	Green-backed Tit	<i>Parus monticolus</i>	Survey	Yes	Forest	Resident	LC	LC
196	Black-lored Tit	<i>Parus xanthogenys</i>	Survey	Yes	Forest	Resident	LC	LC

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migration status	Conservation Status	National Status
197	Black-throated Tit	<i>Aegithalos concinnus</i>	Survey	Yes	Forest	Resident	LC	LC
198	Yellow-browed Tit	<i>Sylviparus modestus</i>	Literature	No	Forest	Resident	LC	LC
199	Barn Swallow	<i>Hirundo rustica</i>	Survey	Yes	Settlement	Resident	LC	LC
200	Red-rumped Swallow	<i>Hirundo daurica</i>	Survey	Yes	Settlement	Resident	LC	LC
201	Black-crested Bulbul	<i>Pycnonotus melanicterus</i>	Literature	Yes	Forest	Resident	LC	LC
202	Himalayan Bulbul	<i>Pycnonotus leucogenys</i>	Survey	Yes	Forest	Resident	LC	LC
203	Red-vented Bulbul	<i>Pycnonotus cafer</i>	Survey	Yes	Forest	Resident	LC	LC
204	Mountain Bulbul	<i>Hypsipetes maclellandii</i>	Survey	Yes	Forest	Resident	LC	LC
205	Black Bulbul	<i>Hypsipetes leucocephalus</i>	Survey	Yes	Forest	Resident	LC	LC
206	Ashy Bulbul	<i>Hemixos flava</i>	Survey	Yes	Forest	Resident	LC	LC
207	Striated Prinia	<i>Prinia criniger</i>	Survey	Yes	Grassland	Resident	LC	LC
208	Grey-crowned Prinia	<i>Prinia cinereocapilla</i>	Literature	Yes	Grassland	Resident	VU	VU
209	Zitting Cisticola	<i>Cisticola juncidis</i>	Literature	Yes	Agricultureland	Resident	LC	LC
210	Oriental White-eye	<i>Zosterops palpebrosus</i>	Survey	Yes	Forest	Resident	LC	LC
211	Winter Wren	<i>Troglodytes troglodytes</i>	Literature	No	Forest	Resident	LC	LC
212	Grey-bellied Tesia	<i>Tesia cyaniventer</i>	Literature	Yes	Forest	Resident	LC	LC
213	Chestnut-headed Tesia	<i>Tesia castaneocoronata</i>	Literature	No	Forest	Resident	LC	LC
214	Common Tailorbird	<i>Orthotomus sutorius</i>	Survey	Yes	Bushes	Resident	LC	LC
215	Aberrant Bush Warbler	<i>Cettia flavolivacea</i>	Literature	No	Bushes	Resident	LC	LC
216	Grey-sided Bush Warbler	<i>Cettia brunnirostris</i>	Literature	No	Bushes	Resident	LC	LC
217	Common Chiffchaff	<i>Phylloscopus collybita</i>	Literature	No	Bushes	Winter visitor	LC	LC
218	Dusky Warbler	<i>Phylloscopus fuscatus</i>	Survey	No	Bushes	Winter visitor	LC	LC
219	Tickell's Leaf Warbler	<i>Phylloscopus affinis</i>	Literature	No	Forest	Resident	LC	LC
220	Blyth's Leaf Warbler	<i>Phylloscopus reguloides</i>	Survey	No	Forest	Resident	LC	LC
221	Buff-barred Warbler	<i>Phylloscopus pulcher</i>	Literature	No	Forest	Resident	LC	LC
222	Greenish Warbler	<i>Phylloscopus trochiloides</i>	Survey	No	Forest	Winter visitor	LC	LC
223	Ashy-throated Warbler	<i>Phylloscopus maculipennis</i>	Literature	No	Forest	Resident	LC	LC
224	Hume's Warbler	<i>Phylloscopus humei</i>	Survey	No	Forest	Resident	LC	LC
225	Lemon-rumped warbler	<i>Phylloscopus chloronotus</i>	Literature	No	Forest	Resident	LC	LC
226	Whistler's Warbler	<i>Seicercus whistleri</i>	Literature	No	Forest	Resident	LC	LC
227	Golden-spectacled Warbler	<i>Seicercus burkii</i>	Literature	No	Forest	Resident	LC	LC
228	Grey-hooded Warbler	<i>Phylloscopus xanthoschistos</i>	Survey	Yes	Forest	Resident	LC	LC
229	Chestnut-crowned Warbler	<i>Seicercus castaneiceps</i>	Literature	No	Forest	Resident	LC	LC
230	Black-faced Warbler	<i>Abroscopus schisticeps</i>	Literature	No	Forest	Resident	LC	LC
231	White-throated Laughingthrush	<i>Garrulax albogularis</i>	Literature	Yes	Forest	Resident	LC	LC

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migration status	Conservation Status	National Status
232	White-crested Laughing Thrush	<i>Garrulax leucolophus</i>	Survey	Yes	Forest	Resident	LC	LC
233	Striated Laughingthrush	<i>Garrulax striatus</i>	Literature	Yes	Forest	Resident	LC	LC
234	Chestnut-crowned Laughingthrush	<i>Garrulax erythrocephalus</i>	Literature	Yes	Forest	Resident	LC	LC
235	Streaked Laughingthrush	<i>Garrulax lineatus</i>	Literature	No	Forest	Resident	LC	LC
236	Puff-throated Babbler	<i>Pellorneum ruficeps</i>	Survey	Yes	Forest	Resident	LC	LC
237	Rusty-cheeked Scimitar Babbler	<i>Pomatorhinus erythrogenys</i>	Survey	Yes	Forest	Resident	LC	LC
238	Streak-breasted Scimitar Babbler	<i>Pomatorhinus ruficollis</i>	Survey	Yes	Forest	Resident	LC	LC
239	Scaly-breasted Wren Babbler	<i>Pnoepyga albiventer</i>	Literature	No	Forest	Resident	LC	LC
240	Pygmy Wren Babbler	<i>Pnoepyga pusilla</i>	Literature	Yes	Forest	Resident	LC	LC
241	Nepal Wren Babbler	<i>Pnoepyga immaculate</i>	Literature	No	Forest	Resident	LC	LC
242	Black-chinned Babbler	<i>Stachyris pyrrhops</i>	Survey	Yes	Forest	Resident	LC	LC
243	Grey-throated Babbler	<i>Stachyris nigriceps</i>	Literature	Yes	Forest	Resident	LC	LC
244	Striped Tit Babbler	<i>Macronous gularis</i>	Survey	Yes	Forest	Resident	LC	LC
245	Spiny Babbler	<i>Turdoides nipalensis</i>	Survey	Yes	Bushes	Resident	LC	LC
246	Jungle Babbler	<i>Turdoides striatus</i>	Literature	Yes	Forest	Resident	LC	LC
247	Red-billed Leiothrix	<i>Leiothrix lutea</i>	Literature	Yes	Forest	Resident	LC	LC
248	Whiskered Yuhina	<i>Yuhina flavicollis</i>	Literature	Yes	Forest	Resident	LC	LC
249	Striped-throated Yuhina	<i>Yuhina gularis</i>	Literature	No	Forest	Resident	LC	LC
250	White-bellied Erpornis	<i>Erpornis zantholeucais</i>	Literature	Yes	Forest	Resident	LC	LC
251	Rufous-winged Fulvetta	<i>Alcippe castaneiceps</i>	Literature	No	Forest	Resident	LC	LC
252	Nepal Fulvetta	<i>Alcippe nipalensis</i>	Survey	Yes	Forest	Resident	LC	LC
253	Rufous Sibia	<i>Heterphasia capistrata</i>	Literature	No	Forest	Resident	LC	LC
254	Plain Flowerpecker	<i>Dicaeum concolor</i>	Survey	Yes	Forest	Resident	LC	LC
255	Fire-breasted Flowerpecker	<i>Dicaeum ignipectus</i>	Survey	Yes	Forest	Resident	LC	LC
256	Thick-billed Flowerpecker	<i>Dicaeum agile</i>	Literature	Yes	Forest	Resident	LC	LC
257	Purple Sunbird	<i>Nectarinia asiatica</i>	Survey	Yes	Forest	Resident	LC	LC
258	Green-tailed Sunbird	<i>Aethopyga nipalensis</i>	Literature	No	Forest	Resident	LC	LC
259	Black-throated Sunbird	<i>Aethopyga saturate</i>	Survey	Yes	Forest	Resident	LC	LC
260	Crimson Sunbird	<i>Aethopyga siparaja</i>	Survey	Yes	Forest	Resident	LC	LC
261	Mrs Gould's Sunbird	<i>Aethopyga gouldiae</i>	Literature	No	Forest	Resident	LC	LC
262	Fire-tailed Sunbird	<i>Aethopyga ignicauda</i>	Literature	No	Forest	Resident	LC	LC
263	House Sparrow	<i>Passer domesticus</i>	Survey	Yes	Settlement	Resident	LC	LC
264	Eurasian Tree Sparrow	<i>Passer montanus</i>	Survey	Yes	Settlement	Resident	LC	LC
265	White Wagtail	<i>Motacilla alba</i>	Survey	No	Wetland	Winter visitor	LC	LC
266	White-browed Wagtail	<i>Motacilla maderaspatensis</i>	Survey	Yes	Wetland	Resident	LC	LC

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migratio n status	Conservati on Status	National Status
267	Grey Wagtail	<i>Motacilla cinerea</i>	Survey	No	Wetland	Resident	LC	LC
268	Paddyfield Pipit	<i>Anthus rufulus</i>	Survey	Yes	Agricult ureland	Resident	LC	LC
269	Olive-backed Pipit	<i>Anthus hodgsonii</i>	Survey	No	Forest	Resident	LC	LC
270	Rosy Pipit	<i>Anthus roseatus</i>	Literature	No	Wetland	Resident	LC	LC
271	Baya Weaver	<i>Ploceus philippinus</i>	Survey	Yes	Agricult ureland	Resident	LC	LC
272	Scaly-breasted Munia	<i>Lonchura punctulata</i>	Survey	Yes	Agricult ureland	Resident	LC	LC
273	White-rumped Munia	<i>Lanchura striata</i>	Survey	Yes	Agricult ureland	Resident	LC	LC
274	Yellow-breasted Greenfinch	<i>Carduelis spinoides</i>	Literature	No	Agricult ure land	Resident	LC	LC
275	Common Rosefinch	<i>Carpodacus erythrinus</i>	Literature	No	Forest	Resident	LC	LC
276	Crested Bunting	<i>Melophus lathami</i>	Survey	No	Agricult ure land	Resident	LC	LC

Annex 2.12: Fish Fauna of the Study Area (based on literature sources and survey)

SN	Species	Common and Local Name	Family	Status		Remarks
				IUCN	Nepal	
1	<i>Acanthocobotis (Nemacheilus) botia</i> (Hamilton-Buchanan)	Sand Loach Pate gadela, Baghe	<i>Cobitidae</i>	LC	DD	Pristine Rare Decorative
2	<i>Anguilla bengalensis bengalensis</i> (Gray)	Indian mottled eel; Rajbam, Rem	<i>Anguillidae</i>	NT	VU	Cited
3	<i>Sperata (Mystus) aor</i> (Hamilton-Buchanan)	Long-whiskered catfish; Kanti	<i>Bagridae</i>	LC	LC	Uncommon
4	<i>Sperata (Mystus) seenghala</i>	Gaint river catfish, Sujah, Tengra	<i>Bagridae</i>	LC	LC	Uncommon
5	<i>Balitora brucei</i> (Gray)	Gray's stone loach Pathertata	<i>Balitoridae</i>	NT	CD	Rare
6	<i>Barilius barna</i> (Hamilton-Buchanan)	Barna baril; Titerkane faketa	<i>Cyprinidae</i>	LC	LC	Common Photo evidence
7	<i>Barilius bendelisis</i> (Hamilton-Buchanan)	Hamilton's barila; Chiple faketa, Gurder, Khasree chala	<i>Cyprinidae</i>	LC	LC	Common Photo evidence
8	<i>Barilius shacra</i> (Hamilton-Buchanan)	Shacre baril; Faketa	<i>Cyprinidae</i>	LC	LC	Uncommon
9	<i>Barilius vagra</i> (Hamilton-Buchanan)	Vagra baril; Lam faketa	<i>Cyprinidae</i>	LC	LC	Uncommon
10	<i>Botia almorhae</i> (Gray)	Yoyo; Baghi, Baghuwa	<i>Cobitidae</i>	LC	DD	Pristine Rare Ornamental Photo
11	<i>Botia lochachata</i> (Chaudhuri)	Y-loach, Tiger loach Baghi, Getu	<i>Cobitidae</i>	LC	LC	Uncommon
12	<i>Chagunius chagunio</i> (Hamilton-Buchanan)	Chaguni; Patharchatti, Kasree	<i>Cyprinidae</i>	LC	VU	Cited

SN	Species	Common and Local Name	Family	Status		Remarks
				IUCN	Nepal	
13	<i>Channa gachua</i> (Hamilton-Buchanan)	Dwarf snakehead; Garahi, Bhoti	<i>Channidae</i>	LC	LC	Common; Photo evidence
14	<i>Channa striata</i> (Bloch)	Asian snakehead; Helae	<i>Channidae</i>	LC	LC	Common
15	<i>Tariqilabeo latius latius</i> (Hamilton-Buchanan)	Gangetic laita, Lohari, Mate buduna	<i>Cyprinidae</i>	LC	LC	Uncommon Photo evidence
16	<i>Cyprinion semiplotus</i> (McClelland)	Assamese kingfish; Khurpe, Chepti	<i>Cyprinidae</i>	NA	LC	Uncommon
17	<i>Parachiloganis hodgarthi</i> (Hora)	Torrent catfish Telkapre	<i>Sisoridae</i>	LC	CD	Rare
18	<i>Eutropichthys vacha</i> (Hamilton-Buchanan)	Batchwa vacha Cherki, Bachawa	<i>Schilbeidae</i>	NA	LC	Uncommon
19	<i>Garra annandalei</i> (Hora)	Annandale garra; Lahare buduna	<i>Cyprinidae</i>	LC	LC	Photo evidence; common
20	<i>Garra gotyla gotyla</i> (Gray)	Gotyla; Dhumke buduna	<i>Cyprinidae</i>	LC	LC	Common; Photo
21	<i>Garra mullya</i> (Sykes)	Mullya garra, Khurpe buduna	<i>Cyprinidae</i>	LC	LC	Common
22	<i>Garra rupecula</i> (McClelland)	Mishmi Garra; Buduna	<i>Cyprinidae</i>	LC	LC	Common
23	<i>Glyptothorax telchitta</i> (Hamilton-Buchanan)	Telcapre	<i>Sisoridae</i>	LC	CD	Rare
24	<i>Glyptothorax trilineatus</i> (Blyth)	Three-lined catfish; Telcapre	<i>Sisoridae</i>	LC	CD	Rare
25	<i>Glyptothorax Cavia</i> (Hamilton-Buchanan)	Vedro	<i>Sisoridae</i>	LC	CD	Photo evidence; Rare
26	<i>Glyptothorax indicus</i> (Talwar)	Capre	<i>Sisoridae</i>	LC	CD	Rare
27	<i>Glyptothorax pectinopterus</i> (McClelland)	Capre	<i>Sisoridae</i>	LC	LC	Uncommon Photo evidence
28	<i>Heteropneustes fossilis</i> (Bloch)	Stinging catfish; Singhi	<i>Heteropneustidae</i>	LC	LC	Common
29	<i>Homaloptera bilineata</i> (Blyth)	Burmese loach; Patherchatti	<i>Balitoridae</i>	LC	DD	Pristine Rare Ornamental
30	<i>Labeo bata</i> (Hamilton-Buchanan)	Minor carp; Bata labeo	<i>Cyprinidae</i>	LC	LC	Common; Photo evidence
31	<i>Bangana dero</i> (Hamilton-Buchanan)	Kalabans, River Rohu; Gurdi	<i>Cyprinidae</i>	LC	LC	Common
32	<i>Labeo dew</i> (Hamilton-Buchanan)	Gardi	<i>Cyprinidae</i>	NA	LC	Common
33	<i>Monopterusuchia</i>	Chuchia, Gangetic mud eel; Andhbam, Anahi, Anali	<i>Synbranchidae</i>	LC	LC	Uncommon

SN	Species	Common and Local Name	Family	Status		Remarks
				IUCN	Nepal	
34	<i>Nemacheilus corica</i> (Hamilton-Buchanan)	Stone loach; Raigadero	<i>Cobitidae</i>	LC	DD	Pristine Rare Ornamental
35	<i>Neolissochilus hexagonalepis</i> (McClelland)	Copper mahseer; Katle, Vadalke	<i>Cyprinidae</i>	NT	VU	Photo evidence
36	<i>Pseudecheneis eddsi</i> (Ng)	Gotel, Kabre	<i>Sisoridae</i>	DD	DD	Rare Ornamental Pristine
37	<i>Pseudecheneis serracula</i> (Ng & Edds)		<i>Sisoridae</i>	LC	DD	Pristine Rare Ornamental
38	<i>Pseudecheneis sulcata</i> (McClelland)	Sulcatus catfish; Kabre	<i>Sisoridae</i>	LC	CD	Rare; Photo evidence
39	<i>Psilorhynchus balitora</i> (Hamilton-Buchanan)	Balitora minnow; Titari	<i>Psilorhynchidae</i>	LC	DD	Pristine Rare Ornamental
40	<i>Puntius terio</i> (Hamilton-Buchanan)	One-spot barb; Pothi	<i>Cyprinidae</i>	LC	LC	Uncommon Photo evidence
41	<i>Schistura beavani</i> (Gunther) <i>Nemacheilus beavani</i>	Dharkee gadero, Kholse gadero	<i>Balitoridae</i>	LC	DD	Pristine Rare Ornamental
42	<i>Schistura multifaciata</i> (Day)	Gadelo, Kachhinya (Newari language)	<i>Balitoridae</i>	LC	DD	Pristine Rare Ornamental
43	<i>Schistura savona</i> (McClelland) <i>Nemacheilus sovana</i>	Ring loach; Gadela	<i>Balitoridae</i>	LC	LC	Uncommon Photo evidence
44	<i>Schizopyger niger</i> (Heckel)	Snowtrout; Kalo tilke	<i>Cyprinidae</i>	NA	NT	Rare
45	<i>Schizothorax progastus</i> (McClelland)	Dinnawah snowtrout, Pointed-snout snowtrout Chuche asla	<i>Cyprinidae</i>	LC	VU	Cited
46	<i>Schizothorax plagiostomus</i> (Heckel)	Golden snowtrout/ spotted snowtrout; Sun asla	<i>Cyprinidae</i>	NA	VU	Photo evidence
47	<i>Schizothorax richardsonii</i> (Gray)	Blunt-nosed snowtrout, Buche asla	<i>Cyprinidae</i>	VU	LC	Common
48	<i>Naziritor chelynoidea</i> (McClelland)	Dark mahseer; Halundae	<i>Cyprinidae</i>	VU	LC	Uncommon
49	<i>Tor putitora</i> (Hamilton-Buchanan)	Putitor mahseer, Golden Pahale sahar, Mahseer, Ratar	<i>Cyprinidae</i>	EN	EN	Photo evidence
50	<i>Tor tor</i> (Hamilton-Buchanan)	Falame sahar; Deep bodied mahseer	<i>Cyprinidae</i>	NT	EN	Cited

Annex 2.13: Critical Habitat Criteria¹⁹

ESS6 Criterion	Equivalent IFC PS6 Criterion	IFC PS6 GN Thresholds
(a) habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches;	Criterion 1: Critically Endangered (CR) / Endangered (EN) species:	(a) Areas that support globally-important concentrations of an IUCN Red-listed EN or CR species (0.5% of the global population AND 5 reproductive units of a CR or EN species); (b) Areas that support globally-important concentrations of an IUCN Red-listed VU species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in (a). (c) As appropriate, areas containing nationally/regionally-important concentrations of an IUCN Red-listed EN or CR species.
(b) habitat of significant importance to endemic or restricted-range species;	Criterion 2: Habitat of significant importance to endemic and/or restricted-range species;	Areas that regularly hold $\geq 10\%$ of the global population size AND ≥ 10 reproductive units of a species.
(c) habitat supporting globally or nationally significant concentrations of migratory or congregatory species;	Criterion 3: Habitat supporting globally significant concentrations of migratory species and/or congregatory species;	(a) Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle. (b) Areas that predictably support ≥ 10 percent of the global population of a species during periods of environmental stress.
(d) highly threatened or unique ecosystems;	Criterion 4: Highly threatened and/or unique ecosystems; and/or	(a) Areas representing $\geq 5\%$ of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN. (b) Other areas, not yet assessed by IUCN, but determined to be of high priority for conservation by regional or national systematic conservation planning.
(e) ecological functions or characteristics that are needed to maintain the viability of the biodiversity values	No equivalent criteria (Criterion 5: Areas associated with key evolutionary processes)	No set criteria

¹⁹International Finance Corporation. (2019). Biodiversity Conservation and Sustainable Management of Living Natural Resources. *Guidance Note 6. 6* (GN52), 16.

ESS6 Criterion	Equivalent IFC PS6 Criterion	IFC PS6 GN Thresholds
described above in (a) to (d).		

Notes: *Endemic Species*: an endemic species is one that has ≥ 95 percent of its global range inside the country or region of analysis²⁰;

Restricted-range Species: Species with world distributions of less than 50,000km²⁰;

Annex 2.14: Results of Critical Habitat Assessment

S/N	Scientific Name	Common Name	IUCN Listing	CH Criterion 1	CH Criterion 2	CH Criterion 3
1	<i>Aquila clanga</i>	Greater Spotted Eagle	VU	Yes	No	No
2	<i>Aquila nipalensis</i>	Steppe Eagle	EN	Yes	No	No
3	<i>Aythya ferina</i>	Common Pochard	VU	Yes	No	No
4	<i>Ciconia episcopus</i>	Asian Woollyneck	VU	Yes	No	No
5	<i>Gyps bengalensis</i>	White-rumped Vulture	CR	Yes	No	Yes
6	<i>Neophron percnopterus</i>	Egyptian Vulture	EN	Yes	No	No
7	<i>Prinia cinereocapilla</i>	Grey-crowned Prinia	VU	Yes	No	No
8	<i>Sarcogyps calvus</i>	Red-headed Vulture	CR	No	No	No
9	<i>Sterna acuticauda</i>	Black-bellied Tern	EN	Yes	No	No
10	<i>Manis pentadactyla</i>	Chinese Pangolin	CR	Yes	No	No
11	<i>Panthera pardus</i>	Common Leopard	VU	No	No	No
12	<i>Schizothorax richardsonii</i>	Blunt-nosed snowtrout, Buche asla	VU	Yes	No	Yes
13	<i>Naziritor chelynoides</i>	Dark mahseer; Halundae	VU	Yes	No	Yes
14	<i>Tor putitora</i>	Himalayan (Golden) Mahseer	EN	Yes	No	No

²⁰ International Finance Corporation. (2019). Biodiversity Conservation and Sustainable Management of Living Natural Resources. *Guidance Note 6.6* (GN52), 16.

Annex 2.15: Critical Habitat Screening Assessment (Criterion 1.1 and Criterion 1.3)

S/N	Scientific Name	Common Name	IUCN Listing	CH Criterion 1	CH Criterion 2	CH Criterion 3	Species information	CH Assessment
Birds								
1	<i>Aegypius monachus</i>	Cinereous Vulture	NT	No	No	No	This Near Threatened migratory species is broadly distributed found continuously from southern Europe to eastern Asia. The EOO is 22,400,000km ² . The population is estimated at 15,600 – 21,000 and considered decreasing.	Considering the very large EOO in comparison to the proportionally small EAA ²¹ , it is unlikely that the Project EAA would sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population or support ≥10 percent of the global population of a species during periods of environmental stress. Therefore, the Project EAA is unlikely to contain critical habitat for this species.
2	<i>Aquila clanga</i>	Greater Spotted Eagle	VU	No	No	No	Species widely distributed in Eurasia and occurs in Nepal and other countries of Southeast Asia only during seasonal migrations or wintering. The global population is estimated in 3,300 – 8,800 individuals.	Considering the very large EOO in comparison to the proportionally small EAA, it is unlikely that the EAA would sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population or support ≥10 percent of the global population of a species during periods of environmental stress or sustain 0.5% of the global population. Therefore, the Project EAA is unlikely to contain critical habitat for this species
3	<i>Aquila nipalensis</i>	Steppe Eagle	EN	Yes	No	No	This endangered species is found throughout eastern Africa, the Middle East and southern and central Asia. The species has an EOO of	Considering the very large EOO in comparison to the proportionally small EAA, it is unlikely that the EAA would sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population or support ≥10 percent of the global population of

²¹EAA means Ecological Appropriate Area of assessment which, according to IFC PS6, is an area that delineates the extent to which a proposed action or project directly impacts the surrounding biodiversity. In the case of the NNM road, this will be the Direct Impact Area of 300m (150m from each side of the road).

S/N	Scientific Name	Common Name	IUCN Listing	CH Criterion 1	CH Criterion 2	CH Criterion 3	Species information	CH Assessment
							12,500,000km ² . The species has an estimated 50,000 – 75,000 mature individuals globally.	a species during periods of environmental stress or sustain 0.5% of the global population. Therefore, the Project EAA is unlikely to contain critical habitat for this species.
4	<i>Aythya ferina</i>	Common Pochard	VU	No	No	No	This migratory species has is found through most of Europe and northern Asia, but also found in parts of southern Asia and Africa. The EOO is 27,800,000km ² . The global population is estimated at 1,950,000-2,250,000 individuals.	Considering the very large EOO in comparison to the proportionally small EAA and the large population size, it is unlikely that the EAA would sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population or support ≥10 percent of the global population of a species during periods of environmental stress. Therefore, the Project EAA is unlikely to contain critical habitat for this species
5	<i>Aythya nyroca</i>	Ferruginous Pochard	NT	No	No	No	This species is found throughout southern and eastern Europe, the Middle East, Northern Africa, and central and southern Asia. The species uses Nepal during the non-breeding season. The EOO is 25,900,000km ² . The global population is estimated at 180,700 -238,300 individuals	Considering the very large EOO in comparison to the proportionally small EAA and the large population size, it is unlikely that the EAA would sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population or support ≥10 percent of the global population of a species during periods of environmental stress. Therefore, the Project EAA is unlikely to contain critical habitat for this species.
6	<i>Ciconia episcopus</i>	Asian Woollyneck	VU	No	No	No	This species is found throughout parts of southern Asia and parts of Southeast Asia. The EOO for this species 18,900,000km ² . The	The Asian Woollyneck is unlikely to become endangered or critically endangered from Project Impacts. The Project EAA is unlikely to contain significant populations of this species. Therefore,

S/N	Scientific Name	Common Name	IUCN Listing	CH Criterion 1	CH Criterion 2	CH Criterion 3	Species information	CH Assessment
							global population is estimated up to 35,000 individuals. The species uses a wide range habitat types.	the Project EAA should not be considered to contain critical habitat for this species
7	<i>Gyps bengalensis</i>	White-rumped Vulture	CR	Yes	No	No	This species is found throughout much of southeast Asia and southern Asia. Although its distribution has been drastically reduced. It is a resident of Nepal. It has an EOO of 7,370,000km ² . Global population of White-Rumped Vulture is estimate to be 2,500-9,999. 0.5% of the population will vary between 12.5–50 individuals.	Although the species was not recorded during the field surveys, the Project EAA is large enough to permanently or temporarily support 13 White-rumped Vultures. Therefore, in accordance with the precautionary principle it is possible that the Project EAA contains critical habitat for this species. Further consultation is necessary
8	<i>Gyps himalayensis</i>	Himalayan Griffon	NT	No	No	No	The EOO of the species is 6,220,000 km ² spread over western China, Central Asian highlands and pastures, Pakistan, Himalaya mountain range in India, Nepal, Bhutan. Global Population estimate is around 100,000-499,999. Therefore, 1% of global population will vary	Considering the very large EOO species in comparison to the proportionally small Project EAA and large population size, it is unlikely that the Project EAA would sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population or support ≥ 10 percent of the global population of a species during periods of environmental stress. Therefore, the Project EAA is unlikely to contain critical habitat for this species

S/N	Scientific Name	Common Name	IUCN Listing	CH Criterion 1	CH Criterion 2	CH Criterion 3	Species information	CH Assessment
							between 1,000 to 4,999.9 individuals.	
9	<i>Neophron percnopterus</i>	Egyptian Vulture	EN	Yes	No	No	Egyptian Vulture is a resident, now widespread and locally fairly common in west and west-central Nepal, but very rare in the east. It has an EOO of 51,600,000km ² . The global population is estimated at 12,000 – 38,000 mature individuals. Therefore, 0.5% of the population would be 60 to 190 individuals.	Considering the very large EOO in comparison to the proportionally small Project EAA and the large population, it is unlikely that the Project EAA would sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population or support ≥ 10 percent of the global population of a species during periods of environmental stress or support 0.5% of the global population. Therefore, the Project EAA is unlikely to contain critical habitat for this specie
10	<i>Prinia cinereocapilla</i>	Grey-crowned Prinia	VU	No	No	No	In Nepal, the species formerly occurred from Kanchanpur district in the west to Ilam district in the east, but it has declined and its distributional range has reduced: it is now almost confined to just three protected areas: Chitwan National Park, and in	Considering the EOO in comparison to the Project EAA and the large population, it is unlikely that the Project EAA would sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population or support ≥ 10 percent of the global population of a species during periods of environmental stress. Therefore, the Project EAA is unlikely to contain critical habitat for this species.

S/N	Scientific Name	Common Name	IUCN Listing	CH Criterion 1	CH Criterion 2	CH Criterion 3	Species information	CH Assessment
							adjoining areas of Parsa Wildlife Reserve and a small area of Bardia National Park and buffer zone. The EOO of the species is 162,000km ² . The population size is preliminarily estimated to fall into the band 10,000-19,999 individuals	
11	<i>Sarcogyps calvus</i>	Red-headed Vulture	CR	Yes	No	No	This critically endangered species has a scattered distribution, found in parts of Southeast Asia and Southern Asia. It has an EOO of 5,230,000km ² and is a resident of Nepal. The global population of mature individuals is estimated at 2,500-9,999.	The estimate of 0.5% of the population will vary between 12.5–50 individuals. Although the species was not recorded during the field surveys, the Project EAA is large enough to permanently or temporarily support 13 White-rumped Vultures. Therefore, in accordance with the precautionary principle it is possible that that the Project EAA contains critical habitat for this species.
12	<i>Sterna acuticauda</i>	Black-bellied Tern	EN	Yes	No	No	The Black-bellied Tern originally found throughout Southeast Asia, India and Pakistan. The species has an EOO of 4,490,000km ² . There is an estimated 6,700 –	Considering the very large EOO in comparison to the proportionally small EAA, it is unlikely that the Project EAA would sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population or support ≥ 10 percent of the global population of a species during periods of environmental stress. Therefore, the Project EAA

S/N	Scientific Name	Common Name	IUCN Listing	CH Criterion 1	CH Criterion 2	CH Criterion 3	Species information	CH Assessment
							17,000 mature individuals globally	is unlikely to contain critical habitat for this species.
Mammals								
13	<i>Manis pentadactyla</i>	Chinese Pangolin	CR	Yes	No	No	This species is found throughout the Himalayas and northern Southeast Asia. It is a resident of Nepal. The global population is unknown but considered decreasing.	Considering the large EOO of the species covering Bhutan, Northeast India, Myanmar, Laos and vast areas in Southern China, it is unlikely the Project EAA would support more than 0.5% of global population is within the EAA.
14	<i>Naemorhedus goral</i>	Himalayan Goral	NT	No	No	No	This species range is stretched in Himalaya in Bhutan, China, India, Nepal and Pakistan. It occurs in cliff and rocky areas, mountain forests, shrublands and grasslands. It avoids areas outside of rocky places.	Considering the very large EOO in comparison to the proportionally small EAA, it is unlikely that the Project EAA would sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population or support ≥ 10 percent of the global population of a species during periods of environmental stress. Therefore, the Project EAA is unlikely to contain critical habitat for this species.
15	<i>Panthera pardus</i>	Common Leopard	VU	No	No	No	The leopard is widely distributed throughout Africa, Central Asia, South East Asia and North Asia. <i>Panthera pardus orientalis</i> , is a sub species found in far east Russia, on the Korean peninsula and in north-eastern China. The EOO is unknown. The population of	The species is unlikely to become endangered or critically endangered from Project Impacts. The Project EAA is unlikely to contain significant populations of this species. Therefore, the Project EAA should not be considered to contain critical habitat for this species.

S/N	Scientific Name	Common Name	IUCN Listing	CH Criterion 1	CH Criterion 2	CH Criterion 3	Species information	CH Assessment
							the species is considered to be decreasing.	
16	<i>Semnopithecus hector</i>	Terai Gray Langur	NT	No	No	No	This species is distributed in Bhutan, India and Nepal, occurring widely in the forested area, in urban settlements and near villages. Roaming langurs can be seen in small groups time to time along the road.	Considering the very large EOO in comparison to the proportionally small EAA, it is unlikely that the Project EAA would sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population or support ≥ 10 percent of the global population of a species during periods of environmental stress. Therefore, the Project EAA is unlikely to contain critical habitat for this species.
Fish								
17	<i>Anguilla bengalensis</i>	Indian Mottled Eel	NT	No	No	No	Widely distributed in South-East Asia, Arabian Peninsula and in Africa. The EOO of this species is unknown. The global population is unknown, although considered common within Indian inland freshwater systems.	Occurrence species in the project area is known from literature sources. Considering the large distribution to the proportionally small EAA, it is unlikely that the EAA would sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population or support ≥ 10 percent of the global population of a species during periods of environmental stress. Therefore, the Project EAA is unlikely to contain critical habitat for this species
18	<i>Balitora brucei</i>	Slender Stone Loach	NT	No	No	No	Species is known in India and not described for Nepal. Species occurs in plain areas: wetlands and rivers.	Species occurrence in the project area needs confirmation.
19	<i>Schizothorax richardsonii</i> (Gray)	Blunt-nosed snowtrout, Buche asla	VU	No	No	No	Species widely distributed in South-East Asia in freshwater reservoirs. The EOO of this	Occurrence species in the project area is known from literature sources. Considering the large distribution to the proportionally small EAA, it is

S/N	Scientific Name	Common Name	IUCN Listing	CH Criterion 1	CH Criterion 2	CH Criterion 3	Species information	CH Assessment
							species is unknown. The global population is unknown, although considered quite common within South-East Asia.	unlikely that the EAA would sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population or support ≥ 10 percent of the global population of a species during periods of environmental stress. Therefore, the Project EAA is unlikely to contain critical habitat for this species
20	<i>Naziritor chelynoides</i> (McClelland)	Dark mahseer; Halundae	VU	No	No	No	It is known from inner wetlands of India (Uttar Pradesh) and Nepal in 8-10 locations. Population size is unknown. Species has decreasing population trends.	Occurrence species in the project area is known from literature sources. No other contemporary records were identified of the species in the watershed during survey. Specific distribution in the project area is unknown.
21	<i>Tor putitora</i> (Hamilton-Buchanan)	Putitor mahseer, Golden Pahale sahar, Mahseer, Ratar	EN	Yes	No	No	<i>Tor putitora</i> is naturally distributed throughout the rivers (and associated reservoirs) of the South Himalayan drainage (namely the Indus, Ganges-Yamuna and Bramaputra) from Pakistan (also unverified reports from Afghanistan) in the West to Myanmar in the East. The EOO is 1,305,202km ² . No comprehensive range-wide population studies have been carried out on the species, although there are studies	This species is known from literature sources. No other contemporary records were identified of the species in the watershed during survey. Given the large range of this species and distribution in Nepal, further assessment is required to determine if the EAA contains 0.5% of the global population AND 5 reproductive units of a CR or EN species Further consultation is required to identify potential critical habitat for this species.

S/N	Scientific Name	Common Name	IUCN Listing	CH Criterion 1	CH Criterion 2	CH Criterion 3	Species information	CH Assessment
							available from many individual river systems and reservoirs that make up the Himalayan landscape, which have observed declines.	
22	<i>Tor tor</i> (Hamilton-Buchanan)	Falame sahar; Deep bodied mahseer	DD	No	No	No	Species is known from India, Bhutan and Nepal on few records. Current population size and population trends are unknown.	This species is known from literature sources. No other contemporary records were identified of the species in the watershed during survey. Further assessment is required to determine if the EAA contains 0.5% of the global population and 5 reproductive units of a CR or EN species Further consultation is required to identify potential critical habitat for this species.

Annex 2.16: Distribution of Caste/Social Groups in Project Municipals

District	Municipality/RM	Brahmin / Chettri	Sanyasi	Chepang	Dalit	Janajati	Muslim	Madhesi	Others	Total
Kathmandu	Chandragiri Municipality-2	28				10			2	40
Dhading	Dhunibeshi Municipality-5	75	1			41			2	119
	Dhunibeshi Municipality-6,7,8 & 9	444	14		3	175		1	8	645
	Thakre RM- 6,7&8	199			3	70	4		8	284
	Thakre RM-1&2	150			1	57	5		7	220
	Galchi RM-4,6&7	279	4	1	6	143	2	1	15	451
	Gajuri RM-5&6	127	3	1	9	103	1		5	249
	Gajuri RM-1&2	166	2		3	129	1	2	16	319
	Benighat Rorang RM-3 & 5	423	1	5	9	97	9	2	13	559
	Benighat Rorang RM-7 & 8	68	1	2	1	14	3		5	94
	Benighat Rorang RM-9&10	71	5	6	7	68	2			159
Chitwan	Ichakamana RM- 3,4 & 5	162	1	7	9	251	7		15	452
	Total	2192	32	22	51	1158	34	6	96	3591
	Percent	61.04	0.89	0.61	1.42	32.25	0.95	0.17	2.67	100

Source: Field Survey 2017/18

Annex 2.17: Literacy Rate of Project Municipalities/Rural municipalities

District	Municipality/ Rural Municipality (RM)	Literacy %
Kathmandu	Chandragiri Municipality	73% to 85%
Dhading	Dhunibeshi Municipality	65.3
	Dhunibeshi Municipality	62.8
	Dhunibeshi Municipality	64.9
	Thakre RM	69.3
	Thakre RM	61.4
	Galchi RM	66.7
	Gajuri RM	55.5
	Gajuri RM	64.3
	Benighat Rorang RM	72.0
	Benighat Rorang RM	59.7
	Benighat Rorang RM	61.4
Chitwan	Ichakamana RM	77.4

Source: Field Survey 2017/18

Annex 2.18: Human Poverty Index of Project Districts

Districts	Human Poverty Index	HPI Rank
Kathmandu	22.5	5
Dhading	33.4	37
Chitwan	24.8	7

Source: Field Survey 2017/18

Annex 2.19: Distribution of HHs Headed by Females in Project Districts

Districts	Total HHs	Women Headed HHs	Percentage
Nepal	5427302	1396692	25.73
Kathmandu	436344	121287	27.8
Dhading	75851	20548	27.09
Chitwan	132462	44638	33.7

Source: Field Survey 2017/18

Annex 2.20: Absentee Population and Household

Project district	Total HHs	Absent household	Sex of absentees			
			Total	Male	Female	Not stated
Kathmandu	435,544	69,521	99,805	71,837	27,967	1
Dhading	73,842	17,055	22,537	20,207	2,330	0
Chitwan	132,345	38,423	50,421	43,728	6,693	0
Total	641,731	124,999	172,763	135,772	36,990	1
%		19.48	172,763	79	21	0

Source: Field Survey 2017/18

Annex 2.21: Distribution of Project Affected HHs By Social /Caste Groups

Road Section	Households to be affected	Percent
Brahmin	41	52.56
Chhetri	6	7.69
Janajatis	27	34.62
Dalits	2	2.56
Muslims	2	2.56
Total	78	100.00

Source: Field Survey 2017/18

Annex 2.22: Sex of Household Heads of Project Affected Surveyed Households

Road Section	Male		Female		Total
	No.	%	No.	%	
NNM	53	84.1	10	15.9	63
Total	53	84.1	10	15.9	63

Source: Field Survey 2017/18

Annex 2.23: Household and Population of Project Affected Surveyed Households

Road Section	Male		Female		Total	Average HH Size
	No.	%	No.	%		
NNM	177	52.8	158	47.2	335	5.3
Total	177	52.8	158	47.2	335	5.3

Source: Field Survey 2017/18

Annex 2.24: Distribution of Project Affected Surveyed Households by Caste and Ethnic Groups

Ethnicity	Naubise-Mugling	
	No.	%
Brahmin	25	39.7
Chhetri	8	12.7
Dalits	2	3.2
Newar	5	7.9
Gurung	4	6.3
Tamang	2	3.2
Magar	6	9.5
Chepong	4	6.3
Sanyasi	2	3.2
Muslim	2	3.2
Gharti	3	4.8
Total	63	100.0

Source: Field Survey 2017/18

Annex 2.25: Distribution of Project Affected Surveyed Households By Ips And Vcs Category

Social/Ethnic Groups	HHs	Percent
Indigenous Peoples (IPs)	24	38.10
Vulnerable Communities (VCs)	4	6.35
Generally Non vulnerable Groups	35	55.56
Total	63	100.00

Source: Field Survey 2017/18

Annex 2.26: Educational Status of Affected Population

Educational Status	NNM Road Section	
	No.	%
Illiterate	44	14.1
Literate to 5 Class	80	25.6
6-10 Class	90	28.8
SLC-12 Class	50	16.0
Graduate & Plus	48	15.4
Total	312	100.0

Source: Field Survey 2017/18

Annex 2.27: Occupational Status of Affected Population

Occupation	NNM Road Section	
	No.	%
Agriculture	17	7.8
Service	11	5.0
Trade	88	40.4
Labor	23	10.6
Foreign Job	17	7.8
House Manager/Wife	36	16.5
Others	26	11.9
Total	218	100.0

Source: Field Survey 2017/18

Annex 2.28: Annual Household Income of Project Affected Household (NRs.)

Road Section	Total Income	Household Income	Per capita Income	Total Household	Total Population
NNM	32,712,000	519,238	97,648	63	335

Source: Field Survey 2017/18

Annex 2.29: List of tracks that are existed along the existing highway connecting different villages

Road Type	Road Start	Road End	M/RM	Ward	Length Affected	Affected road linking
Black Topped	Naagdhunga	Kalanki	Chandra gari	3	7	Kalanki
Black Topped	Patale Ban	Sisort	Chandra gari	3	3	Resort
Black Topped	Chisapani	Dhading			1	Dhading
Black Topped	Tile-ghar	Cement Factory			3	Cement Factory
Black Topped	Khani Khola	Jeevanpur			10	Jeevanpur

Road Type	Road Start	Road End	M/RM	Ward	Length Affected	Affected road linking
Black Topped	Khani Khola	Mayal Dhara	Naubise	7	4	Mayal Dhara
Black Topped	Naubise-8	Hetauda	Tribhuvan Path	8	3	Hetauda
Black Topped	Dharke	Saatghumti	Naubise	1	4	Saatghumti
Black Topped	Mahadevbesi	Ranibari	Tharke	3	3	Ranibari
Black Topped	Galchi	Kerungnaka	Baireni	8	3	Kerung Border
Black Topped	Chabish Kilo	Raile	Baireni	9	5	Raile
Black Topped	Gajuri	Chauki	Gajuri	1	6	Chauki
Black Topped	Phurkekholo	Dhading Besi	Gajuri	2	8	Dhading Besi
Black Topped	Malekhu	Malekhu	Gajuri	2	7	Malekhu
Black Topped	Malekhu	Makwanpur	Benighat	1	5	Makwanpur
Black Topped	Malekhu	Dumre	Benighat	1	5	Dumre
Black Topped	Benighat	Salintar	Benighat	8	5	Salintar
Black Topped	Kurintar	Mankamana	Darecho wk	3	8	Kurintar (Way to Mankamana)
Black Topped	Muglin	Tamil Gau	Darecho wk	4	6	Tamil Gau
Black Topped	East West Highway (Linked to Prithvi Highway)		Darecho wk	4	8	
Gravel	Pipalamode	Sallaghari	Chandragari	3	3	Tileghar
Gravel	Sigrekholo	Dhunga Khani			1	Dhunga Khani
Gravel	Sigrekholo	Khani Khola			2	Khani Khola
Gravel	Tileghar	Sitapaila			2	Sitapaila
Gravel	Naubise	Ganesthan	Naubise	6	3	Ganeshthan
Gravel	Khani Khola	Dimatar	Naubise	7	2	Dimatar
Gravel	Mahadevbesi	Makwanpur	Bhumesthan	4	5	Makwanpur
Gravel	Simle	Makwanpur	Bhumesthan	6	4	Makwanpur
Earthen	Naagdhunga	Basant Tole	Chandragari	3	6	Kalanki
Earthen	Naagdhunga	Koirala Chowk	Chandragari	3	10	Koirala Chowk
Earthen	Pipalamode	Dhawal Chowk			3	Dhawal Chowk
Earthen	Pipalamode	Dhading			3	Dhading
Earthen	Sikrekholo	Khukure Chowk			2	Khukure Chowk
Earthen	Khatri Pauwa	Khadi	Naubise	4	4	Khadi
Earthen	Kanakot	Kanakot			4	Kanakot Gau
Earthen	Kanakot	Pauwa School			3	Pauwa School

Road Type	Road Start	Road End	M/RM	Ward	Length Affected	Affected road linking
Earthen	Kanakot	Maran Ghat			1	Maranghat
Earthen	Kanakot	Kanakot			2	Kanakot Gau
Earthen	Sigrekhol	Dhunga Khani			1	Dhunga Khani
Earthen	Tileghar	Sigrekhol			4	Sigrekhol
Earthen	Khani Khola	Kharke Daanda			1	Kharke Daanda
Earthen	Khani Khola	Naubise	Naubise	2	15	Naubise
Earthen	Khani Khola	Naubise	Naubise	6	5	Naubise
Earthen	Khani Khola	Bhanjyang	Naubise	7	3	Bhanjyang
Earthen	Khani Khola	Bhatta Gau	Naubise	7	2	Bhattagau
Earthen	Khani Khola	Naubise	Naubise	7	8	Naubise
Earthen	Dharke	Jeevanpur	Naubise	1	10	Jeevanpur
Earthen	Dharke	Piple	Tharke	2	4	Piple
Earthen	Jungekhola	Saatghumti	Tharke	8	4	Saatghumti
Earthen	Simbazar	Remigau	Tharke	5	5	Remi Gau
Earthen	Saatkila	Luitel Chowk	Tharke	4	5	Luikel Chowk
Earthen	Simle	Raatmate	Bhumesthan	6	4	Raatmate
Earthen	Simle	Goganpani	Bhumesthan	6	5	Goganpani
Earthen	Baireni	Palangkharka	Baireni	8	5	Palangkharka
Earthen	Baiskilla	Palangkharka	Baireni	8	5	Palangkharka
Earthen	Galchi	Daltar	Baireni	8	7	Daltar
Earthen	Baireni	Koilighar	Baireni	9	4	Koilighar
Earthen	Baireni	Majhikhet	Baireni	9	3	Majhikhet
Earthen	Baireni	Karki danda	Baireni	9	5	Karki danda
Earthen	Balchetar	Balchetar	Pida	1	5	Balchhetar
Earthen	Bange	Raigau	Pida	2	5	Raigau
Earthen	Gajuri	Dharapani	Gajuri	1	5	Dharapani
Earthen	Kalika	Sunderpur	Gajuri	1	7	Sunderpur
Earthen	Chalise	Hatte	Gajuri	1	4	Hatte
Earthen	Malekhu	Chitwn	Gajuri	2	4	Chitwn
Earthen	Majhimitar	Pipaldaanda	Jogimara	9	10	Pipaldaanda
Earthen	Majhimitar	Baluwakhan	Jogimara	9	10	Baluwakhani
Earthen	Jogimara	Jogimara Bhanjyang	Jogimara	1	5	Jogimara Bhanjyang
Earthen	Kurintar	Lamidanda	Darecho	3	10	Lamidaanda
Earthen	Kurintar	Lamidanda	Darecho	3	8	Lamidaanda

Annex 3: Stakeholder Engagement and Public Consultation

Annex 3.1: Public Consultation during ESIA Scoping (22 Aug- 6 Sep 2016):

S N	Settlement, Municipality/Rural Municipality	Date	Participant			Issues raised	Response	Responsible Agency
			Male	Female	Total			
1	Lapshi Khola, Naubise-4	22/Aug/2016 (2073/5/6)	9	5	14	Reasonable compensation should be provided for the affected property (fall within 25 m)	Clear information will be provided	Project, Contract or
						Appropriate wall construction in steep slope area along the roadside	Consideration will be given to minimize damage to the public utilities	Project, Contract or
						Zebra crossing spot should be marked in Bazar area and dense settlement areas.	Consideration will be given for road safety measures and other issues during design	Project, Contract or
						Road expansion work should be conducted equally in each side.	Consideration will be given for road safety measures and other issues during design	GRM, Project, Contract or
2	Dharke, Naubise-1	24/Aug/2016 (2073/5/8)	10	6	16	Prior to road extension work, compensation should be provided to affected structures (fall within 25 m).	Appropriate Compensation will be given to the affected persons	Project, Contract or
						Appropriate structures like Gabion works, wall etc. should be constructed according to geography conditions.	Consideration will be given for road safety measures and other issues during design	Project, Contract or
						During the construction period employment opportunity should be provided for project affected household families.	Consideration will be given to local people	Project, Contract or
						Skill based training should be provided for project affected household families.	Appropriate Trainings, in coordination with the local people will be brought	Project, Contract or
3	Dharke, Naubise-3	25/Aug/2016 (2073/5/9)	10	3	13	Reasonable compensation should be provided for affected property (fall within 25 m)	Appropriate compensation will be provided	Project, Contract or
						Road affect households should be sifted according to resettlement plan before construction work.	Appropriate measures will be done	Project, Contract or
						Road safety sign and structures i.e. overhead bridge, Zebra crossing should be design in Mahadev Besi bazar area.	Consideration will be given for road safety measures and other issues during design	Project, Contract or
4	Simle Bazar, Bhumesthan-6	26/Aug/2016 (2073/5/10)	17	1	18	Reasonable compensation should be provided to affected property (fall within 25 m)	Appropriate compensation will be provided	Project, Contract or
						To prevent landslide, appropriate structures like Gabion works, wall etc. should be constructed according to geography conditions.	Consideration will be given to minimize damage to the public utilities	Project, Contract or
5	Baireni Bazar, Baireni-9	26/Aug/2016 (2073/5/10)	7	5	12	Reasonable compensation should be provided for loss of private property (fall within 25 m)	Appropriate compensation will be provided	GRM, Project, Contract or
						Road safety sign i.e. Zebra crossing sign in Baireni bazar area.	Consideration will be given for road safety measures and other issues during design	Project, Contract or
6	Adhamghat, Pida-1	27/Aug/2016 (2073/5/11)	9	3	12	Road improvement/widening works should start rapidly.	Appropriate measures will be done	Project, Contract or
						Skill-based training should be provided for project-affected household families.	Appropriate Trainings, in coordination with the local people will be brought	Project, Contract or
						Road safety sign i.e. Zebra crossing sign in Adhamghat bazar area.	Consideration will be given for road safety measures and other issues during design	Project, Contract or
7			10	5	15	Only 75 fit structures clear during the road improvement/widening	Clear information will be provided	GRM, Project,

S N	Settlement, Municipality/Rural Municipality	Date	Participant			Issues raised	Response	Responsible Agency
			Male	Female	Total			
	Gajuri Bazar, Gajuri-1	28/Aug/2016 (2073/5/12)				Frequently changed ROW rule create confusion in local level	Clear information will be provided	Contract or Project, Contract or
						Road safety sign i.e. Zebra crossing sign in Gajuri bazar area	Consideration will be given for road safety measures and other issues during design	Project, Contract or
8	Malekhu Bazar, Benighat-1	29/Aug/2016 (2073/5/13)	5	4	9	Reasonable compensation should be provided to affected property (fall within 25 m)	Appropriate compensation will be provided	Project, Contract or
						Road safety sign i.e. Zebra crossing sign in 3/4 spot of Malekhu bazar area.	Consideration will be given for road safety measures and other issues during design	Project, Contract or
						To prevent landslide, appropriate structures like Gabion works, wall etc. should be constructed according to geography conditions.	Consideration will be given to minimize damage to the public utilities	GRM, Project, Contract or
10	Benighat Bazar, Benighat-8	30/Aug/2016 (2073/5/14)	13	6	19	Reasonable compensation should be provided to affected property (fall within 25 m)	Appropriate compensation will be provided	Project, Contract or
						There is not any losses and compensation needed if the ROW will be fixed on 30 m. So, requested for revise the ROW to 30 m.	Appropriate compensation will be provided	Project, Contract or
11	Charaudi Bazar, Dhusha-1	31/Aug/2016 (2073/5/15)	8	5	13	Reasonable compensation should be provided to affected property (fall within 25 m)	Appropriate compensation will be provided	Project, Contract or
						Road safety sign i.e. Zebra crossing sign in Charaudi bazar area.	Consideration will be given for road safety measures and other issues during design	Project, Contract or
12	Hugdi Khola, Jogimara-1	31/Aug/2016 (2073/5/15)	9	6	15	Reasonable compensation should be provided to affected property (fall within 25 m)	Appropriate compensation will be provided	GRM, Project, Contract or
						Highway should not be affected during rural road construction. Most of rural road link points have damaged the highway.	Appropriate measures will be taken	Project, Contract or
13	Darechok, Darechok-7	2/Sep/2016 (2073/5/17)	16	8	24	Reasonable compensation should be provided to affected property (fall within 25 m)	Appropriate compensation will be provided	Project, Contract or
14	Mugling Bazar, Darechok-4	3/Sep/2016 (2073/5/18)	12	5	17	Reasonable compensation should be provided to affected property (fall within 25 m)	Appropriate compensation will be provided	Project, Contract or
						Business hold households should be resettled within commercial location within the road alignment.	Appropriate compensation will be provided	Project, Contract or
						Constructed of the new road should be 4-lane wide.	Clear information will be provided	Project, Contract or
						In Darechok VDC there is still 15 m land are being selling and buying in practice, so the compensation amount should be equal with AILAYANI land.	Appropriate compensation will be provided	Project, Contract or
15	Makaising, Makaising-2	3/Sep/2016 (2073/5/18)	16	3	19	New alignment should be fixed through public land in possible place.	Clear information will be provided	Project, Contract or
						Reasonable compensation should be provided to affected property and agricultural land (fall within 25 m)	Appropriate compensation will be provided	Project, Contract or
						The proposed alignment will be support to seal agro based production and easy in transportation good.	Clear information will be provided	Project, Contract or

S N	Settlement, Municipality/Rural Municipality	Date	Participant			Issues raised	Response	Responsible Agency
			Male	Female	Total			
						Entire sector will be developed if the proposed alignment approved.	Appropriate Trainings, in coordination with the local people will be brought	Project, Contractor
						It will help to easy access in health and education sector.	Appropriate measures will be taken	Project, Contractor
16	Gorditar, Tanglichok -9	4/Sep/2016 (2073/5/19)	10	2	12	Reasonable compensation and resettlement programme should be provided to affected property and agricultural land (fall within 25 m)	Appropriate compensation will be provided	Project, Contractor
						The proposed alignment will be support to seal agro based production and easy in transportation good.	Appropriate measures will be taken	Project, Contractor
						Entire sector will be developed if the proposed alignment approved.	Appropriate Trainings, in coordination with the local people will be brought	Project, Contractor
						It will help to easy access in health and education sector.	Appropriate measures will be taken	Project, Contractor
17	Kaudiphant, Bhumlichok -8	5/Sep/2016 (2073/5/20)	7	2	9	Reasonable compensation and resettlement programme should be provided to affected property and agricultural land (fall within 25 m)	Appropriate compensation will be provided	Project, Contractor
						The life of local people will be easy if the proposed road pass through the Bhumlichok of Kaudiphant settlement.	Consideration will be given to local people's opinions	Project, Contractor
						Skill based training should be provided for project affected household families.	Appropriate Trainings, in coordination with the local people will be brought	Project, Contractor
18	Baltar, Ghyalchok -5	5/Sep/2016 (2073/5/20)	17	5	22	Reasonable compensation and resettlement programme should be provided to affected property and agricultural land (fall within 25 m)	Appropriate compensation will be provided	Project, Contractor
						Local should use in construction work.	Consideration will be given to locals	Project, Contractor
						Skill based training should be provided for project affected household families.	Appropriate Trainings, in coordination with the local people will be brought	Project, Contractor
19	Jiwanpur, Jiwanput-9	6/Sep/2016 (2073/5/21)	8	2	10	Reasonable compensation should be provided to affected property (fall within 25 m)	Appropriate compensation will be provided	Project, Contractor
						To prevent landslide, appropriate structures like Gabion works, wall etc. should be constructed according to geography conditions	Consideration will be given to minimize damage to the public utilities	Project, Contractor
						Public land and river bank should be followed to protect productive agricultural land.	Consideration will be given to protect agricultural land	Project, Contractor
		Total	184	76	260			

Source: Field Survey, 2016

Annex 3.2: Public Consultation during ESIA phase (26-30 Jan 2017)

S N	Settlement, Municipality/Rural Municipality	Date	Participant			Issues raised	Response	Responsible Agency
			Male	Female	Total			
1	Naubise VDC office, Khanikhola, Naubise, Dhading	26/Jan/2017 (2073/10/13)	3 2	3	3 5	Reasonable compensation should be provided for the affected property (fall within 25 m)	Clear information will be provided	Project, Contractor
						Appropriate wall construction in steep slope area along the roadside	Consideration will be given to minimize damage to the public utilities	Project, Contractor
						Zebra crossing spot should be marked in Bazar area and dense settlement areas.	Consideration will be given for road safety measures and other issues during design	Project, Contractor
						Road expansion work should be conducted equally in each side.	Consideration will be given for road safety measures and other issues during design	GRM, Project, Contractor
2	Pida VDC office, Ghatbesi, Dhading	27/Jan/2017 (2073/10/14)	2 6	4	3 0	Prior to road extension work, compensation should be provided to affected structures (fall within 25 m).	Appropriate Compensation will be given to the affected persons	Project, Contractor
						Appropriate structures like Gabion works, wall etc. should be constructed according to geography conditions.	Consideration will be given for road safety measures and other issues during design	Project, Contractor
						During the construction period employment opportunity should be provided for project affected household families.	Consideration will be given to local people	Project, Contractor
						Skill based training should be provided for project affected household families.	Appropriate Trainings, in coordination with the local people will be brought	Project, Contractor
3	Jogi Mara VDC office, Majhi tar, Dhading	30/Jan/2017 (2073/10/17)	3 2	4	3 6	Reasonable compensation should be provided for affected property (fall within 25 m)	Appropriate compensation will be provided	Project, Contractor
						Road affect households should be sifted according to resettlement plan before construction work.	Appropriate measures will be done	Project, Contractor
						Road safety sign and structures i.e. overhead bridge, Zebra crossing should be design in Mahadev Besi bazar area.	Consideration will be given for road safety measures and other issues during design	Project, Contractor
4	Jogi Mara, Majhi tar (Chepangs community)	30/Jan/2017 (2073/10/17)	1 4	-	1 4	Reasonable compensation should be provided to affected property (fall within 25 m)	Appropriate compensation will be provided	Project, Contractor
						To prevent landslide, appropriate structures like Gabion works, wall etc. should be constructed according to geography conditions.	Consideration will be given to minimize damage to the public utilities	Project, Contractor
		Total	10 4	11	11 5			

Source: Field Survey, 2017

Annex 3.3: Consultations with Community Forest Groups for Flora and Fauna in the Project Area (15-21 March 2017)

S.N.	Name	Title	Community forest	Meeting date
1	Krishna Bahadur Subedi	President	Pateleban CF	15-03-17
2	Binod Prasad Chappagain	President	Nisakot CF	15-03-17
3	Rajendra Regmi	President	Deubuje CF	16-03-17
4	Loknath Lamsal	Officer	Baireni Illaka Ban	16-03-17
5	Ram Sharan Adhikari	President	Indrayeni CF	17-03-17
6			Chiraudi CF	17-03-17

S.N.	Name	Title	Community forest	Meeting date
7	Raju Karakheti	President	Sutkeri Dhunga CF	17-03-17
8	Shiva Rimal	Treasurer	Balkumari CF	17-03-17
9	Bishnu Gatraj	Member	Balkumari CF	17-03-17
10	Indra Bahadur Thapa	-	Bhasme lam CF	18-03-17
11	Nawaraj Subedi	Secretary	Setidevi CF	18-03-17
12	Binod Bhandari	-	Gauri Bhanjyan CF	18-03-17
13	Chandra B. Tamang	-	Indradevi CF	19-03-17
14	Bhumi Kandel	-	Kashi khola CF	19-03-17
15	Narendra Upreti	-	Kankali devi CF	19-03-17
16	Dev Raj Tripathi	President	Falepakho CF	19-03-17
18	Kesab Raj Naharki	Member	Bishal Samyukta CF	20-03-17
21	Tulashi Regmi	President	Salleri CF	20-03-17
22	Ram Kumar Gurung	Member	Nivare CF	20-03-17
24	Uttam Ghale	President	Jwang Mauwa Khola CF	20-03-17
25	Inshan Gurung	Secretary	Cheppang CF	21-03-17
26	Shivaram Pokharel	President	Dharapani CF	21-03-17
27	Mundra Bahadur Thapa	President	Leasehold forest network	21-03-17
28	Yuddhasingh Basnet	Forest guard	Gorkha Illaka	22-03-17
29	Ram Chandra Dhakal	Forest guard	Gorkha Illaka	22-03-17
30	Bhojraj Dhakal	-	Mugling illka ban	23-03-17

Annex 3.4: Public Hearing (9-12 April 2019)

S N	Settleme nt, Municip ality /Rural Municip ality	Date	Participant			Issues raised	Response	Responsible Agency
			Male	Female	Total			
1	New Activitie s Youth Club, Ward 9, Khatripa uwa, Dhunibes i Municipa lity.	9/Apr/2018 (2074/12/2 6)	41	11	52	The proposed alignment should be rerouted to avoid the meadows and cultivated areas owned by locals of ward No. 9 and 5 of Dhunibesi Municipality.	Clear information will be provided	Project, Contractor
						There are 3 National Highways proposed within the span of 1 KM in Dhunibesi Municipality, which will cause a significant loss of cultivable lands and private properties. So, the proposed Sisnekhola-Dharke alignment is questionable and thus the alignment is deemed to be unnecessary.	Consideration will be given to minimize damage to the public utilities	Project, Contractor
						All the public infrastructures such as canals, local water supply pipelines and taps should be rebuilt.	Appropriate measures will be taken	Project, Contractor
						In the course of road expansion, new recreation facilities and parks should be built.	Design team will review	Project, Contractor
						Some locals haven't yet received the compensation for the loss of the properties incurred during the construction of Tribhuvan Highway. So, people are doubtful about the appropriate compensations they ought to receive. Therefore, locals should be assured about the compensation for any loss of properties resulting from the expansion of road.	Appropriate compensation will be given	Project, Contractor
						The right of way should be reduced to 30 m from 50 m.	Clear information will be provided	Project, Contractor
						Another public hearing should be conducted in presence of locals, stakeholders and the proponents.	Appropriate measures, if possible, will be taken	

S N	Settleme nt, Municip ality /Rural Municip ality	Date	Participant			Issues raised	Response	Responsible Agency
			Male	Female	Total			
2	RIMS Hall, Jintetar, Baireni Ward 6, Galchhi Rural Municipa lity	10/Apr/201 8 (2074/12/2 7)	52	5	57	The road expansion should be done keeping the center as it is in the existing road. The center-line of the road should be fixed before commencing any construction activities.	Appropriate measures will be taken	Project, Contractor
						The spoil and the waste generated during construction should be disposed of properly and should not be dumped in the river.	Appropriate measures will be taken	Project, Contractor
						The road expansion should be carried in both sides rather than encroaching a particular side. Similar consideration should be given while constructing bridges and installing culverts drainage and other structures.	Appropriate measures will be taken	Project, Contractor
						Locals with unregistered landholdings, whose properties fall in Right of Way of the road should also be provided with proper compensation.	Appropriate compensation will be given	Project, Contractor
						Rather than upgrading the existing road alignment, new alignment should be constructed on the opposite side of the Trishuli River.	Appropriate measures will be taken	Project, Contractor
						Bishaltar-Phisling road alignment should be upgraded and constructed where necessary.	Appropriate measures will be taken	Project, Contractor
3	Ward office Bishaltar Ward 5, Benighat -Rorang Rural Municipa lity	11/Apr/201 8 (2074/12/2 8)	88	7	95	There should be uniformity in the expansion of road all along from Naubise to Mugling.	Clear information will be provided	Project, Contractor
						There should be the presence of the proponents and the engineers from the design team in the public hearing.	Appropriate measures will be taken	Project, Contractor
						Any expansion work that will be carried out beyond 30 m Right of Way should be done with proper compensation to the affected locals.	Clear information will be provided	Project, Contractor
						The confusion prevalent regarding Right of Way (RoW) should be made clear.	Clear information will be provided	Project, Contractor
						All the compensations necessary should be provided as per the current market rates prior to commencing any construction activities.	Appropriate measures will be taken	Project, Contractor
						Public participation in decision making should be given due consideration.	They will be continuously involved	Project, Contractor
						Resettlement and rehabilitation plans for those displaced by road expansion must be done.	Appropriate measures will be taken	Project, Contractor
						Tree plantation should be carried out on both sides of the road.	Appropriate measures will be taken	Project, Contractor
						Grievance redress mechanism should be developed in every ward in coordination with ward chiefs while carrying out the project activities.	Appropriate measures will be taken	Project, Contractor
						Locals do not have any opposition regarding the expansion of road; however, the locals must be pre-informed well about all the activities and the role of state in such matters should be made clear to the public.	Information via appropriate means, will be circulated	Project, Contractor
4	Agricul tural Hall, Phisling, Gandaki Rural	12/Apr/201 8 (2074/12/2 9)	47	8	55	The Right of Way should be 30 m as demanded by local stakeholders.	Clear information will be provided	Project, Contractor
						The road construction should begin as soon as possible as the people are in a dire need of the road.	Appropriate measures will be taken	Project, Contractor

S N	Settle ment, Municip ality /Rural Municip ality	Date	Participant			Issues raised	Response	Responsible Agency
			Male	Female	Total			
	Municipa lity					All the affected households during the road construction and expansion should be provided with compensation as per the existing market rates.	Appropriate compensation will be given	Project, Contractor
						The households which lose all their properties due to the road construction and expansion should be provided with resettlement alternatives.	Appropriate compensation will be given	Project, Contractor
						Family members of affected households as mention in point No. 4 should be assured of employment opportunities and income generating sources by the project.	Appropriate measures will be taken	Project, Contractor
						Ward level Grievance redress mechanism should be developed while implementing the project.	Appropriate measures will be taken	Project, Contractor
						Proper disposal of spoil and waste generated during construction activities should be ensured so as not to harm the local environment	Appropriate measures will be taken	Project, Contractor
						Tree replantation should be done to compensate for the loss of trees during construction of road.	Appropriate measures will be taken	Project, Contractor
						Measures shall be taken to minimize the impact on environment, and proper structures to avoid soil erosion and landslides such as retaining wall, gabion wall etc. should be constructed.	Appropriate measures will be taken	Project, Contractor
						The priority should be given to locals for employment as per their skills during the project implementation.	It will be considered	Project, Contractor
						The construction of culverts, canals and drainage should be done properly so as to avoid impact on water bodies.	Consideration will be given to minimize damage to the public utilities	Project, Contractor
						Existing public infrastructures such as schools, temples, resting places, public water supply should be rebuilt if they incur any losses or the loss of such infrastructures should be minimized as much as possible.	Consideration will be given to minimize damage to the public utilities	Project, Contractor
		Total	228	31	259			

Source: Field Survey, 2019

Annex 3.5: Consultation for Footbridge and Public Toilet (26-31 June 2018)

S N	Settle ment, Municip ality /Rural Municip ality /chain age	Date	Participant			Proposed Structure	Issues raised	Response	Responsible Agency
			Male	Female	Total				
1.	Ryale, Dhuni besi MP-9, (7+350)	26/Jun/2018 (2075/03/12)	9	4	13	Public toilet	The responsibility of operation and management of public toilet after construction will be borne by local community	Will be reviewed by Project	DoR, local government
							Bus waiting shed at that location	Will be reviewed by design team	Design team

S N	Settle ment, Munic ipality /Rural Munic ipality /chain age	Date	Participant			Proposed Structure	Issues raised	Response	Responsible Agency
			Male	Female	Total				
2.	Ryale, Dhuni besi MP-9, (7+350)	26/Jun/2018 (2075/03/12)	9	4	13	Public toilet	1 more foot-over bridge at school area	Will be reviewed by design team	Design team
							The responsibility of protection of public toilet will be borne by local community	Will be reviewed by Project	DoR, local government
3.	Dhark e, Dhuni besi MP-6, (2+775)	26/Jun/2018 (2075/03/12)	1	13	14	Foot-Over Bridge	The responsibility of protection of foot-over bridge will be borne by local community	Will be reviewed by Project	DoR, local government
4.	Mahadevbesi, Thakre RMP-6, (10+680)	27/Jun/2018 (2075/03/13)	3	10	13	Foot-Over Bridge	Design and drawing of foot-over bridge has been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people highly appreciated the provision of construction of foot-over bridge	Supports of local people are highly appreciated	Project, Contractor, Local Community
							The responsibility of protection of foot-over bridge will be borne by local community	Will be reviewed by Project	DoR, local government
5.	Simle, Thakre RMP-2, (14+250)	27/Jun/2018 (2075/03/13)	3	9	12	Foot-Over Bridge	Design and drawing of foot-over bridge has been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people highly appreciated the idea of construction of foot-over bridge	Supports of local people are highly appreciated	Project, Contractor, Local Community
							The responsibility of protection of foot-over bridge will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community
6.	Eklephat, Thakre RMP-1, (15+875)	27/Jun/2018 (2075/03/13)	6	7	13	Public Toilet	Design and drawing of public toilet have been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people have shown full interest to support to construct public toilet	Supports of local people are highly appreciated	Project, Contractor, Local Community
							The responsibility of operation and management of public toilet after construction will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community
7.	Baireni, Galchhi RMP-6, (23+650)	28/Jun/2018 (2075/03/14)	16	10	26	Foot-Over Bridge	Design and drawing of foot-over bridge has been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people highly appreciated the concept of construction of foot-over bridge	Supports of local people are highly appreciated	Project, Contractor, Local Community

S N	Settle ment, Munic ipality /Rural Munic ipality /chain age	Date	Participant			Proposed Structure	Issues raised	Response	Responsible Agency
			Male	Female	Total				
							The responsibility of protection of foot-over bridge will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Additional foot-over bridge has been demanded at Galchhi area	The demand of foot-over bridge at Galchhi area will be reviewed	Project, Contractor, Local Community
8.	Banchhetar, Gajuri RMP-5, (29+750)	28/Jun/2018 (2075/03/14)	4	19	23	Public Toilet	Design and drawing of public toilet have been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people have shown full interest to support to construct public toilet	Supports of local people are highly appreciated	Project, Contractor, Local Community
							The responsibility of operation and management of public toilet after construction will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community
9.	Ghatbesi, Gajuri RMP-6, (35+000)	28/Jun/2018 (2075/03/14)	6	3	9	Public Toilet	Design and drawing of public toilet have been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people have shown full interest to support to construct public toilet	Supports of local people are highly appreciated	Project, Contractor, Local Community
							The responsibility of operation and management of public toilet after construction will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community
10.	Mathilobazar, Gajuri RMP-1, (37+600)	28/Jun/2018 (2075/03/14)	4	27	31	Foot-Over Bridge	Design and drawing of foot-over bridge has been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people highly appreciated the provision of construction of foot-over bridge	Supports of local people are highly appreciated	Project, Contractor, Local Community
							The responsibility of protection of foot-over bridge will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community
11.	Traffic Chowk, Gajuri RMP-1, (37+850)	29/Jun/2018 (2075/03/15)	3	11	14	Foot-Over Bridge	Design and drawing of foot-over bridge has been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people highly appreciated the concept of construction of foot-over bridge	Supports of local people are highly appreciated	Project, Contractor, Local Community
							The responsibility of protection of foot-over bridge will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community

S N	Settle ment, Munic ipality /Rural Munic ipality /chain age	Date	Participant			Proposed Structure	Issues raised	Response	Responsible Agency
			Male	Female	Total				
12.	Purano Malekhu Bazar, Gajuri RMP-2, (43+400)	29/Jun/2018 (2075/03/15)	-	14	14	Foot-Over Bridge	Design and drawing of foot-over bridge has been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people highly appreciated the provision of construction of foot-over bridge	Supports of local people are highly appreciated	Project, Contractor, Local Community
							The responsibility of protection of foot-over bridge will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community
13.	Malekhu Bazar, Benighat Rorangi RMP-3, (44+350)	29/Jun/2018 (2075/03/15)	6	9	15	Foot-Over Bridge	Design and drawing of foot-over bridge has been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people highly appreciated the idea of construction of foot-over bridge	Supports of local people are highly appreciated	Project, Contractor, Local Community
							The responsibility of protection of foot-over bridge will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community
14.	Malekhu Petrol Pump, Benighat Rorangi RMP-3, (44+700)	29/Jun/2018 (2075/03/15)	1	13	14	Foot-Over Bridge	Design and drawing of foot-over bridge has been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people highly appreciated the idea of construction of foot-over bridge	Supports of local people are highly appreciated	Project, Contractor, Local Community
							The responsibility of protection of foot-over bridge will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community
15.	Benighat, Benighat Rorangi RMP-5, (50+915)	30/Jun/2018 (2075/03/16)	2	10	12	Foot-Over Bridge	Design and drawing of foot-over bridge has been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people highly appreciated the idea of construction of foot-over bridge	Supports of local people are highly appreciated	Project, Contractor, Local Community
							The responsibility of protection of foot-over bridge will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community
16.	Bishaltar, Benighat Rorangi RMP-5,	30/Jun/2018 (2075/03/16)	5	11	16	Foot-Over Bridge	Design and drawing of foot-over bridge has been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people highly appreciated the idea of construction of foot-over bridge	Supports of local people are highly appreciated	Project, Contractor, Local Community

S N	Settle ment, Munic ipality /Rural Munic ipality /chain age	Date	Participant			Proposed Structure	Issues raised	Response	Responsible Agency
			Male	Female	Total				
	(53+325)						The responsibility of protection of foot-over bridge will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community
17.	Charau di/ Khatritar, Benighat Rorangi RMP-7, (56+150)	30/Jun/2018 (2075/03/16)	3	12	15	Public Toilet	Design and drawing of public toilet have been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people highly appreciated the idea of construction of public toilet	Supports of local people are highly appreciated	Project, Contractor, Local Community
							The responsibility of protection of public toilet will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community
18.	Majhi tar, Benighat Rorangi RMP-9, (60+900)	30/Jun/2018 (2075/03/16)	4	9	13	Public Toilet	Design and drawing of public toilet have been shared with local people	Demand of foot-over bridge will be reviewed Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people highly appreciated the idea of construction of public toilet	Supports of local people are highly appreciated	Project, Contractor, Local Community
							The responsibility of operation and management of public toilet after construction will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people demanded one public toilet bridge	Will be reviewed by design team	Design team
19.	Kurintar, Ichchakamana RMP-4, (74+800)	31/Jun/2018 (2075/03/17)	2	9	11	Foot-Over Bridge	Design and drawing of foot-over bridge has been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community
							Local people highly appreciated the idea of construction of foot-over bridge	Supports of local people are highly appreciated	Project, Contractor, Local Community
							The responsibility of protection of foot-over bridge will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community
20.	Ramailodanda, Ichchakamana RMP-4, (77+280)	31/Jun/2018 (2075/03/17)	6	7	13	Foot-Over Bridge	Design and drawing of foot-over bridge has been shared with local people	Suggestion of local people will be reviewed	Project, Contractor, Local Community
							Local people have not shown their interest to construct foot-over bridge at Ramailodanda and suggested to construct at Lewatar area if feasible	Will be reviewed by design team	Design team
21.	Mugling Bazar, Ichcha	31/Jun/2018 (2075/03/17)	3	9	12	Foot-Over Bridge	Design and drawing of foot-over bridge has been shared with local people	Supports of local people are highly appreciated	Project, Contractor, Local Community

S N	Settle ment, Munic ipality /Rural Munic ipality /chain age	Date	Participant			Proposed Structure	Issues raised	Response	Responsible Agency
			Male	Female	Total				
	kaman a RMP- 5, (82+30 0)						Local people highly appreciated the idea of construction of foot-over bridge	Supports of local people are highly appreciated	Project, Contractor, Local Community
							The responsibility of protection of foot-over bridge will be borne by local community	Supports of local people are highly appreciated	Project, Contractor, Local Community
		Total	96	22 0	31 6				

Source: Field Survey, 2019

Annex 3.6: First Supplementary Public Consultation (16 June -11 Aug 2019)

S N	Rural MP / Municipal ity	Settlement	Participant			Issues raised	Measures to Resolve the Issue	Responsible Agency
			Male	Female	Total			
1	Mayor Office, Dhading Dhunibesi MP	16/Jun/2019 (2076/03/1)	3	1	4	The social and environmental aspect must be taken into consideration	Appropriate measures will be taken	Project, Contractor
						Gender equality and more opportunities for employment women	More efforts to have a women/gender-friendly conditions	DoR, Contractor
2	Ward 8 Office, Dhunibesi MP,	16/Jun/2019 (2076/03/1)	15	-	15	The social and environmental aspect must be taken into consideration	Appropriate measures will be taken	Project, Contractor
						Gender equality and more involvement of women in the process	More efforts to have a women/gender-friendly conditions	DoR, Contractor
3	RMP office, Bishaltar, Benighat-Rorang RMP	17/Jun/2019 (2076/03/2)	16	6	22	The social and environmental aspect must be taken into consideration	Appropriate measures will be taken	Project, Contractor
						Gender equality and more involvement of women in the process	More efforts to have a women/gender-friendly conditions	DoR, Contractor
4	Galchhi Ward Office, Galchhi RMP, Dhading	18/Jun/2019 (2076/03/3)	8	1	9	The social and environmental aspect must be taken into consideration	Appropriate measures will be taken	Project, Contractor
						The rehabilitation of the Vulnerable groups should be done properly	Appropriate measures will be taken	DoR, Contractor
5	Thakre Ward Office, Thakre RMP, Dhading	18/Jun/2019 (2076/04/22)	10	-	10	Construction of public structures in Mahadevbesi bazar	Design Team will look over it	Contractor
						Overhead Foot Bridge in Junge Khola	Design Team will look over it	Contractor
						The social and environmental aspect must be taken into consideration	Appropriate measures will be taken	Project, Contractor
6	Ward-3 Office, Benighat-Rorang RMP, Malekhu, Dhading	19/Jun/2019 (2076/04/23)	6	-	6	Reasonable compensation and resettlement programme should be provided to affected property and agricultural land, as Chepangs will be the one affected	Appropriate compensation will be provided	Project, Contractor

S N	Rural MP / Municipal ity	Settlement	Participant			Issues raised	Measures to Resolve the Issue	Responsible Agency
			Male	Female	Total			
						The social and environmental aspect must be taken into consideration	Appropriate measures will be taken	Project, Contractor
7	Gajuri Ward Office, Gajuri RMP, Dhading	18/Jun/2019 (2076/04/22)	9	-	9	To-verify the public structures that will be affected	Appropriate measures will be taken	Project, Contractor
						The public structures were discussed	Design Team will look over it	Contractor
						The social and environmental aspect must be taken into consideration	Appropriate measures will be taken	Project, Contractor
8	Ichchakamana Ward Office, Kurintar, Chitwan	19/Jun/2019 (2076/04/23)	8	6	14	Issues of Gender-based violence were discussed	Appropriate measures will be taken	Project, Contractor
						The public structures were discussed	Design Team will look over it	Contractor
						The social and environmental aspect must be taken into consideration	Appropriate measures will be taken	Project, Contractor
9	Female group	11/Aug/2019 (2076/5/26)	-	8	8	Issues of Gender-based violence were discussed	Appropriate measures will be taken	Project, Contractor
		Total	75	22	97			

Source: Field Survey 2019

Annex 3.6: Second Complimentary Consultation (December 2019)

S N	Settleme nt/Rural MP / Municipa lity	Dat e	Participant			Issues raised	Response Given	Responsible Agency
			Male	Female	Total			
1	Khatripau wa, Dhunibesi	8/D ec/ 201 9	-	2	2	More communication between stakeholders to solve problems	Regular meeting, at the ward level, will be held	Project, Contractor
						Reasonable compensation and resettlement programme should be provided to affected property and agricultural land (fall within 25 m)	Appropriate compensation will be provided	Project, Contractor
						Advance agreement on rules and regulation between all the stakeholders (project, contractors, locals, government officials) for upcoming problems when the labor camp arrives	Appropriate measures will be taken	Project, Contractor
						Road safety sign i.e. Zebra crossing sign	Appropriate facilities will be added, if possible	Project, Contractor, design team
2	Naubise that, Toll collecting Centre, Dhunibesi	8/D ec/ 201 9	3	-	3	Difficult to collect toll from Motorbikes as it is only 2-lane	Appropriate facilities will be added, if possible	Project, Contractor, design team
						Not enough facilities, considering the amount of tariff raised (more than 4 thousand vehicles go out of valley)	Appropriate facilities will be added, if possible	Project, Contractor, design team
						Separate lane to collect the tariff	Appropriate facilities will be added, if possible	Project, Contractor, design team
						Not a safe place for women to work, it can be minimized if modern booth with banking and smart card, etc. is used	Appropriate measures will be taken to make it safer for women	Project, Contractor
3	Baireni, Galchhi 6	8/D ec/ 201 9	-	5	5	Grievance centre in each ward	Appropriate measures will be taken	Project, Contractor
						Separate Parking Place in a fixed location	Consideration will be given for road safety measures and other issues during design	Project, Contractor
						Safety for school children	Consideration will be given for road safety measures and other issues during design	Project, Contractor
						Proper drainage of water through canals	Appropriate measures will be taken	Project, Contractor
4	Police Office, Munglin	8/D ec/ 201 9	3	-	3	Coordination for traffic management	Appropriate measures will be taken	Project, Contractor, DoR,
						Collaboration to decrease trafficking of drugs, weapons etc.	Appropriate measures will be taken	Project, Contractor,
						In traffic jams during construction period, priority should be given to emergency vehicles like ambulance	Appropriate measures will be taken	Project, Contractor, DoR,
						To prevent GBV, human trafficking and prostitution, measures should be taken from community level	Appropriate measures will be taken	Project, Contractor, local government, community
						To help police in their work	Appropriate measures will be taken	Project, Contractor, DoR, local government, community
5	Travel Agencies	15/ Dec. 201 9	3	-	3	To have an official portal like webpage, Facebook page for information sharing	Appropriate measures will be taken	Project, Contractor, DoR
						Sending emails directly to agencies of travel, tour and guides	Appropriate measures will be taken	Project, Contractor, DoR
						If construction work is done during night, it would have minimal impact for tourists	Appropriate measures will be taken	Project, Contractor, DoR
6		15/ Dec.	1	-	1	Facebook and Viber groups are mostly used for information sharing	Appropriate measures will be taken	Project, Contractor, DoR

S N	Settleme nt/Rural MP / Municipa lity	Dat e	Participant			Issues raised	Response Given	Responsible Agency
			Male	Female	Total			
	Transport ation Agency	201 9				Proper traffic management	Appropriate measures will be taken	Project, Contractor, DoR
7	Media	16/ Dec. 201 9	1	-	1	Proper resource person to disseminate information in lay-man words	Appropriate measures will be taken	Project, Contractor, DoR
						The information officer should be a reporter so as to give-out information in an effective way	Appropriate measures will be taken	Project, Contractor, DoR
						Information can be updated via Facebook for efficiency	Appropriate measures will be taken	Project, Contractor, DoR
8	Constructi on workers	16/ Dec. 201 9	3	4	7	Proper rules and regulation	Appropriate measures will be taken	Project, Contractor, DoR
						Proper implementation and monitoring	Appropriate measures will be taken	Project, Contractor, DoR
						CC camera in work space	Appropriate measures will be taken	Project, Contractor, DoR
						Gender friendly toilet and child care	Appropriate measures will be taken	Project, Contractor, DoR
						If paid properly and with facilities, night shift would not be a problem	Appropriate measures will be taken	Project, Contractor, DoR
9	Differently able	16/ Dec. 201 9	1	1	2	Wider Footpath, so that wheelchair can move	Consideration will be given during design	Project, Contractor, DoR
						Signals or sign language for deaf	Consideration will be given during design	Project, Contractor, DoR
						'check-trail' for blind people	Consideration will be given during design	Project, Contractor, DoR
	total		38	1 2	50			

Source: Field Survey 2019