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

Environment and Social Impact Assessment (ESIA)

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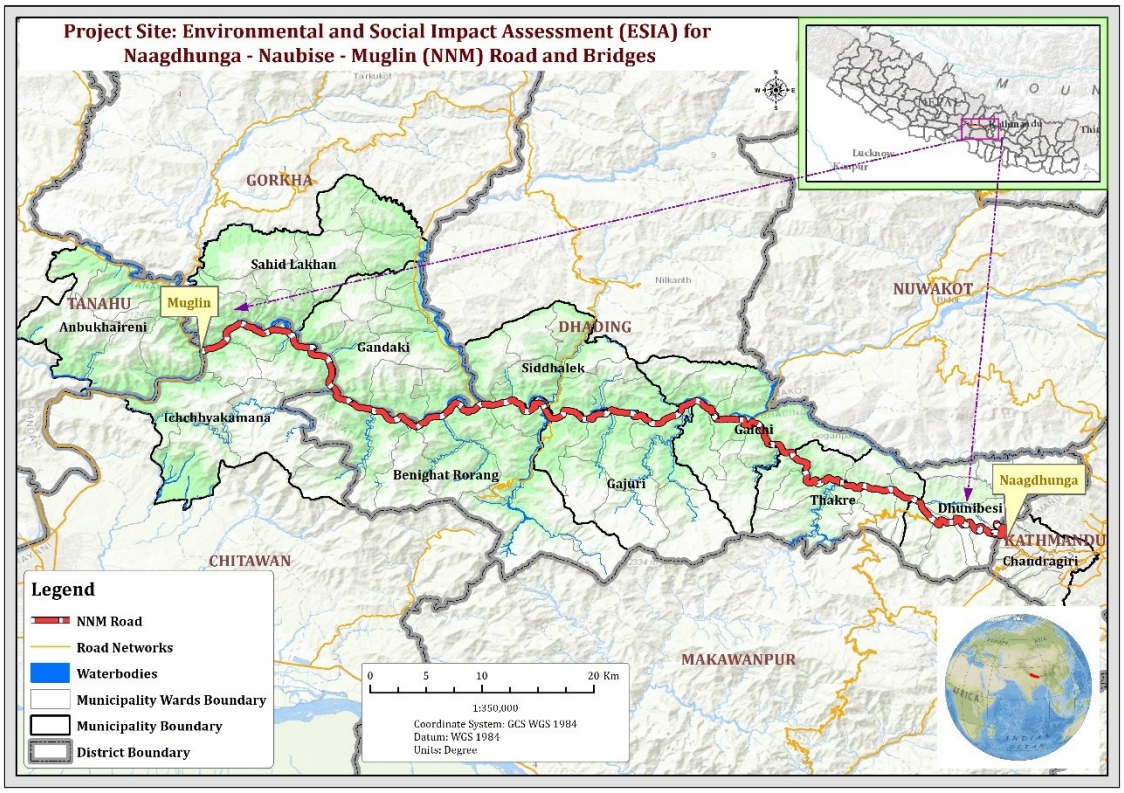
EXECUTIVE SUMMARY

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). This project will support (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 2-lane Asian Highway standard; and (b) Upgrading of the Kamala-Dhalkebar-Pathlaiya (KDP) road of the Mahendra Highway (East West Highway) from 2-lane to 4-lane. This Environmental and Social Impact Assessment (ESIA) report only assesses the environmental and social risks and impacts of the NNM road in accordance with the Government of Nepal's (GoN) requirements and the World Bank's Environmental and Social Framework (ESF) and relevant Environmental and Social Standards(ESSs). 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 inform the detailed ESIA at the detailed design stage of the KDP road.

Project Description

The existing 2-lane Nagdhunga-Naubise – Mugling (NNM) (94.7-km section) will be improved to 2-lane Asian Highway Standards under SRCTIP. The total length of NNM road comprises of Naghdhunga-Naubise(12.3 km) (part of Tribhuvan Highway(TH) andNaubise-Mugling(82.4 km) (part of a Prithvi Highway(PH). The road is located in Kathmandu, Dhading and Chitwan district of Province 3. The alignment starts atNagdhunga check-post and passes throughNaubise, Khanikhola, Mahadevbesi, Galchhi, Baireni, Malekhu, Benighat, Kurintarandends 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 headquarter of Dhading District at PhurkeKhola, Malekhu. Similarly, at Mugling the highway has junction of Mugling-Narayanghat Road Section connecting this highway to Mahendra Highway (MH).



Map of Existing Road alignment

The existing NNM road has been proposed to be improved into 2- lane Asian Highway Standard with 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 improvements, including 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. Improvement of 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 infrastructures, 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 (EPA), 1997 and Environmental Protection Regulations (EPR), 1997 and WB Operational Policies[1]. The ESIA report was submitted to WB as per the requirements. The WB released the new Environment and Social Framework (ESF) in 2018. So, this report is updated as per the requirements of the ESF, 2018.

Scope of ESIA

The scope of the ESIA is to: i) update the existing baseline status of the environment within Corridor of Impact and Project Zone of Influence; ii) identify the additional probable adverse and positive E&S risk and impacts due to the planned project during its

[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).

entire cycle i.e. from preconstruction to construction to operation & maintenance; iii) consider all Environment, Health and Safety (EHS) likely in the project for further usage towards preparation of Stakeholder Engagement Plan (SEP), Labour Management Procedure (LMP), Gender Based Violence (GBV) Action Plan.

Legal and Institutional Framework

Nepal's national legislative framework, WB ESF and EHS guidelines forms the legal and institutional framework for this ESIA at different stages includingthe assessment and development of mitigation measures to be complied in construction and operation stages. This section of the ESIA provides an overview of the applicable environmental and social policy, legislative and institutional framework, which the project will be required to comply during its implementation. The legal and institutional framework is based on the Constitution of Nepal (2015), which states the right of everybody to live in clean and healthy environment as well as to conserve, promote and make sustainable use of natural resources. Further, the detailed analysis of the existing legislative framework in Nepal was provided, including 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 relevance of key provisions to NNM 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 includes 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; andsocial attributessuch asprivate assets, cultural heritages, public utilities, Indigenous People (IPs), vulnerable groups, affected groups, GBV of the proposedproject.

Physical Environment

The highest point along the NNM road is at Nagdhunga (1,500 m).The road alignment passes through hilly area from Nagdhunga toNaubise. 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 very in bad condition due to a number of slope failure sites and landslide deposits. The entire section of the road from Manakamanacable car station 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[2]. 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 PM_{10} and $PM_{2.5}$. The observed equivalent noise pressure levels were found to exceed the National Noise Quality Standard Limit (NNQSL) andOccupationalSafety 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, Majhimtaracross 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 is represented by terrestrial habitats (5 forest types), aquatic habitats including fish and other aquatic fauna and, terrestrial fauna, comprised by 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 detected during systematic surveys, conducted along the road. Based on critical habitat screening conducted based on ESS6 criteria for critical habitats and IFC Performance Standard 6 and IFC PS6 threshold, the ESIA showed that the project area does not cross or impact any critical habitats. There is a total of 7 critically endangered and endangered species of birds (5 species), mammal (1 species) and fish (1 species) in the project area but these species have widespread distribution in Nepal, in the Himalayas and even in the South Asia and Southeast Asia Regions and applying the IFC PS6 thresholds indicated that the improvement of NNM road will not be affecting the global population of these species considering the small DIA and the ROW and the minimal clearing during the road works. There are also no sensitive wildlife habitats along the NNM corridor, including protected areas, wildlife reserve or migratory corridors. The road was built in 1973 AD, 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, which provide habitats for animals, well adapted to live in such conditions. Many invasive plant species grow along the Right of Way (ROW), indicating the high degree of disturbance of natural habitats. The project area comprises 28 community forests, 7 governmentand 6 leasehold forests.

[2] The road alignment is considered starting from Nagdhunga

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

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, RamailoDanda, and Mugling.The caste and ethnic groups found in project area are Brahmin, Chhetri, Sanyashi, Dalit, Muslims, Madheshi and Janajatis/IPs viz. Newar, Gurung, Magar, Tamang,Chepang and others. 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 beZoI 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 the 150 m on either side from the centerline of the road (300m) has been considered as the DIA. However, the Corridor of Impact (CoI) is considered as 30 m (15m on either side) within Right of Way (ROW. The affected population within DIA is 16,959. Out of this population, the population of males and females are 8,407 and 8,550 respectively. The total HHs affected within ROW by the project is 78. The population of the project affected HHs is 407.

Stakeholder Engagement and Public Consultation

Stakeholder engagement is an inclusive process to engage stakeholders throughout the project lifecycle. ESS-10 has recognized the voice of different stakeholders. So that project has to provide the platform to raise their voice as individuals or in a group.The stakeholder consultation carried out during ESIA preparation covers the issues of indirectly affected groups including local government line agencies (RM/M). The additional stakeholder consultations were carried out during ESIA update to incorporate the issues of directly affected groups and other interested parties.

The key identified stakeholders are: local governments (2 M & 5 RM), local Non-Governmental Organizations (NGOs), civil society, teachers, political leaders, women groups, local entrepreneurs led by women groups, vulnerable and IPs, differently able 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 (including travellers).

The discussions during preliminary study (prefeasibility) were organized to share the information to the local people of project affected wards of RM/M. Initial walkover survey was carried out followed by individual interview with local government officials. The tools such as Focus Group Discussions (FGD) and Key Informant Interviews (KII) were used to conduct discussions. The preliminary consultation during prefeasibility stage was carried out at three different locations, Dhunibesi M, Gajuri RM and BenighatRorang RM from 27-30 January, 2017. Total 115 participants took part with 104 male and 11 females. The participants were only from the indirectly affected groups. Then, public hearing was carried out at 4 different locations of Dhunibesi M, Galchi RM,

BenighantRorang RM and Ichhankamana RM with 259 participants (228 male and 31 female).

The supplementary consultation was 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. The additional consultation with the specific groups such as women, vulnerable/IPs, project affected parties, other interested parties were carried out during May-November, 2019 to fill up gaps present in the consultations with direct affected groups (project affected vulnerable groups and IPs), and other interested parties (broader and general groups)there were still present after the public hearing and supplementary consultations. The total participants of additional consultation were 252(female- 171, male- 81). The agenda for discussions were impacts on private/ public structure, common property and public utilities along with cultural heritage includingGrievance Redress Mechanism(GRM)and GBV related issues. The key issues raised during consultations were: compensation of impacted land, affected private and public structures, construction of public structures as foot over bridge near school and major market places, construction of vegetable collection centres, gender friendly public toilets with refreshment centres,landslide risks during construction of road establishment of ward level, GRM, ensuring priority for local employment (including female) and stakeholder engagement during road upgrading works.

Analysis of Alternatives

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. First alternative considered the improvement of existing road to 2-Lane standards with curve improvement and additional 2 bridges and 4-lanes in Urban Areas. Second alternativewas to improve existing road to 2-Lane standards with curve improvement and Tunnel Bypass and 4-lanes in Selected Urban Areas. Third alternative included improvement of existing road to 2-Lane standards with curve improvement and construction of additional 2-lane new alignment from Sisnekhola-Dharke and 4-lanes in Selected Urban Areas. First three alternatives have less impact on the environment andcosts of construction;however, they will not address the problems of road congestions adequately.

Fourth alternative included minor improvement in 2-Lane standards and construction of new lane of 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. Fifth alternative proposed the improvement of existing road from Nagdhunga to Dharke into 2-Lane standards with curve 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. Fourth and Fifth alternatives were recognized to pose more physical, biological and socio-economic impacts. Sixth alternative included improvement of NNM Road to 2-lane Asian Highway Standard including two bypass sections. Among these alternatives, sixth alternative was chosen for the ESIAas it minimizes impact on environment.In this updated ESIA, sixth alternative has been studiedwithout the two new bypass sections as GoN has decided to drop the bypass from the improvement works along NNM road.

Environmental and Social Risks and Impacts

Beneficial impacts of the NNM 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, etc. Beneficial impacts are related to 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 to 2042.

All impacts were categorizedas per WB ESF and rankedagainst risk assessment criteria as high, substantial, moderate or low. Following sections summarize the environmental and social risks and impacts likely due to the project road by each relevant environmental and social standard.

Assessment and Management of Environmental and Social Risks and Impacts (ESS -1: 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 accidentsand 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 an area thathas 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 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 exacerbatedby climate change and uncoordinated development of local communities, that, finally, may cause significant economic losses.The improvement of NNM roadwill affect 10 HHs considered as vulnerable and disadvantaged, including IPs (4), women-headed HHs (4) and Dalits (2).

Labour and Working Conditions (ESS-2):

This project will employdirect, contracted and primary supply workers who might be exposed to risks such asinadequate accommodation;non-payment of wages; non-payment of benefits, discrimination at employment,child labour, forced labour,human trafficking, Occupational Health and Safety (OHS) issues including workplace accident and work related diseases,communicable diseases includingSexually Transmitted Infections (STIs),

grievances related to workersand GBV. The contracted workers are more susceptible to such risks.

Resource Efficiency and Pollution Prevention Management (ESS-3)

ESS-3 covers 6 generic risks and impacts such as landscape aesthetic, air and noise pollution, potential hazards and solid waste management, and pollution of water sources. The project's impacts and risk 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, stack 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 (ESS-4)

Transporting construction materials will cause nuisance to community. The project activities such as hill cutting, road excavation, use of vibratory equipment might result in landslides/mass wasting, and dust pollution. The stockpiling of construction materials, debris generated during construction will disturb the landscape and cultivated lands and contaminate the water bodies.Impact upon existing traffic is likely with the construction activities and plying of construction vehicle, storage of construction materials close to the existing 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. The project area lacks well-defined and coordinated response mechanism and GBV risks associated with labour influx indicating 'substantial' level of GBV risk[4]. Furthermore, the lack of institutional and infrastructural capacity of the GBV service provider will result in inefficient response to GBV survivors. Further, risks associated with labour influx and increased mobility of outsiders may aggravate spreading of communicable diseases including HIV/AIDS and STIs.

Land Acquisition, Restrictions of Land Use and Involuntary Resettlement (ESS-5):

The total numbers of project affected HHs are 78, out of this, 68 HHs are affected by losing private structures and remaining 10 HHs are affected by losing their private lands(0.20 ha.). The 68-project affected HHs will lose 76 private structures and 10 HHs will lose 11 land parcels. Out of total project affected HHs (78), 57 HHs will lose residence along withtrades. Similarly, 48 HHs will lose trade only and 10 HHs belong to project affected vulnerable HHs (4 comprise to Chepangs (IPs), 4 women headed (3 Brahmins and 1 Chhetri) and 2 Dalits). The project will affect 9 public structures (3 temples, 2 pubic taps, 2 public toilets, 1 study center and 1 waiting shed). Further, 1,161 electric poles anddrinking water supply pipes[5]will need to be relocated. Construction related impacts during project implementation will be managed as per the same resettlement framework mentioned in the Resettlement Action Plan (RAP).

[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

Biodiversity Conservation and Sustainable Management of Living Natural Resources (ESS-6):The habitat in the ROW and in surrounding areas of the NNM road is already fragmented and anthropogenic pressure on the area is very much prevalent. A critical habitat screening conducted as part of the ESIA indicated that there are no critical habitatswithin the ROW and within the Direct Impact Area (DIA) of the project. Although vegetation clearing along RoW and bridge upgrading will impact on aquatic habitats, however the impact is expected to be moderate only. Removal of52 trees and 2,253 poles[6]withinRoW will be required.About 3,164.67 tons of carbon stock will be lost due to clearance of trees and poles.There are no protected areas, wildlife corridors and other environmentally-sensitive habitats needing protectionwithin the ROW and in DIA.However, the project will apply measures such as speed limit for the areas with forest patches, especially at night time. The impact on wildlife and other living resources may occurduring construction period by use of forest resources, disturbance and poaching of wild animalsby the project workers in the forests of ZoI.

Indigenous People (ESS-7):
The upgrading of NNM road affects 4 IPHHs. They will lose housing structures but their houses are only for business purposes within RoW but not in communal lands. No private lands of these vulnerable HHs are affected. There is no impact of the project on land and natural resources on traditional ownership or lands under customary use or occupation, cultural heritage of IPs, that is material to the identity, ceremonial, or spiritual aspects of their lives. As impacts on IPs are deemed not significant, Free and Prior Informed Consent (FPIC) is deemed to be unnecessary for this project.

Cultural Heritage (ESS-8):There are no any impact and risk on tangible and intangible heritage by project intervention. The alignment of NNM road does not have any ancient monuments and tangible religious, cultural, historical and archaeological sites. Similarly, the cultural heritages, such as religious and cultural practices, languages, religions, values and norms of IPs community will not be affected. However, 3 small temples/shrines will be affected, which can be relocated to nearby public land having consultation with local community. In case of chance finding, the existing procedure for management of impacts will be applied.

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

Stakeholder engagement and Information Disclosure (ESS 10): During the stakeholder consultation, the key issues raised were: compensation of impacted land, affected private and public structures; construction of public structures as foot over 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).

Environmental and Social Management Measures

The major managementmeasures in line with ESSs have been given below.

[6] Poles: (Trees with diameter at breast height (DBH) more 10cm and less than 30cm) Trees: DBH more than 30 cm

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

An Environmental and Social Management Plan(ESMP)applying the mitigation hierarchyhas been prepared to manageProject's environmental and social risks and impacts. It includes mitigation measures, monitoring plan, capacity building, responsibilities and reporting system and environmental and social costs. In addition, the ESMP provides measures to address GBV issue at project level. The key issues regarding the 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). Established GRM will help to lodge grievances and its resolution. Worker Camp Operation Plan and Worker's Code of Conduct will be prepared to discourage or minimize GBV.

A separate RAP has been prepared to address physical and economic displacement as a result of minimal land take. All losses (private and public assets) will be compensated with replacement costs as per RAP. 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-(C-ESMP), which shall be prepared prior to the commencement of construction activities. The C-ESMP shall include OHS plan, Water and Waste Management Plan, Influx management Plan, Workers camp management plan, Traffic management and road safety management Plan, Quarry/borrow area management plan, and Site restoration Plan among others in accordance with the GoN and IFC&WB workers accommodation guidelines.

The SEP will provide materials for community awareness and sensitization with emphasis to women and young girls, promoting health seeking behaviour. The Vulnerable Community Development Plan (VCDP) has been prepared to highlight issues, associated with affected vulnerable and IP HHs. The Compensation Plan for the acquired land will cover compensation for both land and crops.

Mitigation measures for generic risks and impacts include erosion control plan with bioengineering and reinforcement structures, restoration of affected landscape, develop 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; establish speed limitation signs in appropriate locations; awareness to the drivers, establish complaint mechanisms (GRM), provide workers transportation to and from the project sites., adopt safety measures for workers like shinning jackets (aprons), boots, gloves, helmet etc., Vigilance from law enforcement authority and compliance with the labour laws, establish Worker Camp Operations Guidelines, develop a Hazardous Materials Management Plan to manage hazardous material use, storage, transport, and disposal, develop a Water Quality Management Plan, Community awareness and sensitization with emphasis to women and young girls, chemical management plan prior to construction including handling and disposal of hazardous chemical and waste. There is

no any tangible/ intangible archaeologically important heritage will be impacted. In case of chance finding, the procedure will be followed.

Site-specific mitigation measures include avoidance of haphazard excavation of slopes, benching of slopes and excavation in piece-meal applied along the steep slope area, management of existing natural drainage, bioengineering and slope protection work, compensatory plantation of 25 saplings for each felled tree; selection of native trees, 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 installed noise barrier, 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 369,092,726 (USD3.25 million).

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

The ESCP requires compliance with the provisions defined in the ESIA, ESMF, SEP, LMP, RAP, Resettlement Policy Framework, (RPF), VCDP and Vulnerable Community Development Framework (VCDF) as identified and developed for the Project. The MinistryofPhysical Infrastructure andTransport (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 this ESCP will be monitored and reported to the Bank by DoR as specified in the ESCP. World 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 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.

Institutional Arrangement

DoRunderMoPIT is the key implementing agency for developmentandimplementationofstrategic roadprojects (Government/Donor funded). DoRhasfivedeputy directorates/branchesthatdevelopandimplementprojects.Tofacilitate fieldimplementation, DoRmaintains33 DivisionalRoadOffices(DROs). Development Cooperation Implementation Division is one of the key directorates undertaking all donor funded projects. Project Coordination Units (PCU) under DCID preparesInitial Environmental Examination (IEEs), ESIAs, RAPs/VCDPsandperformotherE&Sriskmanagement. A PCU will be created to manage this project.

Geo-EnvironmentandSocialUnit(GESU) is thefocalpointfortheE&Sriskmanagementand monitoring unit at DoR.GESUundertakescompliancemonitoring and review of IEE, ESIA and RAP and VCDP for government/donor-fundedprojects. MoPITis the governing

agency mandatedby theEPA to reviewandapproveIEEsfor projectsin thetransportsector.Italso reviewsandendorsesESIA reportsforreviewand approvalby theMinistryof Forest and Environment (MoFE). EIAUnit under MoFE undertakesreviewand approvesEIAs.

The other institutions such as DepartmentofForestryandSoilConservation(DoFSC), DepartmentofNationalParksandWildlifeConservation(DNPWC), Department of Labour and OccupationalSafety(DoLOS) and, project affected M/RM also have supportive roles for the project implementation.

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

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

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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
C-ESMP	Contractor's Environmental and Social Management Plan
CF	Community Forests
CITES	Convention on International Trade of Endangered Species
COI	Corridor of Impact
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	DepartmentofNationalParksandWildlifeConservation
DO	Dissolved Oxygen
DoLOS	Department of Labour and OccupationalSafety
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-EnvironmentandSocialUnit
GF	Governmental Forest
GHG	Green House Gas
GoN	Government of Nepal
GPN	Good Practice Note
GRM	Grievance Redress Mechanism
ha	Hectare
HHs	Households

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	Ministryof 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	Naghdhunga-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
SPA	Severely Project Affected Families
SRCTIP	Strategic Road Connectivity and Trade Improvement Project
SRN	Strategic Road Network
STI	Sexually Transmitted Infections
TH	Tribhuvan Highway
VCDF	Vulnerable Community Development Framework
VCDP	Vulnerable Community Development Plan
WB	World Bank

1 CHAPTER 1: PROJECT DESCRIPTION

1.1 The Project Background

The existing Naghdhunga – Naubise – Mugling (NNM) road section is a part of Tribhuvan and Prithvi Highway (North – South Highway). It starts at Nagdhungacheck-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 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 and upgrading to 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 fromGalchhi and connects to the district headquarter of Dhading District at PhurkeKhola, Malekhu. Similarly, at Mugling the highway has junction of

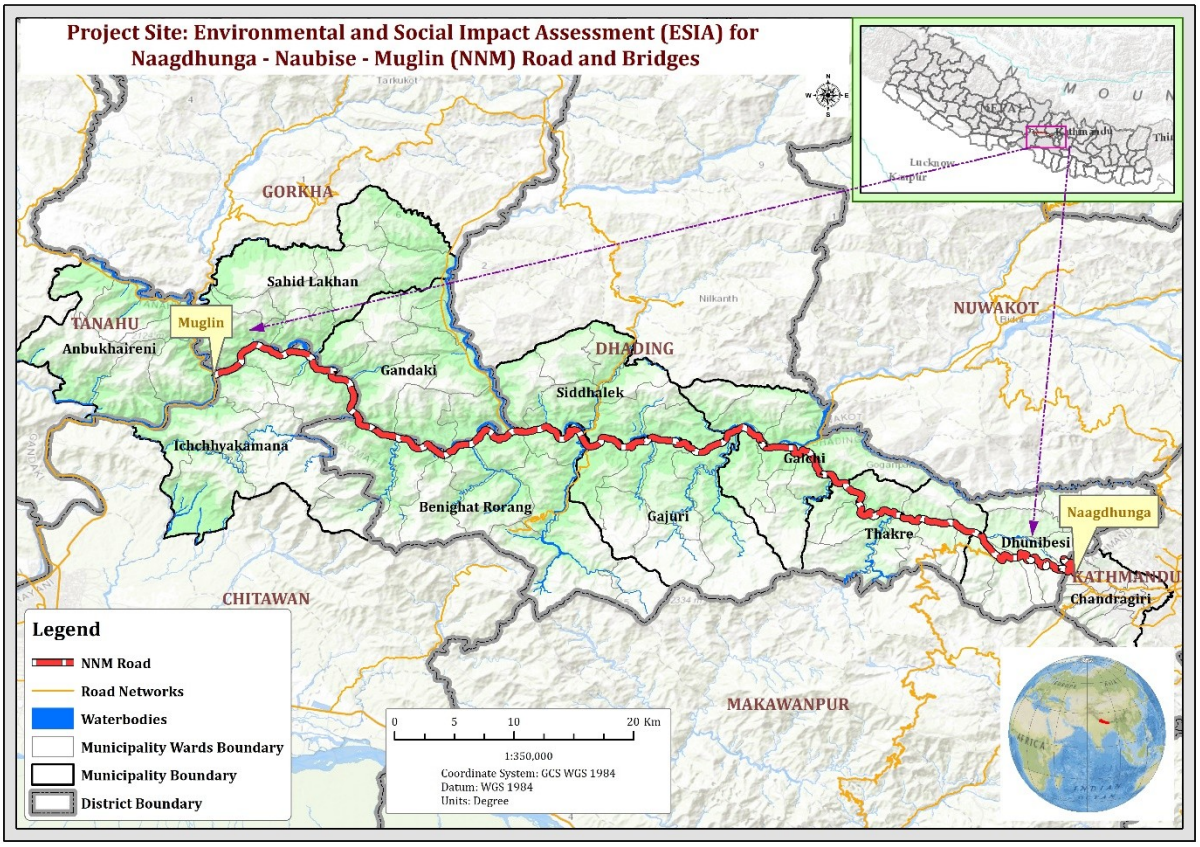

Figure 1-1: Map of NNM road Alignment

Mugling-Narayanghat Road Section connecting this highway to Mahendra Highway.

The Kamala-Dhalkebar-Pathlaiya (KDP) road of the Mahendra Highway (East West Highway)will also be supported by the project and is covered by an upstream Environmental and Social Assessment (ESA) based on pre-feasibility to inform the preparation of detailed ESIA at the detailed design phase of the said road.

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 any traffic lights. No passing lanes are being provided. Speed limits have not been applied on most of the section, except some warning signs 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. Still the passing lanes along the proposed section are lacking and not sufficient, though some are being implemented in the Naubise-Nagdhunga Section.

Figure 1-2: Current Road condition of NNM raod section

The 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.

Nagdhunga — Naubise Road

Nagdhunga- Naubise sectionis part of TH, a national highway as per DoR classification with road reference no. H 02. This road was initially constructed in 1956 AD, and rehabilitated in 1997 AD.

Naubise — Mugling Road

Naubise — Muglingsectionis a part of PH, a national highway no. H04 as classified by DoR. The road was constructed in 1973 AD and rehabilitated/upgraded in 1995 AD.

1.2 Salient Features

The existing 2-lane NNMroad 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 1-1: 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 is provided in the **Error! Reference source not found.**2.

Table 1-2: 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

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 AD

and then rehabilitated in 1997 AD. 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

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 AD and rehabilitated/upgraded in 1995 AD. 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 MawaKhola** : H 0403
  - **MawaKhola 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 20existing bridges, 18 will be rehabilitated while2 will be newly constructed. The list the of the existing bridges along the NNM highway is presented in the **Annex 1**.

1.3 Project design

Improvement of existing highway will enhance movement of traffic from Kathmandu, not only to Mugling, but also to Birgunj, connecting 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 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.

1.4 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, however; will be environment friendly. Machines and excavators will be used throughout the length for the formation of road width and site clearance. 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 helmet, visibility vest, gumboot, mask, 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 contractor for each package will prepare traffic management plan and will seek approval from construction supervision consultant prior to the implementation.

1.5 Four-Laning in the built-up areas

Table 1-3: 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	1570
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	1320
14	Lewatar To RamailoDanda	75+840	77+380	1540
15	Mugling	82+050	82+403	350
	Total Length			**9840**

1.6 Plan for Footbridge

Safety aspect along the project corridor has 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.

Locations

Siting of the foot bridges identified are primarily located in the market and town area where schools, colleges, hospitals and other public facilities are being used by the pedestrians. There are 19 pedestrian bridges proposed for construction.

Table 1-4: 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
		37+850		
7	Malekhu	43+400	3	30
		44+350		
		44+700		

S. N.	Locations	Chainage	Pedestrian Bridge (Foot-over Bridge)	
			No of Pedestrian Bridges	Span (m)
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	RamailoDanda	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

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 Pedestrian footbridges (FB) have been designed. These FBs have two equal spans with a central pier to be constructed in median.

Typical elevation displayingthe arrangement of FB with respect to road cross-section has been shown in **Figure 1-3**.

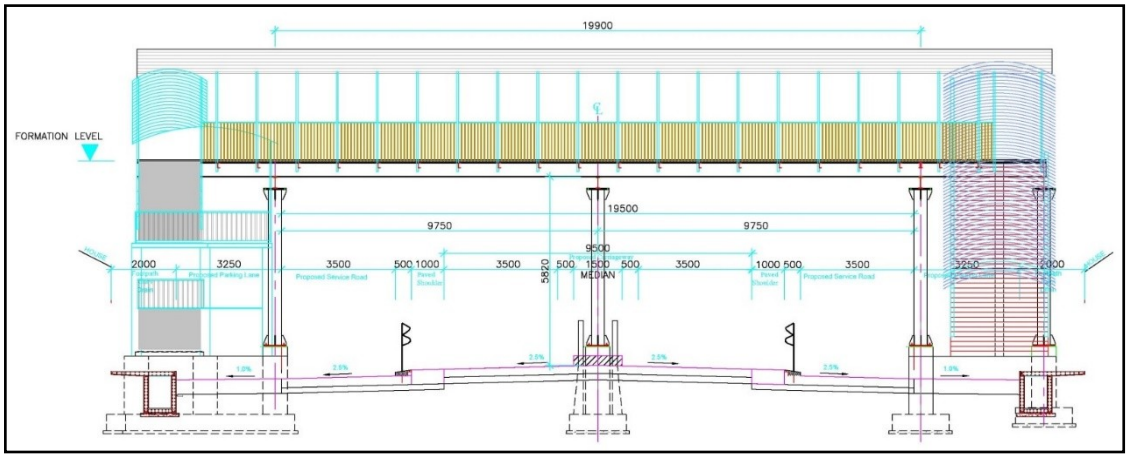

Figure 1-3: Typical elevation of FB (road width 30m)

Pedestrian Facilities

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 the pedestrian from heats and rains. The safety barriers are provided to keep the things and users from falling on the roads. Anti-skidding textured deck tiles have been recommended for safety and slipping of the users.

1.7 Procedure of Operation

The road is coming under the Strategic Road network of PH; whereas 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.

1.8 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 1-4: Project implementation Schedule of NNM Road Project

1.9 Labour and working conditions

Consultation with the local municipality and other project parties at the project vicinity has spelled out there have not been the practices of standard operating system (hiring, payment and management) for labours, employed through mutual agreement. In the project vicinity there are industries and commercial activities where labours are engaged but, the status of comply with the labour act provision is seemed 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. But RM/Ms have committed to introduce the labour management into their core function. The current project is estimated to have employment of 741,635 man-days of skilled while 3,711,633 man-days of unskilledworkers[7] 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.

1.10 Construction Materials

1.10.1 Sources of Rock Aggregates and Natural Sand

Most of the burrowed soil suitable for embankment and subgrade will be used within the project area. Average lead 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

[7] Number of workers extracted from Detailed Design Report, 2019

embankment and 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.

Figure1-5: 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 1-5 shows location of the construction material site together with available quantity and distance from the road.

Table 1-5: Construction material availability and estimated volume

Sn.	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	JabangKhola	288,000	2/66+100	Quarry
4	27°48'8.71"N, 84°50'5.31"E	MalekhuKhola, 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					
8	27°55'2.53"N, 84°32'15.36"E	Marsyangdi River, AnbuKhaireni	84,000	11/82+400	River bed
9	27°48'17.72"N, 84°44'49.52"E	Trishuli River, Charaundi	90,000	0.3/55+500	River Bed
10	27°48'18.13"N, 84°50'50.90"E	Trishuli River, Malekhu	74,000	1/42+300	River Bed

Source: Field survey, 2017

Significant numbers 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) is being carried out on the southern side along the highway particularly in 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 TrishuliRiver. 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 1-6: Ongoing Practices of River material extraction

1.10.2 Source of Construction Water

Water from 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. The construction materials not available locally will be sourced from India or China.

1.11 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.

1.12 Road Traffic Analysis

1.12.1 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 1-6**6.

Table 1-6: 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	2384	1857	935	1807
Car	1299	1136	816	907
B	1086	1340	1220	1214
MB	434	414	242	179
MiB	1071	858	670	710
4WD	552	609	332	487
Utility	468	461	260	300
MAT	620	800	626	627
HT	2996	2867	1841	1436
LT	319	467	375	277
Total	11231	10809	7317	7944

Source: Consultants' surveys and estimates, 2018

1.12.2 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 (**Error! Reference source not found.**8)[8].

Economic parameters, including GDP and per capita income (Annex 1, Economic anylisis) 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
9.

1.12.3 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

[8]Government 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.

improvement of road conditions. Based on the extent of VOC and travel time savings, generated traffic is not considered in the analysis.

Table 1-7: 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 1-8: 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 1-9: 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

1.13 Delineation of the Project Area

1.1.1 Zone of Influence (ZOI)

The project area delineation of proposed road alignment will be the area that will receive both beneficial as well as adverse impacts due to its construction and implementation. The project affected municipalities and rural municipalities are considered to beZoI 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:

1.13.1 Direct Impact Area (DIA)

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)[9], 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 1-7: Direct impact area along the NNM

The DIA might be further 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 **Error! Reference source not found.** presents affected locations and wards existed within the DIA along the highway alignment.

Table 1-10: 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

[9]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)

District	/ Former VDCs	Earlier Wards		New Municipality/RMs	New Wards
		Along the alignment	Indirect influence wards		
	Gajuri VDC	1,2		Gajuri RM	1,2
	Benighat VDC	1,9,8,7	2	BenighatRorang RM	3,5
	Dhusa VDC	1,3		BenighatRorang RM	7,8
	Jogimara VDC	8,9,1,2		BenighatRorang RM	9,10
Chitwan	DarechokVDC	9,1,2,7,3,4	5	Ichakamana RM	3,5

Source: Field Survey, 2017

1.13.2 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 impacts during the time of construction. The Indirect Impact Area 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).

Figure 1-8: Direct impact area along existing road.

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.

2 CHAPTER2: LEGAL AND INSTITUTIONAL FRAMEWORK

A brief description of the policy, legislative and institutional framework provides details on relevant international and national policies as well as clarifying the legal requirements related to the project. Relevantlegal and institutional frameworks are of paramount importance to the realization of the right to environmental and social security. This section of the present ESIA provides an overview of the applicable environmental and social policy, legislative and institutional frameworks, national and international legal instruments which the project will require to comply. The policy, legal and institutional framework under which the project will be undertaken is outlined below.

2.1 Environmental and Social Legislation of Nepal

2.1.1 The Constitution of Nepal

The Environmental and Social sustainability has been covered explicitly in the Constitution of Nepal, 2015. Constitution of Nepal (2015) states the right of everybody 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 NNMroadwhich is highlighted in following table.

Table 2-1: Environmental and social rights of citizens declared in the Constitution of Nepal

Article	Rights guaranteed
18	Right relating equalitynot 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
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 (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.

2.1.2 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 2-2: 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.
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 ofterrestrial ecosystems, sustainably manage forests, combatdesertification, and halt and reverse land degradation andhalt 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
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	Policy outlines the needs to conduct an economic and social impact assessment of the development projects.

S.N.	Plans, Policies, Strategies Rules/Regulations	Key provisions	Relevance to NNM ESIA
		compensation amount should be calculated on the market rate.	
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.
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 42of 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)
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,	Provisions to construct and maintain dams, embankment, terrace improvements, diversion channels and	Section 13 of the act empowers the authority to prohibit the commission of any acts that may cause soil-erosion or soil

S.N.	Plans, Policies, Strategies Rules/Regulations	Key provisions	Relevance to NNM ESIA
	2039 (1982)	retaining walls, protect vegetation in landslide-prone areas and undertake a deforestation programs, and Regulate agricultural practices pertinent to soil and watershed conservations	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	*The act ensues that n*o 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
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 *and the* Act 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.
28.	Child Labour	The Child Labour (Prohibition and	Under the Section 3 of the Act, child

S.N.	Plans, Policies, Strategies Rules/Regulations	Key provisions	Relevance to NNM ESIA
	(Prohibition and Regulation) Act, 2056 (2000)	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.	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.
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

2.1.3 National Directive, Guidelines, Manuals and Standard

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 Strategy???(NPS) 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. In general, the national legislative framework, WB environmental and social safeguard policies including the EHS guidelines and new ESS guided implementation of the current ESIA project and were applied at the stage of assessment and development of appropriate mitigation measures as well as in the prepared documents guiding implementation of construction and operation stages.

2.2 International Policy Framework

2.2.1 Relevant International Conventions

Nepal is a signatory party for many international conventions and other treaties. In the current review we analyse only those of them, which are relevant to sustainable development 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.Details of International Conventions and Protocols and their implementation in road development projects is provided in **Annex 2, Table A.1**.

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 againstWomen, 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 WoB, is to eliminate extreme poverty and promote shared prosperity. The WBESF sets out the WB's commitment to sustainable development and mandatory requirement for the bank finance projects. The Bank's ESF is 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 WB are required to meet the 10 ESSs.

Following are ESF/ESSs WB's instrument and applicability in road development and improvement projects in Nepal. Effective management of environmental and social impacts related to the project, as detailed in the Table below.

Table 2-3providesthe comparison of ESSs with national legislative framework and requirements. ESS create mechanisms for integration of environmental and social issues into decision making. They provide a set of specialized tools to support development. No financial intermediary is involved, so the ESS-9 is not applicable. The comparative analysis of national regulatory frameworks with ESS (1-8) and 10, the requirements in regulatory frameworks were found to be 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 2-3: 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 AssessmentGuidelines (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. • Does not emphasize hierarchy of measures in ES risk management planning
2. Labour and Working Conditions	Labour Act (2017)	• Current OHS provisionsare 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 DoLOS[10] 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)	
	Water Resources Rules (1993)	
	Drinking Water Regulation (1998) Drinking Water Quality Standards	
	Water Quality Guidelines for the Protection of	
	Aquatic Ecosystem	
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 ESIAs 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	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

[10]Department of Labour and Occupational Safety

World Bank ESS	Relevant Nepal Laws, Regulations and Policy Issuances	Gaps vis-à-vis WB ESS
Land Uses and Involuntary Resettlement	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.
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	• Does not require ―Free and Prior Informed
	Indigenous Nationalities Act (2002) Local Government Operation Act (2017) ILO Convention 169 (2007)	Consent‖ for projects in IP territories
	Forest Act (1993) and Forest Regulation (1995)	• 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 for the development of Cultural Heritage Plan
	Ancient Monument Act (1956)	
		• Does not provide for the application of globally recognized practices in the study, documentation and protection of cultural heritage
		• Does not provide 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.	

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2.2.1.1 WBG General EHS Guidelines, 2007

The WBGGeneral 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.

2.2.1.2 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.

2.2.1.3 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.

3 CHAPTER 3: METHODOLOGY

The environmental and social assessment was proportionate to the potentialrisks and impacts of the project, and should assess, inan integrated way, all relevant direct,indirect andcumulative environmental and social risks andimpacts throughout the project life cycle, includingthose specifically identified in WB ESSs2–10 and with respect to prevailing institutional and legislative setup of the GoN. The approach and methodology adopted for the assignment have been described here under.

3.1 Approach

The environmental and social assessment has beenbased on a detailed ESIA conducted in 2016-2018 following the World Bank safeguard policies and additional information collected recently, including an accuratedescription and delineation of the project and associated aspects, and environmental and socialbaseline data at an appropriate level of detail sufficienttoinformcharacterizationand identificationofrisks and impacts and mitigation measures.Theassessmentevaluatedthe project'spotentialenvironmentaland social risks and impacts; examinedprojectalternatives;identifiedwaysofimprovingprojectselection,siting,planning, designand implementationin and the mitigation hierarchywas applied foradverseenvironmentaland social impacts and seekopportunitiestoenhancethepositiveimpactsofthe project. Theenvironmentalandsocialassessmentalsoincludedstakeholderengagementas an integralpartof the assessment, in accordancewith ESS10.The ESIA was retrofitted with outcomes from different components namely, Stakeholder Engagement Plan (SEP), Gender Based Violence (GBV) report, Labour Management Procedures (LMP), Resettlement Action Plan (RAP), Vulnerable Community Development Plan (VCDP), Environmental and Social Commitment Plan (ESCP) and Borrower's Capacity Assessment made by WB. The approachused for ESIA is illustrated in **Figure 3-1**.

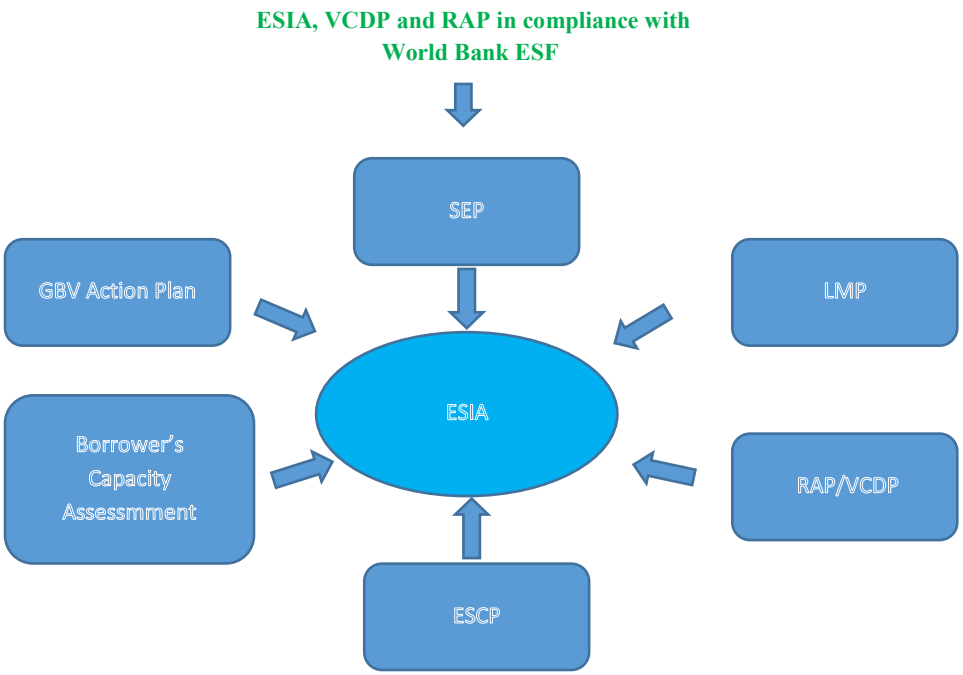
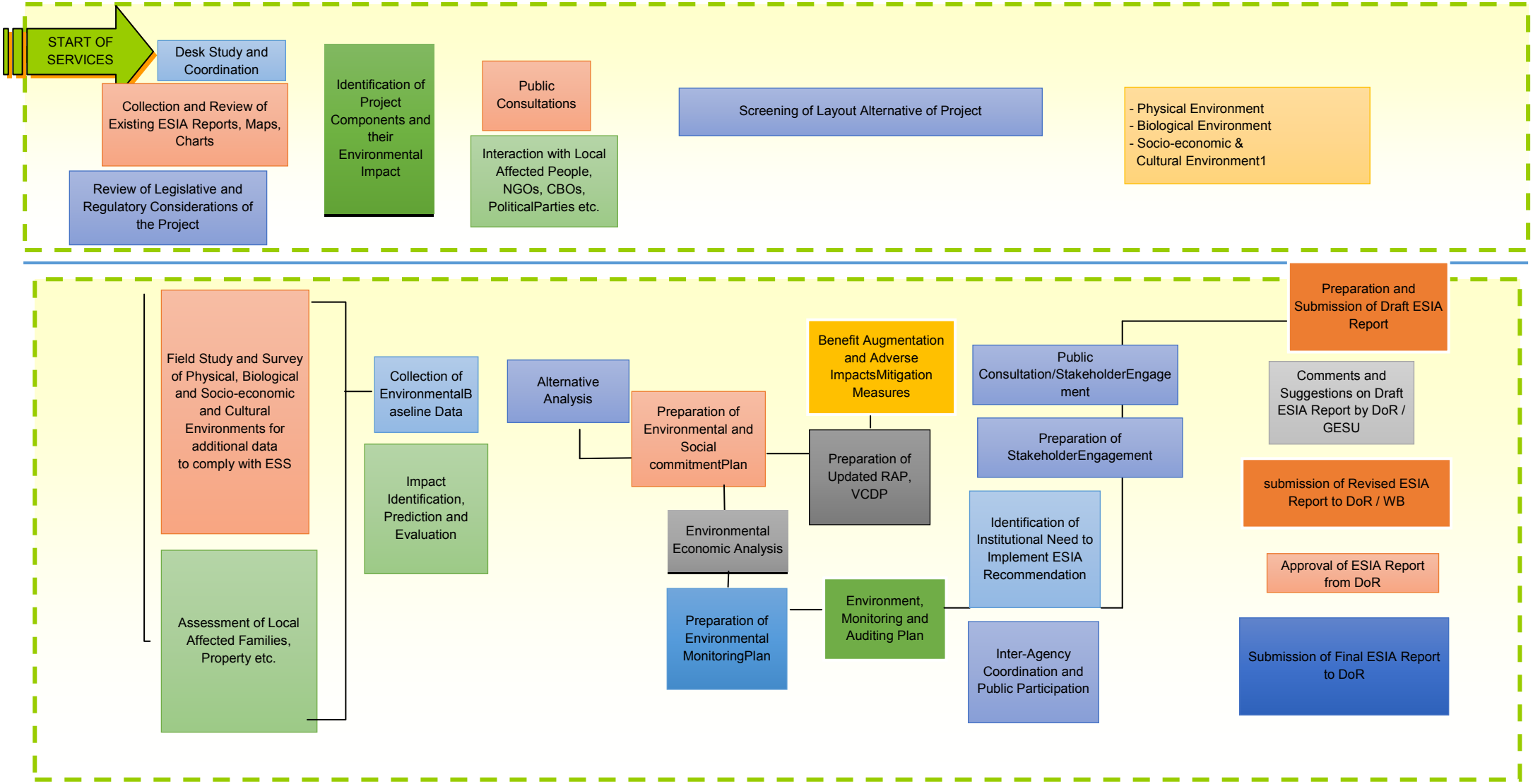


Figure 3-1: Approach for ESIA

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 Client

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 WBESF, policies, national and international policies and national laws and so forth. The existing RAP and VCDP 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 if the shift from safeguards to 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 making field survey and study, 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 Monitoring Plan (EMP), Benefit Augmentation and Adverse Impacts Mitigation Measures, Updating of existing RAP and VCDP, 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 which was followed by the development of 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 Entry and Processing

Data entry process consists of office editing, coding, data entry and machine editing. Although all the completed checklists were thoroughly examined and edited in the field, they were further rechecked and verified. Data entry program was developed keeping in view the skip pattern and other check mechanism so as to rectify inconsistencies.

3.10 Data Analysis and Interpretation

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.

3.11 Preparation and Submission of Retrofitted Draft ESIA Report along with other specified Plans

Following the data analysis and interpretation, 1st draft ESIA report was prepared and submitted to the client in a prescribed standard format as appropriate provided thereafter soliciting critical comments, feedback and suggestions by DoR/GESU over the draft ESIA report including other specified plans.

3.12 Incorporation of comments and preparation of revised ESIA report and Submission

The comments and suggestions received from DoR/GESU were duly incorporated and revised accordingly and supplemented into the report and submitted to DoR/WB.

3.13 Approval of ESIA Report from DoR

Following the submission of revised ESIA report, was endorsed/approved from DoR.

3.14 Submission of Final ESIA Report to DoR

After approval of the revised ESIA report and other specified plans, the consulting organization submitted the final ESIA report to DoR.

4 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 4-1**). 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 uptoMugling (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 SisneKhola and Dharke has the south to southwest aspect, crossing rivers like Sirkekhola, Khanikhola, NaubiseKhola, SugureKhola, SopyangKhola, JugeKhola, Agra Khola, PhediKhola, KhesteKhola, MachhediKhola, BelkhuKhola, GalaudiKhola, MalekhuK, Gomati Khola, CharaudiKhola, KhataudiKhola, HugdiKhola, MauwaKhola, Chum Khola, DahakiKhola, BarbanKhola and NagdiKhola. 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 4-1: Elevation with chainage of locations

Sn.	Location	Chainage	Elevation (m)
1	Nagdhunga	0+000	1500
2	SisneKhola	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

4.1.2.1 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 to2016, 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 4**), 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 Fig. 4.1 below.

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.

4.1.2.2 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 4-2**.

Table 4-2: Rivers/rivulets along NNM roadside

1. Mahesh Khola	10. KhesreKhola	19. Gomati Khola
2. ThareKhola	11. Trishuli Ganga Nadi	20. BisuralKhola
3. JhapreKhola	12. ChiraudiKhola	21. CharaudiKhola
4. SikreKhola	13. BelkhuKhola	22. KhatautiKhola
5. KhaniKhola	14. Trishuli River	23. HughdiKhola
6. NaubiseKhola	15. PokhareKhola	24. MauwaKhola
7. Agra Khola	16. GalaudiKhola	25. Chum Khola
8. PhediKhola	17. MalekhuKhola	26. DahakiKhola
9. MachhediKhola	18. Kadam Khola	27. BarbanKhola

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).

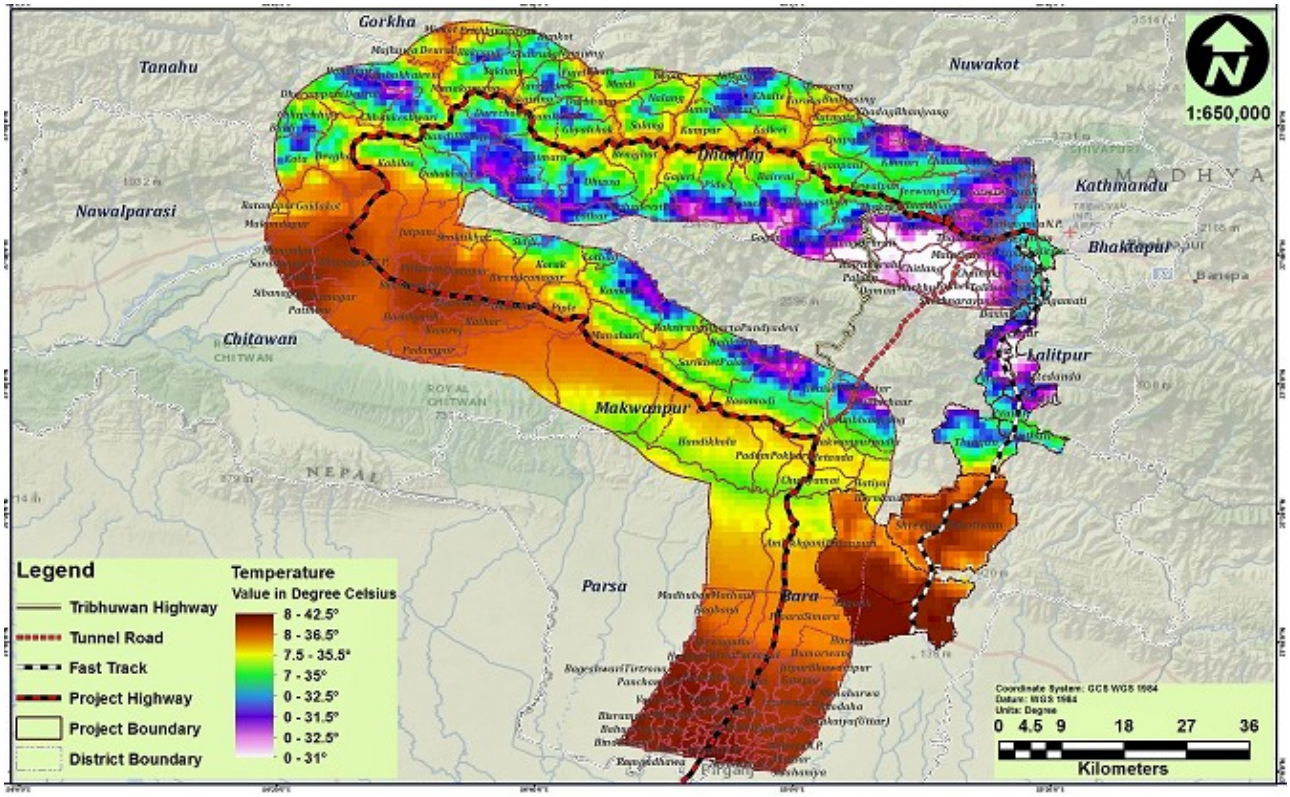


Figure 4-1: Temperature variation map in the road corridor from Birgunj to Kathmandu:

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 **(Annex4),** whereas the annual instantaneous maximum flow has decreasing pattern **(Annex4)**. 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 0.0289 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 is estimated to be 1.2134 m³ per year and that of Kali Khola it is to be 14.912 m³ per year.

According to the rainfall trend analysis, the annual average rainfall of the study area is decreasing at the rate of 10.408 mm per year **(Annex 4)**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 Error! Reference source not found. 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 4-3**).

Table 4-3: 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) [11]. 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.

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 ^{0} C and minimum average temperature less than 10 ^{0} 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

[11] 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.

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 ^{o}Cper year (Annex 4). The highest temperature was recorded in 2010 (20.25 ^{o}C), whereas the lowest temperature was recorded in 1997 which was 17.97 ^{o}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). 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 representsthe 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.

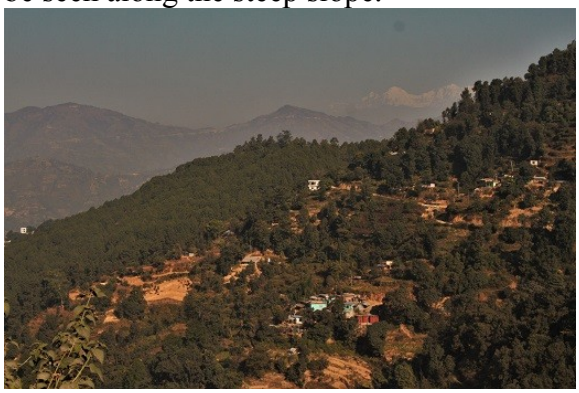


Figure 4-2: Relief along NNM road

Geologically, the project area (Nagdhunga-Naubise-Mugling 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.
The Lesser Himalaya lies in between the Sub-Himalaya (Siwalik Group) in the south and

Table 4-4: Geological Characteristicof 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 quartizete beds and basic sills and dykes present

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, klippes 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 (Nagdhunga-Naubise-Mugling Road) belongs to the rocks of the Lesser Himalaya and falls in Central Nepal.

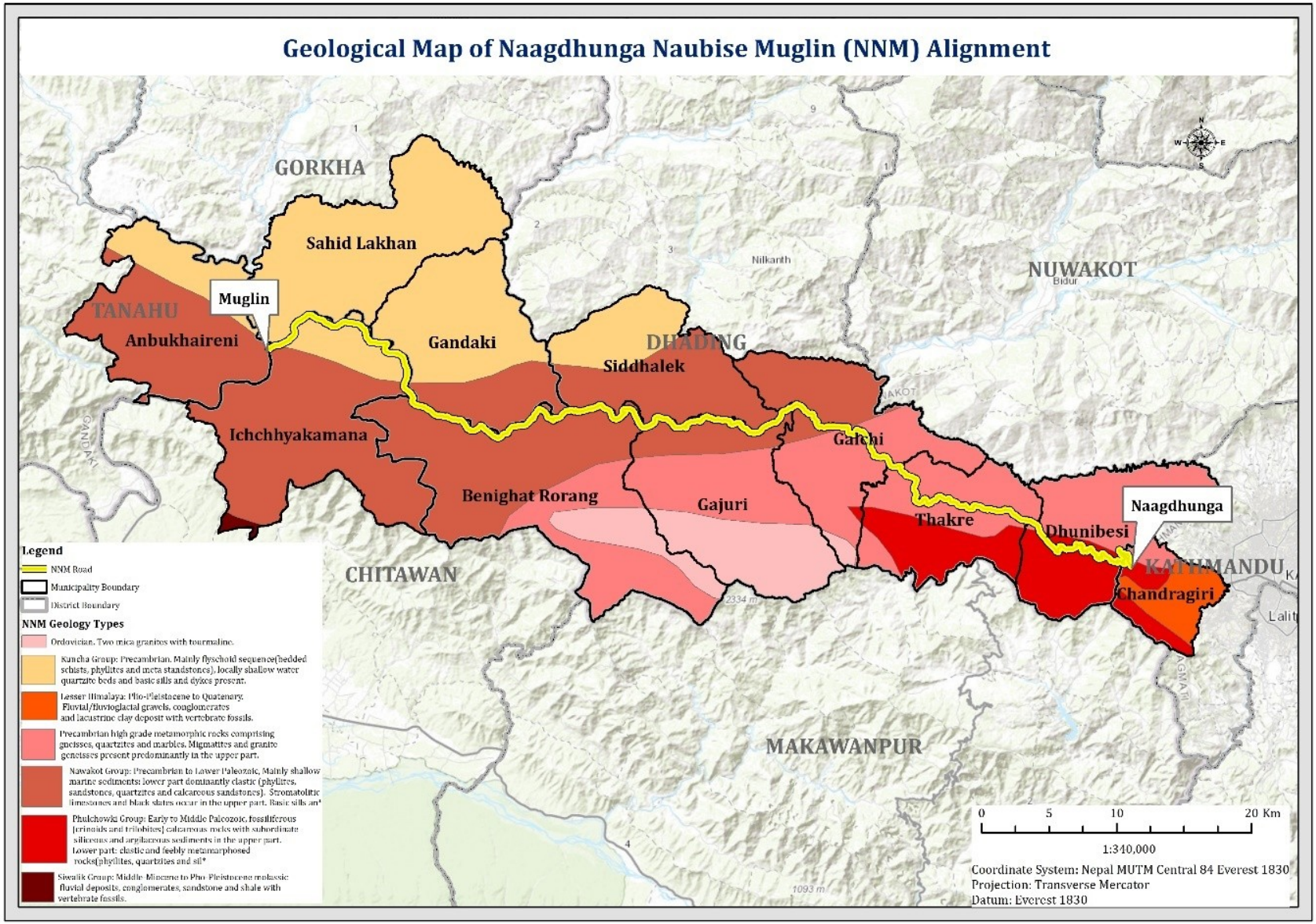


Figure 4-3: Geological Map of the Road corridor

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 A**nnex 4.**

Table 4-5: 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 - SisneKhola	00+000-03+750	3.75		1500-1320	15-30◦	Northeast	Phyllite and quartzite/ limestone	Gentle to steep sloped	Colluvial/residual soil deposits	Cultivated land/ forest/barren /river valley
2.	SisneKhola-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.	Tharke-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	20-35◦	North	Quartzite/ phyllite	Steep slope	Colluvial deposits	Forest/cultivated land

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

Table 4-6: Soil Types and their distribution

Chainage	Length	Phyllite/ quartzite	Limestone	Slate	Gneiss/ Schist	Colluvium/ Residual soil	Alluvium
2 00+000-03+750 3 Nagdhunga-SisneKhola	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 4-7: 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 4-8: Section wise Hazard Category

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

Source: Field survey, 2016

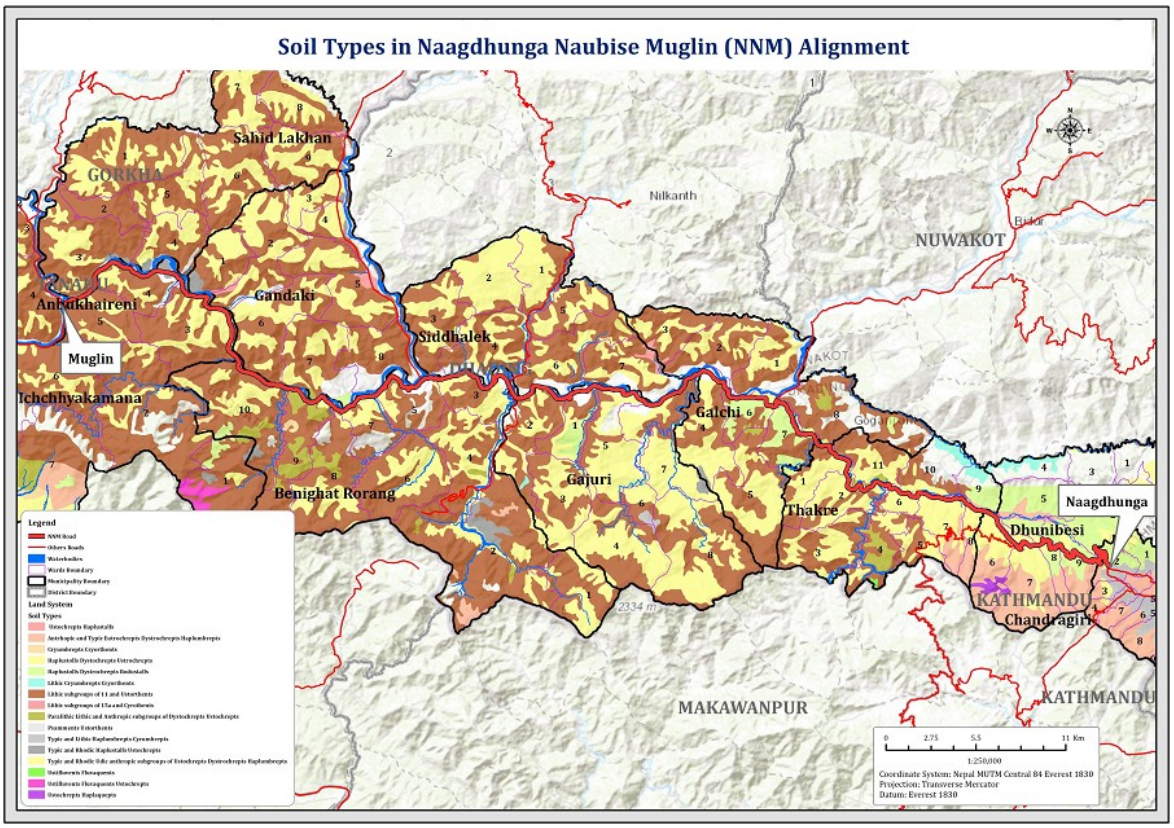


Figure 4-5: Soil types along NNM Road: Source: Data analysis, 2019

4.1.5 Seismicity

Earthquake records of Nepal since 1253 indicate that Nepal was hit by at least 19 earthquakes (the last major earthquake was that of 1988) with various digress 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 4-7**7).

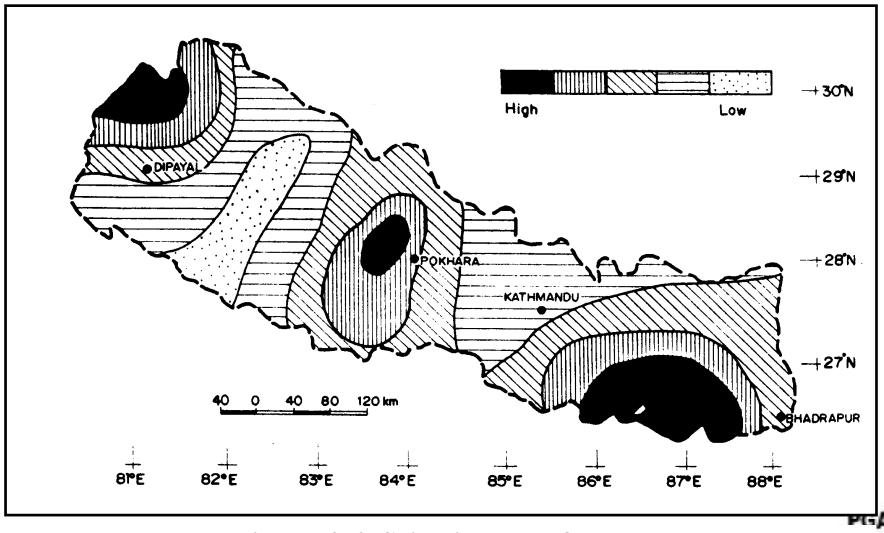


Figure 4-6: Seismic map of Nepal

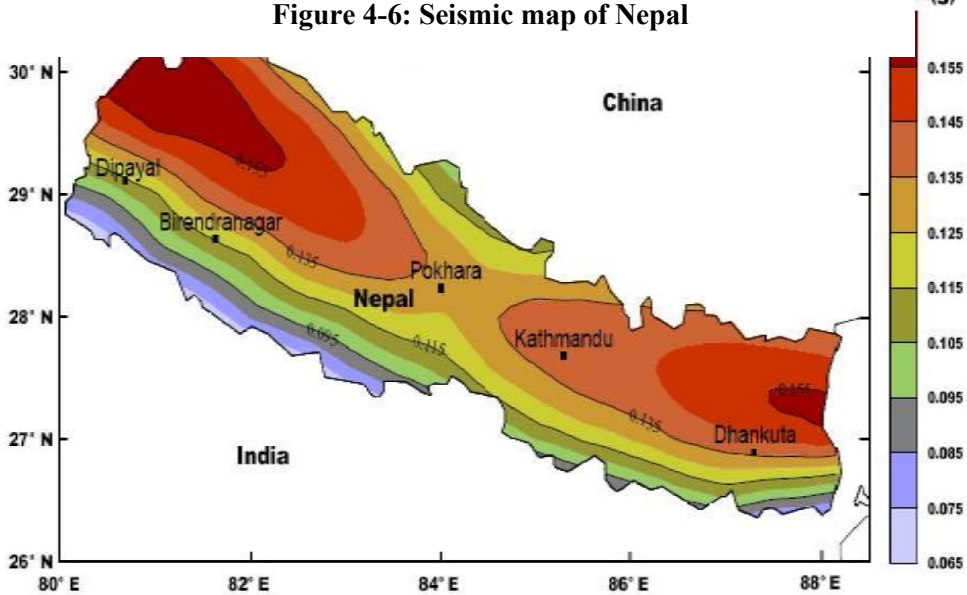


Figure 4-7: Peak Ground Acceleration Map of the Nepal Himalaya (Thapa and Wang, 2012)

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 **Error! Reference source not found.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 (subsidence and collapsed) the road alignment between Nagdhunga and Mugling.

Table 4-9: 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 A**nnex 4.**

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 Department of Roads, 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 HugdiKhola 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 HudgiKhola area the rocks are black slates and some limestone and/or dolomite. At least three different faults are dissecting the area and they are KhaniKhola fault at Phisling running along KhaniKhola F2, the Trishuli fault running almost along the Trishuli River from near MauwaKhola to Phisling and beyond Fl and a fault running almost east west direction from Ghyalchok crossing Trishuli River near MauwaKhola 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 HugdiKhola 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 throughBishaltar, Charaundi, Krishnabhir, Majhimtar, up to HugdiKhola 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 Krjshnabhir 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 ChiraundiKhola 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 NaubiseKhola 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 4-8: Landslide and instable slopes along NNM section.

From SisneKhola 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

Naghdhunga-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 fluvio-lacustrine sediments or alluvial fan deposits of the Kathmandu basin. The fan deposits are confined mainly to the foothills of the Chandragiri Range.

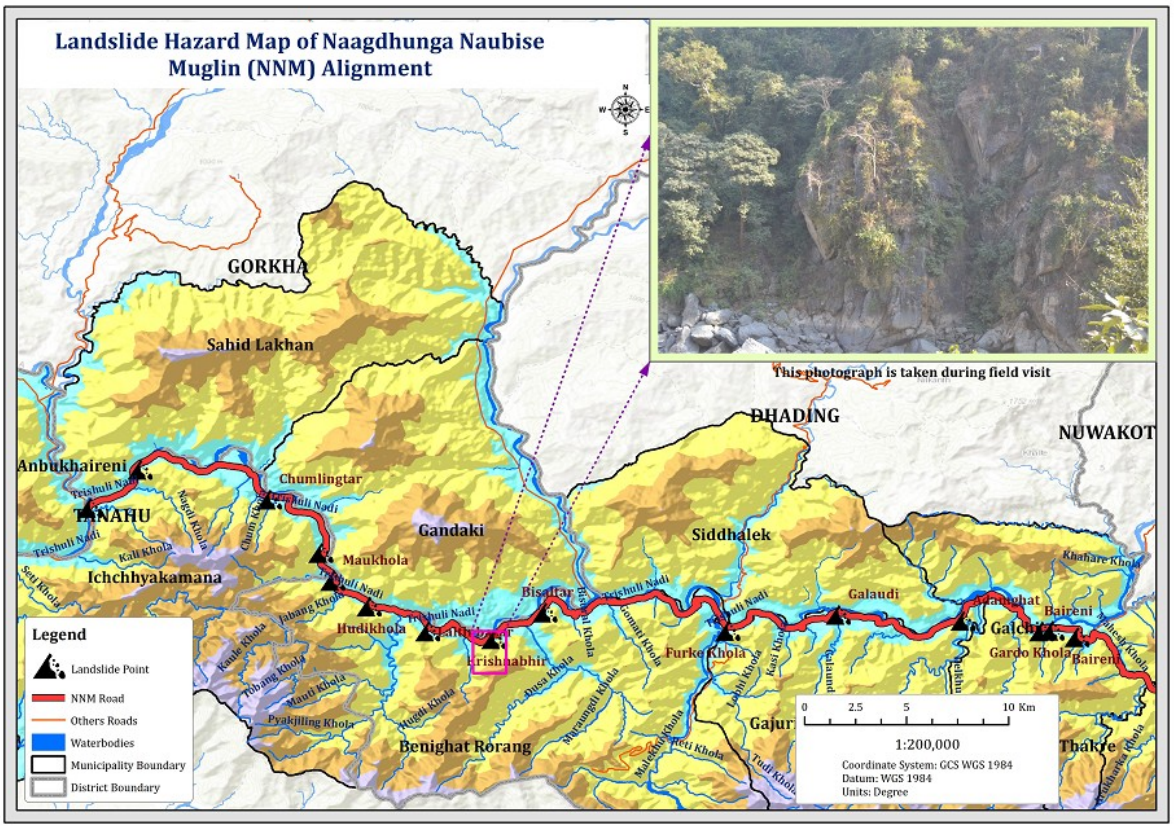


Figure 4-9: Landslide Hazzard map along NNM Road in the project area. Source: Project data analysis, 2019

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 **Error! Reference source not found.** 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 4-10: Active landslide areas in the proposed road alignment

From	To	Distance (m)	Name of the Place	Remarks
NagdhungaNaubise				
0+050	0+200	150	Nagdhunga	Hillside Active L/S
2+250	2+400	150	Jhakribas	

From	To	Distance (m)	Name of the Place	Remarks
2+790	2+830	40	JhyapleKhola	Vally side L/S
3+950	4+075	125	Khatri pauwa	Hillside Active L/S
4+125	4+175	50	Khatri pauwa	
4+400	4+650	250	West of Khatripauwa	Stabilized L/S
Total		**765**		
NaubiseMugling				
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	1000	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		**2035**		

Source: Field survey, 2017

4.1.8 Air Quality

The air quality monitoring was carried out in 3 locations (Mugling, Malekhu and at NagdhungaCheck 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 4)

Table 4-11: 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)
NagdhungaCheck 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 4-12: 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	gdhungaCheck post (at VDC Ward Office - (1253 - NM - 5)	105.6	59.5	86.5	96.8	96.2	82.8	60.0	59.9	*

S. N.	Location Spots	Test Parameters								Range
		L_{max}	L_{min}	L_{eq}	L_5	L_{10}	L_{50}	L_{90}	L_{95}	
	**									
NNQS for Industrial Area**				**70**						
*Note: OSHA TLV Range acceptable at industrial workplace area for 8 working hours**				**85**						

Source: Field Study, 2017

Table 4-13: 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 4-14: 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 NDWQS[12] 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

[12]National Drinking Water Quality Standard, 2005.

contaminated with Total Coliforms in all samples. Detailed result of the water quality analysis is presented in the **Annex 4.**

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, BelkhuKhola 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 4**). All these guidelines have to be followed during the time of construction as per requirements.

4.1.11 Land Use

Land use pattern of the NNM project alignment was overlaid in digital topographical Maps and its patterns were analysed (**Error! Reference source not found.**5). Land use calculation was conducted within Right of Way area (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 4-15: Land use within the ROW, DIA and IIA of NNM and (area in Ha.)

	Within RoW		Within 300 m Corridor (DIA)		Within 2km corridor (IIA)	
Land use type	**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)

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 Fig. 4-11 and 4-13, the land along the road is mostly occupied by agriculture with some forest patches in the indirect impact area.

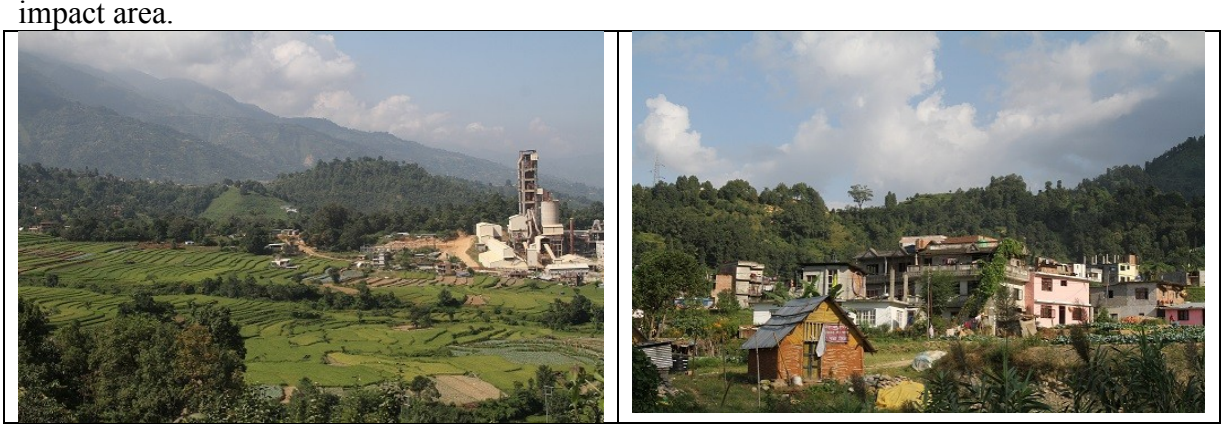


Figure 4-10: Settlements surrounded by forests and agricultural fields

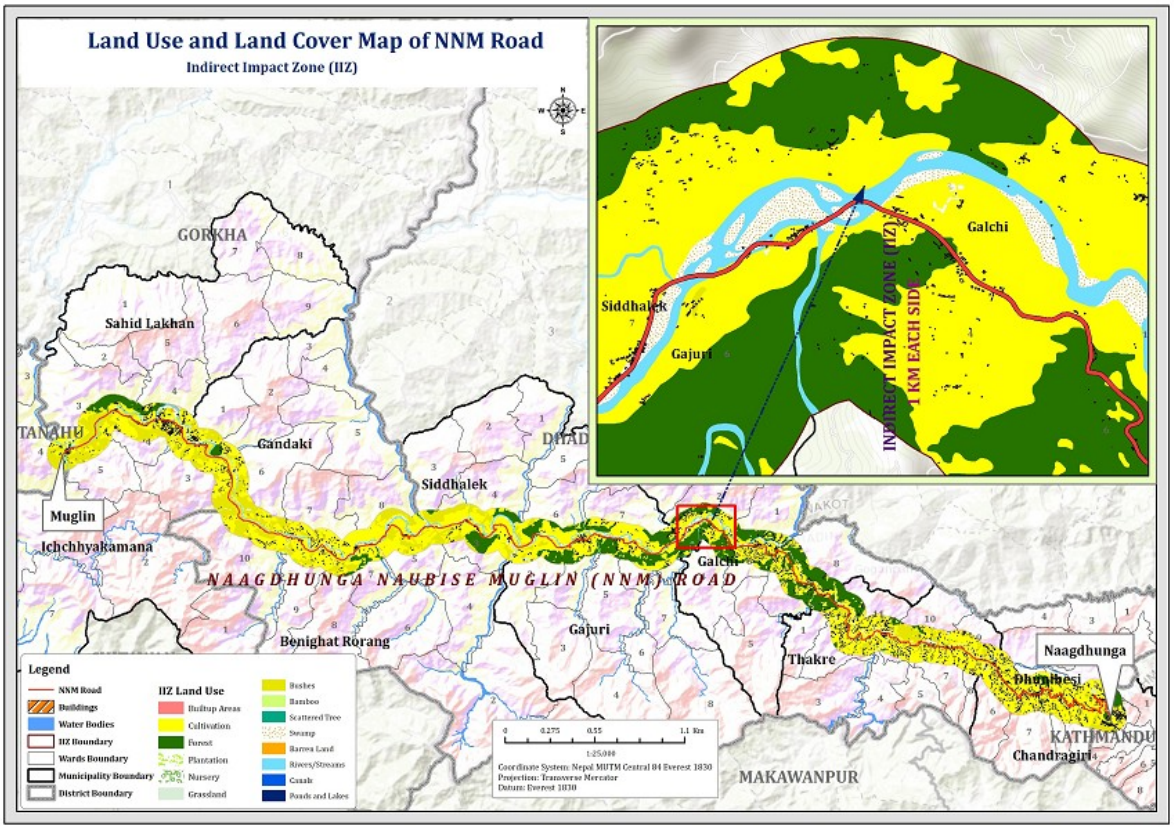


Figure 4-11: Land Use and Land Cover Map in the IIA along NNM Section

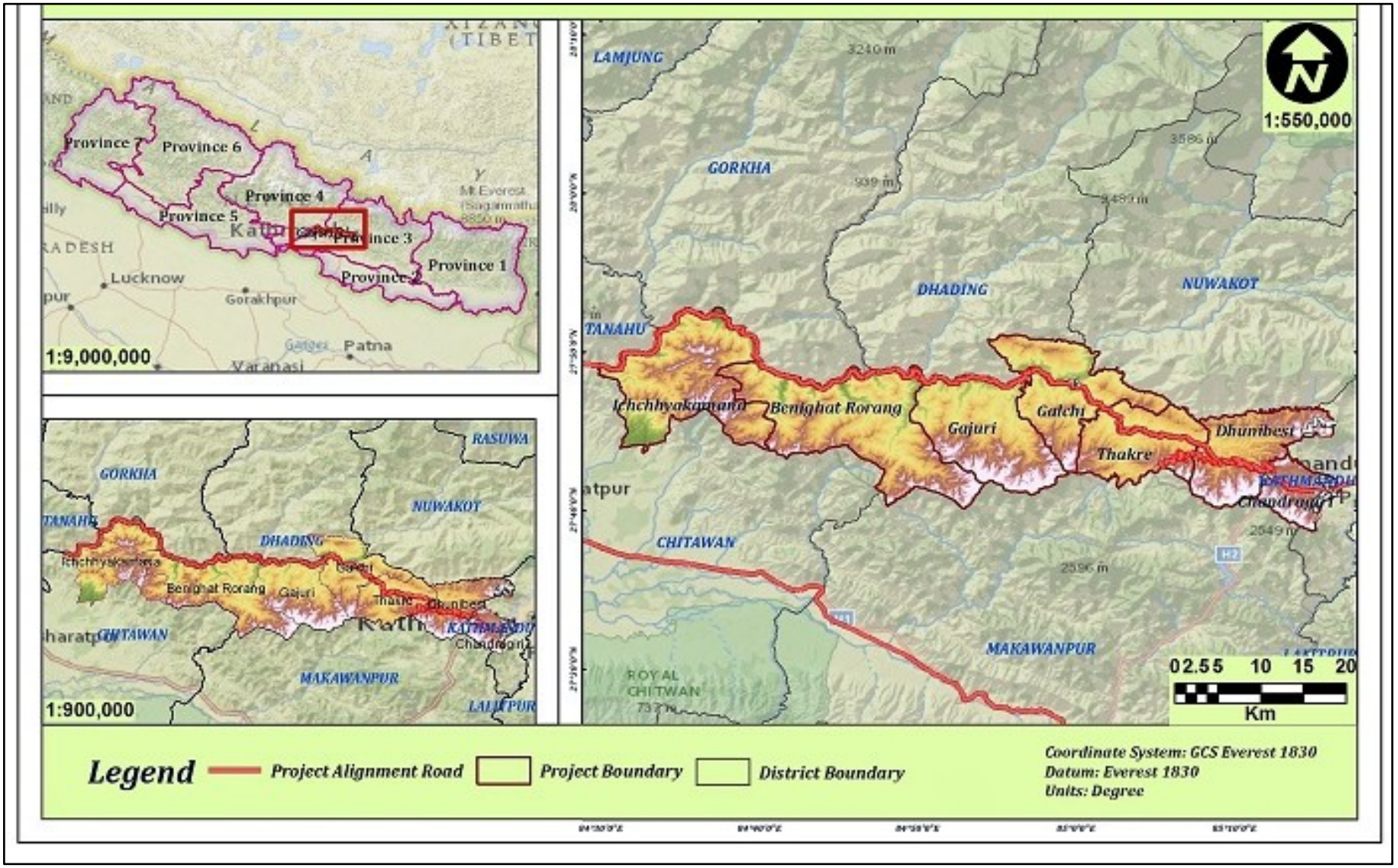


Figure 4-12: Road alignment showing Rural Municipalities and Municipalities

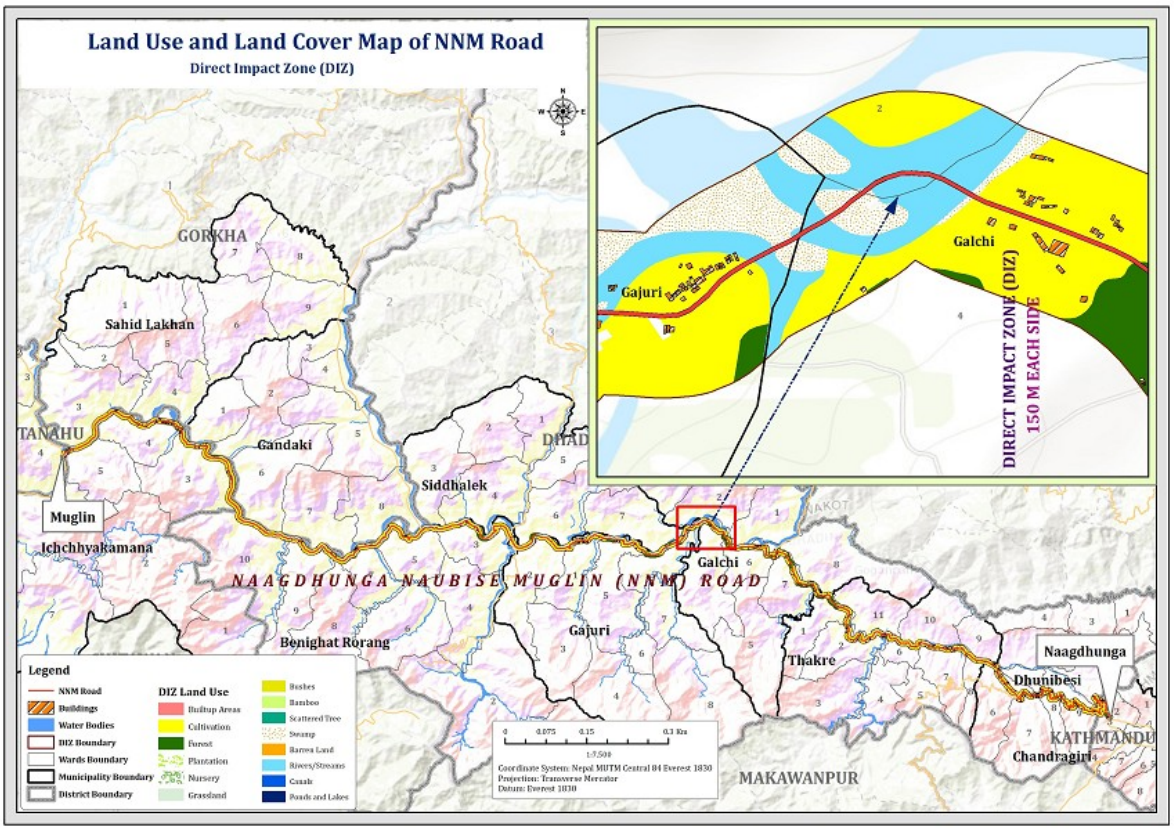


Figure 4-13: Land use map of NNM road (Direct Impact Area)

4.1.12 Solid Waste Management

The settlement along interior part of the roadside manages the degradable waste by local technology, i.e. they make compost manure. However, non-biodegradable wastes are thrown either along the roadside, highway or directly disposed into river.

Figure 4-14: Solid wastes dumped along the road (Near Naubise)

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

Detailed field survey, conducted in 2016-2017, indicated that the NNM road does not cross any protected area, wildlife reserves and wildlife migration corridors. However, the vicinity of the road still serves as a habitat for many wildlife species. A Screening on Critical Habitat following ESS6 and IFC PS6 Criteria and IFC PS6 thresholds has been applied to ascertain whether there is presence of critical habitat within the ROW and DIA. Description of Criteria and detailed screening are presented in the Annex 2.14 to Chapter 4. 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.However, applying IFC PS6 thresholds indicated that these CR and EN species are widely distributed in South East Asia, South Asia, the Himalayas and in Nepal and given the very small area considered as Ecologically Appropriate Area (EEA) (in the case of NNM will be the 300m DIA) of the project, the improvements of NNM road are not expected to affect the global population of these species. Thus, it can be concluded that there is no presence of critical habitats in the ROW and in the DIA of NNM road. The results of Critical Habitat assessment have been provided in Annex 2.15 and 2.16. In addition, there will be minimal felling of trees, 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.

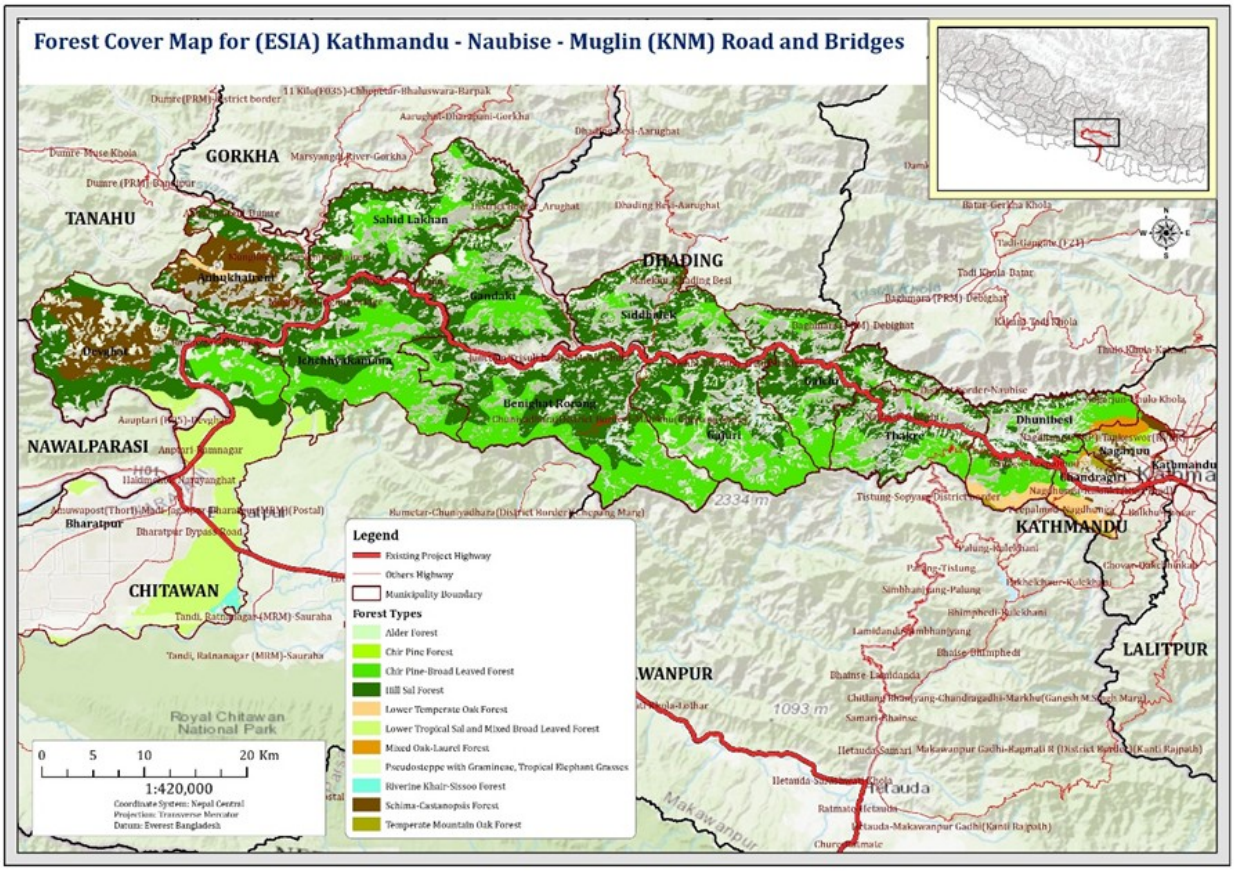


Figure 4-15: Forest Cover Map of NNM Road

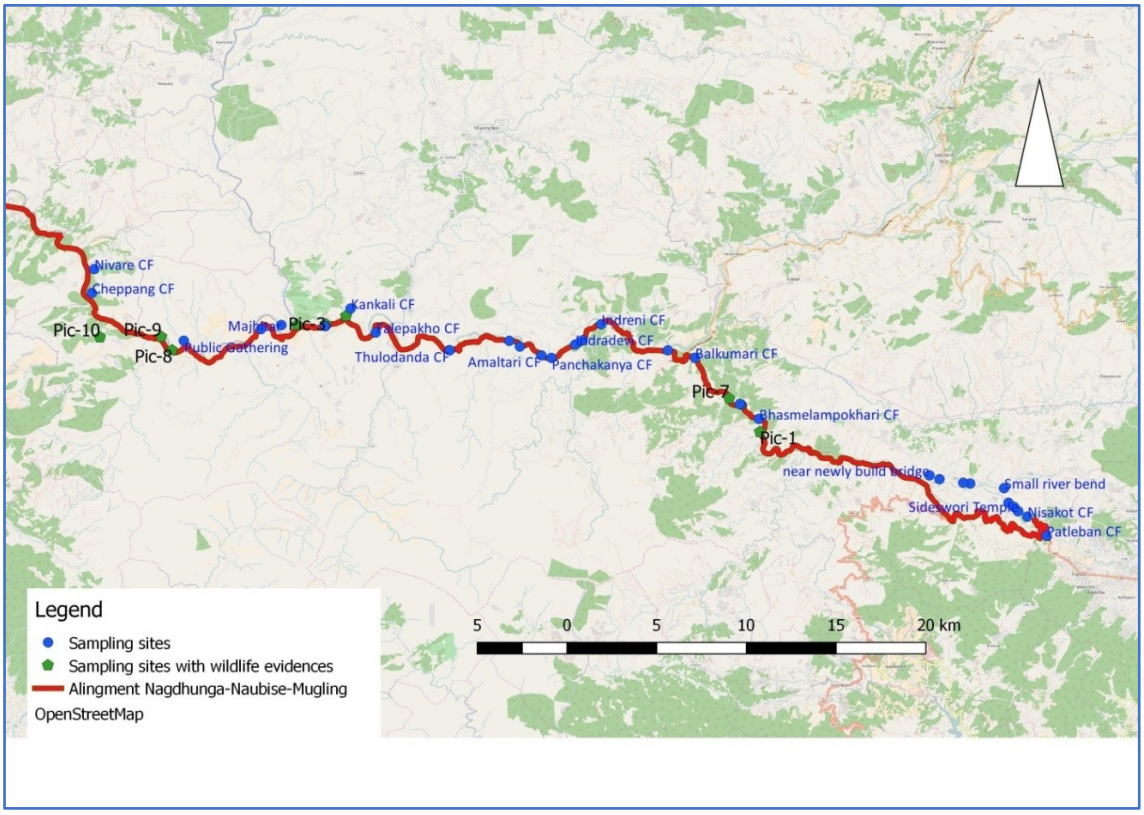


Figure 4-16: Spots with wildlife species presence along NNM road

4.2.2 Types of Forest by Vegetation

Five different forest types are found in the project area: *Schima-Castanopsis*, pine forests (*Pinus roxburghii* and *Pinus patula*), Hill sal, Khair Sissoo and upper Terai Mixed Hardwood Forest type. 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.

4.2.2.1 Schima-Castanopsis forest

Figure 4-17: Schima-Castanopsis forest in Kathmandu district

The *Schima-castanopsis* forest is found along the old Kathmandu (Nagdhunga) - Naubise section. In the upper part, the dominant species is *Castanopsistribulodies*. Other presented species include *Schimawallichii, Mericaesculanta*, and several others. The SchimaCastanopsis forest area at Nagdhunga is enriched with Utis (*Alnusnepalensis*) plantation. This forest is mostly presented in Kathmandu District. The majority of the forest is composed by *SchimaCastanopsis* 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., *Castanopsisindica, Schimawallichaii*domination. This is a forest type that has the diversity of woody and other species, which are listed in Appendices.

4.2.2.2 Hill Sal forest

Figure 4-18: Hill-Sal Forest along NNM section

Both hill Sal forest and upper sub-tropical Sal forest are available along the lower end of the project area. 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 closeto the highway. Hill sal forest has diverse type of woody and other tree species, some of which are listed in **Annex**.

4.2.2.3 Riverine Khair-Sissoo forest

Figure 4-19: Riverine forest in the Trishuli River Valley

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. 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.

4.2.2.4 Mixed forest

Along the alignment many patches are composed of mixed forest, resembling upper mixed hardwood, with species including *Mallatusphilipinnes*(sindure), *Lagerstroemia parvifolia*(Bodhangero), *Schimawallichiana*(Chilaune)*, Adina cordifolia*(Karma)*, Melia azedarach* (Bakino)*, Engelhardia spicata* (Mahuwa), *Castanopsisindica*(Dhalekatus) 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**.

4.2.2.5 Pinus roxburghii forest

Figure 4-20: Pine forest in NNM section.

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 *Alnusnepalensis*is also found along the fringes in the lower part where the location is moist comparatively.

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 GFsoccur mostly on the steep slopes andare degraded due to high demand of fuel wood and timber by the people and 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 (**Error! Reference source not found.**).

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 **Error! Reference source not found.**. Among these only Madan Pakha LHF, Dhading district has 22 poles.
From all the three differently managed Forest management regimes, 52 trees and 2,253poles 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 on trees needing to be cut (**There are** very few scattered poles available, and that too in Madanpakha LHF only. On the other hand, these LHF were densely grown by seedlings and saplings. In Madanpakha LHF, a total of 22 trees including Khair and Sindure were found. LHF is degraded forest area as the principle of the government is to lease degraded forests. However, other LHFs have few saplings of Sal, Khair, Kyamun, etc. and fruit trees and cash crops including Mango, Banana, Lemon, Pineapple, Bamboo, Cassia, Guava, etc.

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

Table 4-16: Impact of NNM on forest, trees, wood volume, biomass and carbon

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 (m^3)	Total biomass (ton)	Carbon (ton)	Remarks
				Trees	Poles	Total				
Nagdhunga-Naubise										The dimensions stated by Govt. of Nepal are diameter of breast height (DBH) 10cm and above. Technically, DBH10-30 is pole and above 30 is tree. There are more poles (92%) in GoNcategorized trees(Tamrakar 1999)
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**	
NaubiseMugling										
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.	SutkeriDhunga - 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	PhalePakha - 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	
21	BishalSamjhauta– CF	900	0.189	5	101	106	12.54	18.82	12.14	
22	JabangMauwaKhola - 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	BharyangPakha - 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 Majhimtar – 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	

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 (m^3)	Total biomass (ton)	Carbon (ton)	Remarks
				Trees	Poles	Total				
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	SimleGaira - LHF	320	0.023	0	0	0	0	0	0	
38	DhapPakha - LHF	80	0.032	0	0	0	0	0	0	
39	Bombay Aanp - LHF	300	0.032	0	0	0	0	0	0	
	Total	**20609**	**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 was 194.66 tons. Wood/timber volume of the trees 203.54 m^3.

4.2.6 Tree Species diversity in CF

The most affected tree species are Sal (*Shorearobusta*) 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.

4.2.5.3 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 (*Mallatusphillipinus*), Utis (*Alnusnepalensis*) and Chilaune (*Schimawallichii*). 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 regeneration category of the project area forests.

4.2.5.4 Protected, Rare or Endangered Species

Khair(*Acacia catechu*) and Sal(*Shorearobusta*) are the two species found in the area which are under the protected species category and *Dalbergia sissoo* under CITES Appendix II (Table 4-17).

Table 4-17: List of Protected, Rare or Endangered Plant species

SN	Local Name	Latin name	Protection Status				Remarks
			GoN	CITES codes	IUCN status	NRBD	
1.	Khair	*Acacia catechu*	P		T		
2.	Sal	*Shorearobusta*	P				
3.	Sissoo	*Dalbergia sissoo*		II			

Legend: P= protected,GoN: Government of Nepal, NPWC Act: National Park and wild life conservation Act, CITES Appendix II: Not yet threatened but which could become endangered if trade is notcontrolled,IUCN World Conservation Union E=Endangered, V=Vulnerable, R=Rare, I=Intermediate, Insufficiently known=Threatened, NRDB= National Red Data Book

4.2.8 Fauna in the Project Area

4.2.6.1 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 critical wildlife habitats are found within the existing ROW. As 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 endangered (*Manis pentadactyla* or Chinese pangolin) but applying the threshold in IFC PS6, the ROW and DIA could not be considered critical habitats. The Chinese pangolin while considered endangered is widely distributed in Nepal and in China and the Himalayas and considering the very small area of the project that will be disturbed the global population of Chinese pangolin is not expected to be affected by the project.

Table 4-18: Global and national status of Mammal species reported in the ZOI of the road

No	Species name	Occurrence	Status	
			IUCN	Nepal
1	Chinese Pangolin – *Manis pentadactyla*	+ (NN)	CR	CR
2	Common Leopard – *Panthera pardus*	+ (NM)	VU	VU
3	Jungle cat - *Felischaus*	+ (NM)	LC	VU
4	Leopard Cat - *Prionailurusbengalensis*	+ (NaM)	LC	VU
5	Bengal fox - *Vulpes bengalensis*	+ (NM)	LC	VU
6	Golden Jackal - *Canis aureus*	+ (NM)	LC	LC
7	Grey Wolf - *Canis lupus*	+ (NaM)	LC	VU
8	Mangoose- *Herpestesspp*	+ (NM)	LC	LC
9	Marten – *Martes spp*.	+ (NaM)		
10	Rhesus Monkey - *Macaca mulatta*	+ (NM)	LC	LC
11	Terai Gray Langur – *Semnopithecus hector*	+ (NaM)	NT	LC
12	Indian Porcupine - *Hystrixindica*	+ (NM)	LC	LC
13	Squirrel - *Funambulus spp.*	+ (NN)		
14	Himalayan Goral – *Naemorhedus goral*	+ (NaM)	NT	NT
15	Wild Boar – *Sus scrofa*	+ (NN)	LC	LC
16	Barking Deer - *Muntiacus vaginalis*	+ (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 4-21: Highly disturbed and fragmented landscape along NNM road; monkey attracted to road

4.2.6.2 Avian Fauna in the project area

Altogether, 276 species of birds have been recorded along the ZOI ofNNM 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.

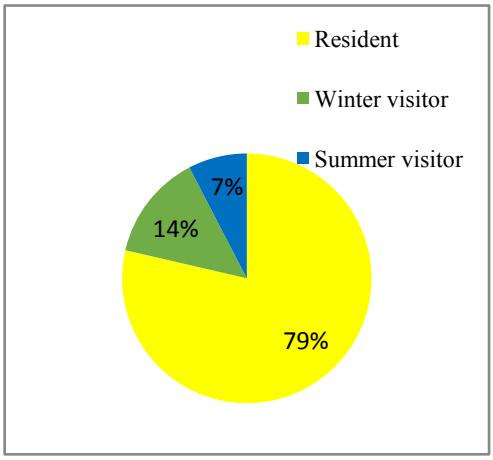


Figure 4-22: Migration status of birds found along road alignments

Of total recorded species, morethan 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
some nests (12) were also found 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**.

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 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).

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 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 found in orchards or small forest patches or rivers along the road; 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

Figure 4-24: Black Kite is one of the most common scavengers, found near the road

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, 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: Common Pochard, Mallard, Common Kingfisher, Blue Whistling Thrush, White Wagtail, White-browed Wagtail, Common Sandpiper, River Lapwing, Cattle Egret, Indian Pond Heron, etc. The Ibis bill, Great Cormorant, Woolly-necked Stork etc. migrate through the TrishuliRiver 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.

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.

4.2.7.1 Herpetofauna and Aquatic fauna along Nagdhunga-Naubise Section

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

This section of road has five streams with alder as the dominant vegetation. Majority of streams have unconstrained channel form 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: JhyapleKhola, SisneKhola and KhatripauwaKhola were dry during the survey time in December 2016. This means that these springs are intermittent type. JhyapleKhola and SisneKhola is more as a drainage and filled with wastes, while Khatripauwakhola was under mining of gravel. Unlike these springs, SikreKhola and KhaniKhola 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).

4.2.7.2 Herpetofauna and Aquatic fauna along Naubise-Mugling Section

The existing road runs along the Mahesh KholafromNaubisetoGalchi, where the Mahesh Kholameets 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. NaubiseKhola,

Figure 4-25: Fish harvest from the Trishuli River

JungaKhola, Agra Khola, KhesteKhola, DangdungeKhola) showed that the rivers were running with low flow contributing less than 30 percent of total flow of Mahesh Khola. NaubiseKhola, JungeKhola and Agra Khola are under human influence. Dumping of waste in the banks of NaubiseKhola and JungaKhola 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 tributariespollute 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 Barnabaril (*Barilusbarna*), Ring loach (*Schistureasovana*) and Barb (*Punctius sp.*) in the monsoon. Along with these fish species, Copper Mahseer (*Nelissochilushexagonolepis*) in DangdungeKhola 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 ChiraudiKhola, BelkhuKhola, GalaudiKhola, SotiKhola, MalekhuKhola, Kadam Khola, KhatautiKhola, ChiraudiKhola, HugdiKhola, MauwaKhola, Chum Khola, KumKhola and NagdiKhola 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 (*Euphlyctiscynoplyctis*) and Barnabaril (*BariliusBarna*) were observed near the confluence ofBelkhuKholawith Trishuli River which 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 GalaudiKhola riverbank. No fishes were recorded in this khola at the time of survey and similar case was found with SotiKhola. Moreover, this Khola is very small with very low flow. Hamilton's Barila (*BariliusBendelisis*) was recorded from MalekhuKhola. Fish species such as; Golden Snowtrout (*Schizothoraxplagiostomus*), Gangetic Laita (*Crossocheiluslatiuslatius*), Annandale Garra (*Garraannandalei*), Gotyla (*GarraGotylagotyla*), Asiatic Snakehead (*Channaorientalis*) were reported in Kadam Khola and Trishuli River at Malinga. No aquatic fauna was found in KumKhola during the survey time as it had significantly low flow (almost dry).

Golden Snowtrout (*Schizothoraxplagiostomus*), Gangetic Laita (*Crossocheiluslatiuslatius*), Annandale Garra (*Garraannandalei*), Gotyla (*GarraGotylagotyla*), Asiatic Snakehead (*Channaorientalis*), Bata labeo (*Labeobata*), Ring Loach (*Schisturasovana*) and Copper Mahseer (*Neolissochilushexagonolepis*) are some fish species found in the Trishuli River. Moreover, River Rohu (*Labeo dero*), Stinging catfish (*Heteropneusteusfossilis*), Straited or Banded Snakehead (*Channastriatus*), Longfin Freshwater eel (*Anguilla bengalensis*) are some other fish species present in the river added 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 (*Paralaudakiahimalayana*) 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.

4.2.7.3 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 4-19: : Herpetofauna Species Observed During the Field Survey

S N	Species	Common Name	Local name	Family	Status (Nepal, IUCN)	Remarks
Amphibia						
1	*Duttaphrynusmelanostictus* (Schneider, 1799)	Black spined toad/ Common Asian toad	Khasrebhyagutto	Bufonidae	Most common toad; LC	Photo evidence
2	*Euphlyctiscynoplyctis*(Schneider, 1799)	Skittering frog	Dholbajepaha/ Tik-tikepaha	Ranidae	Common frog; LC	Photo evidence
Reptiles						
1	*Calotes versicolor* (Daudin, 1802)	Common garden lizard	Chheparo	Agamidae	Most common lizard; LC	Photo evidence
2	*Paralaudakiahimalayana*	Himalayan agama		Agamidae	Very common; LC	Photo evidence
3	*Mabuyacarinata*(Schneider, 1801)	Brahminy skink/Common Indian skink	Bhanemungro	Scincidae	Very common; LC	Photo evidence
4	*Varanus flavescens*	Golden Monitor Lizard/ Bengal Monitor		Varanidae	Rare in Nepal; LC	Observations during mammal survey

Source: Field survey, 2017

Table 4-20: Some Macroinvertebrates of the Study Area

S. N	Species	Common Name	Local name	Family	Status	Remarks
1	*Nepa sp.*	Water scorpion	_	Nepidae	_	Photo evidence
2	Dragonfly nymphs		_	Odonata	_	Photo evidence
3	*Lymnea sp.*		_	Lymnaeidae	_	Photo evidence
4	Water Beetle	Water Beetle	_	Hydrophilidae	_	Photo evidence

Source: Field survey, 2017

Besides three large reptilian species (*Gavialisgangeticus*, *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 fishes (*Anguilla bengalensisbengalensis* (Gray), *Chaguniuschagunio*(Hamilton-Buchanan),

Neolissocheilushexagonalepis(McClelland), *Schizothoraxplagiostomus*(Heckel), *Schizothoraichthysprogastus*(McClelland), are reported as vulnerable.

4.2.10 Protected, Rare or Endangered Flora and Fauna Speciesin 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.

Figure 4-26: Himalayan Vulture

Table 4-21: 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	*Aythyaferina*	कैलोटाउके हाँस	NM; BK	VU	NT	-
Black-bellied Tern	*Sterna acuticauda*	उत्कोशी फ्यालफ्याल	NM	EN	CR	-
Egyptian Vulture	*Neophron percnopterus*	सेतो गिद्ध	NM; BK	EN	VU	II
White-rumped Vulture	*Gyps bengalensis*	डंगर गिद्ध	NM; BK	CR	CR	II
Red-headed Vulture	*Sarcogyps calvus*	सुन गिद्ध	NM; BK	CR	EN	II
Greater Spotted Eagle	*Aquila clanga*	जीवाहार महाचील	NM; BK	VU	VU	II
Steppe Eagle	*Aquila nipalensis*	गोमायु महाचील	All	EN	LC	II
Asian Woollyneck	*Ciconia episcopus*	लोभीपापी गरुड	All	VU	NT	-
Grey-crowned Prinia	*Priniacinereocapilla*	घेघरी घाँसेफिस्टा	NM	VU	VU	-
Ferruginous Pochard	*Aythyanyroca*	मालकहाँस	NM; BK	NT	VU	-
Barn Owl	*Tyto alba*	गोठे लाटोकोसेरा	All	LC	VU	II
Brown Wood Owl	*Strixleptogrammica*	चश्मे उलूक	All	LC	VU	II
Ibisbill	*Ibidorhynchastruthersii*	तिलहरी चरा	NM; BK	LC	EN	-
Brahminy Kite	*Haliasturindus*	सेतोटाउके चील	NM	LC	CR	II
Himalayan Griffon	*Gyps himalayensis*	हिमाली गिद्ध	All	NT	VU	II
Cinereous Vulture	*Aegypiusmonachus*	राजगिद्ध	NM; BK	NT	VU	II

Source: Field survey, 2017

Legend: NM-Naubise-Mugling; BK - BenighatKurintar

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

4.3.1.1 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 BenighatRorang rural municipalities in Dhading districtand Ichchhakamana rural municipality in Chitwan.

4.3.1.2 Settlement Pattern

Figure 4-27: Clustered settlements along existing highway.

Most existing settlements along the NNM road alignment are semi-clustered and clustered type. The major settlements include Khanikhola, Naubise, Dharke, Mahadevbesi, Galchi, Gajuri, Baireni, Majhimatar, Malekhu, Benighat, Charaudi, Kurintar, RamailoDanda, 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.

4.3.1.3 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 municipals in Dhading district comprise Dhunibesi municipality, and Thakre, Galchhi, Gajuri and BenighatRorang rural municipalities. The total number of HHs within DIA of these projects influenced municipals is 3591. The total population within DIA is 16959 (Males: 8407 and Females: 8550).

4.3.1.4 Caste and Ethnic Groups

The caste and ethnic groups found in project area are Brahmin, Chhetri, Sanyashi, Dalit, Muslims, Madheshi and Janajatis/IPs viz. Newar, Gurung, Magar, Tamang,Chepang and others.The affected population within DIA is 18840. Out of this population, the population of males and females are 9280 and 9560 respectively. Out of total HHs within DIA (3591), 61.04% HHs belong to that of Brahmin and Chhetri followed by Janajatis (32.25%), others (2.67%), Dalits (1.42%), Muslims (0.95%), Sanyasi (0.89%), Chepang (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. Madhesis are Terai/plain dwellers. Both Muslims and Madhesi also belong to deprived and disadvantaged groups. The list of these caste/social groups of project municipals is presented in the table in **Annex-4.3.1.**

4.3.1.5 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. Majority of the populations follow Hinduism followed by Buddhism, Christians, Islams and others in the DIA. The Nepali language is spoken as an official language by the majority of population in all project municipals, 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 being 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&Shawauneskranti, Nepal Sambat, Janaipurnima, Naag Panchami, Buddha Jayanti, Thulo Ekadashi, Holi, Shivaratri etc. other major festivals being celebrated by general people in the project area.

4.3.1.6 Literacy Rate

The literacy rates of populations of project influenced municipals within the DIA ranges from 55% to 85%.Among the project affected municipals, the highest literacy rate is in IchakamanaRM (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 affectedmunicipalities/rural municipalities is presented in **Annex-4.3.2.**

4.3.1.7 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-4.3.3.**

4.3.1.8 Occupational Status in Project Districts and Municipals

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 4-28: Agricultural production along NNM.

4.3.1.9 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-4.3.4.**

4.3.1.10 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 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 projectaffected M/RMs. The list of absentee HHs and populations is presented in **Annex-4.3.5.**

4.3.1.11 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 DIAof 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.

4.3.1.12 Land Value

There have been significance changes in the values of landed 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 m^2.

4.3.1.13 Agricultural practices

Nepal is an agricultural country having 66 %of 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 being involving into 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.

4.3.1.14 Food Sufficiency Level

The food self-sufficiency level of the 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.

4.3.1.15 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 4-29: Markets along the road.

4.3.1.16 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.

4.3.1.17 Household income and expenditure patterns

Pension, wage employment, non-farm enterprises, remittances, house/land rental, agriculture production, livestock production etc. are the major sources of income in project area. So, 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 are the main areas of expenditure in project area. 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.

4.3.1.18 Cottage and small industries

Nepal is an agricultural country where there is high unemployment 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 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.

4.3.1.19 Market centre and marketing

There are 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, RamailoDanda, 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.

4.3.1.20 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.

4.3.1.21 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 households depending on wood/firewood for cooking purpose. Minimum 2.5%, and 2.0% HHs depending upon Biogas, and Kerosene use for cooking purpose respectively.

4.3.1.22 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/PipalChautaro) 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 worshiping daily considering some as holy deity. Altogether, 3 temples along the road alignment will be affected requiring relocation and rehabilitation.These temples are being located at 12+300 and 44+050 chainages. No any historically, religiously and archeological important cultural heritages are found to be affected and triggered along the NNM road alignment.

4.3.1.23 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 4-30: Pilgrimage and touristic places along NNM

4.3.1.24 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.

4.3.1.25 Gender and GBV situation in the Project area

Nepal has high incidences of GBV cases 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 measure 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.

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 are measured to be on the higher side of "Low". 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 volume and various form 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.

4.3.1.26 Public and private services

The available public services in the project area include the government services to be 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.

4.3.1.27 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 lanourforce thereby creating ample opportunities at the local level.

4.3.1.28 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 4.**

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[13] http://nwchelpline.gov.np

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

Table 4-22: 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

Table 4-23: 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

4.3.2.1 Project Affected HHs

Altogether, 78 households will be affected within ROW by the road upgrading works. Out of total project affected HHs, only 63 HHs were surveyed and remaining 15 HHs were absent. These absentee HHs were residing somewhere outside the project area but all the private loss details of them were recorded having consulted with their respective neighbours who were familiar with the land and property to be affected along the NNM road alignment. 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. However, there is no impact on land and natural resources of IPs, traditional ownership or lands under customary use or occupation, cultural heritage that is material to the identity, ceremonial, or spiritual aspects of their lives. So, Free Prior Informed Consent (FPIC) process is not required for this project.Among the surveyed project affected HHs (63), 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% (CBS, 2012) indicating depived situation of women. The project affected HHs by caste/ethnic groups is presented in **Annex-4.3.7 and Annex-4.3.8.**

4.3.2.2 Demographics of project affected surveyed households

The total population of the surveyed HHs (63) is 335. Out of this population, 52.8% and 47.2% belong to 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. The population composition of the affected surveyed households is **Annex- 4.3.9.**

4.3.2.2.1 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-4.3.10.** Out of total project affected surveyed households (63), 55.56% households belong to non-vulnerable [15] followed by indigenous peoples (38.10%) and vulnerable communities [16] (6.35%). The distribution of project affected surveyed HHs by IPs and VCs is presented in **Annex-4.3.11.**

4.3.2.2.2 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-4.3.12.**

4.3.2.2.3 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%), labor (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 labor 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-4.3.13.**

4.3.2.3 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-4.3.14.**

4.3.2.4 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

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

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

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.

4.3.2.5 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 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 poverty 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

5 Chapter 5: Stakeholder Engagement and Public Consultations

5.1 Introduction

Stakeholder engagement is an inclusive process conducted throughout the project lifecycle. ESS10 of World Banks's ESF has recognized different stakeholders, where engagement is done in all different phases of project intervention (from design till implementation), in a timeframe that 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 ESS-10, 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 upgrading workhas been identified by the stakeholder mapping.The key identified stakeholders are: 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 able 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 5-1: Consultant team meeting and stakeholder interview

5.1.2 Affected Parties

Project Affected Families (PAFs) or Project Affected Persons (PAPs); Severely Project Affected Families (SPAFs); project affected vulnerable households (both last groups include HHs loosing 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 Group: 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 includes 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 etc.) 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 Discussion (FGD), Key Informants Interview (KII) and mixed group discussions were 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 5-2: Stakeholder consultations and key informant interview

5.3 Stakeholder Consultation

The discussions during preliminary study (prefeasibility) were organized to share the information to the local people of project affected wards of RM/M. Initial walkover surveywas carried out followed by individual interview with local government officials. The preliminary consultation during prefeasibility stage was carried out at four different locations of Dhunibesi M, Gajuri RM and BenighatRorang RMfrom 26-30 January, 2017. Total 115 participants took part with 104 male 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, BenighantRorang RM and Ichhankamana RM with 259 participants (male- 228, female-31). The supplementary consultationwas carried out at 22

different locations of the affected RM/M focusing on female groups (210 females and 106 males out of 316 participants) inJune 2018.

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). So, the additional consultation 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. The total participants of additional consultation were 312 (female- 312, male- 86).

The agenda for discussions were 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 of impacted land, affected private and public structures, construction of public structures as foot over bridge near school and major market places, construction of vegetable collection centres, gender friendly public toilets with refreshment centres etc., and 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 5-1**

Table 5-1: 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 adhamghat. • 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, BenighatRorang RM, Ichhakamana RM The issues were raised during public consultations and hearings	• The road safety issues will be incorporated in the detailed design r • Rapid Response team will be mobilized during project implementation
	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, BenighatRorang 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 EMP 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	Chandragiri M, Dhunibesi M, Thakre RM, Galchi RM, Gajuri RM, BenighatRorang RM, Ichhakamana RM	The incorporation of issues of road infrastructures will be recommended to design team

	start rapidly. • There should be uniformity in the expansion of road all along from Naubise to Mugling.	The issues were raised during public consultations	
	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 inMahadevbesi bazaar(Thakre RM) • Overhead Foot Bridge in JungeKhola(Thakre RM)	Dhunibesi M, Thakre RM, Galchi RM, Gajuri RM, BenighatRorang 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, BenighatRorang 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)
	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, BenighatRorang 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, BenighatRorang RM, Ichhakamana RM Issues were raised during public consultations and hearings	The ESIA, RAP/VCDP will incorporates 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, BenighatRorang RM, Ichhakamana RM Issues were raised during public consultations and hearings	The ESIA, RAP/VCDP will incorporates 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, BenighatRorang 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	Chandragiri M, Dhunibesi	ESIA recommends overall one GRM

	• Issues of project related grievances during construction phase • Grievances related to workforce/labor • Community related grievances(due to labor influx) • GBV related grievances	M, Thakre RM, Galchi RM, Gajuri RM, BenighatRorang RM, Ichhakamana RM Issues were raised during public consultations and hearings	and within that two separate committee(one for labor 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 grievance redress mechanism (GRM). GRM is the potentiality divided into three types: grievances related to land acquisition and compensation, grievance related to labor and grievance related to GBV.

5.4.1 Project Related Grievances

It covers overall project related Grievances. The construction related issues and impacts such as land acquisition and compensation, relocation and rehabilitation of public utilities, impact on private and public structures, impact on forest and natural resources, issues of landslide, draining management, road safety, traffic management etc. will be covered by project related grievances. Community related grievance will also be addressed by project related grievances.

Any HH/local stakeholder, feeling that adverse and material harm caused by the project may contact municipality leaders or local leaders of affected municipalities or rural municipalities that 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.

For this sub-project, a grievance redress mechanism will be established to allow project affected persons (PAPs) to appeal any disagreeable decisions, practices, and activities arising compensation for land and assets, and technical and general project-related disputes. As specified in ESMF the PAPs will be made fully aware of their rights and the procedures for doing so verbally and in writing during compensation, survey, and time of compensation. There is potentiality of several types of grievances: grievances related to land acquisition and resettlement requirements, grievances related to compensation or entitlement and any other social and environmental issues. The PAPs 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

This includes all issues of project workers. The accommodation (health and sanitation), availability of safety gazettes, equal wages to male and female for similar nature of works, delay in payments, hiring of labours without contract document and GBV. The issues of project workers related grievances will be addressed by the Labour Management Plan (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.

Stakeholder consultation in NNM road was conducted was based on design phase of project. As stakeholder engagement is continuous process to ensure the compliance of the issues raised during project design phase. So additional stakeholder consultation will be carried out during the implementation phase and in addition to that monitoring and reporting will be carried out to the specific identified groups. It reflects the process of iteration and two way communication between stakeholders and project team.

There will be Stakeholder Engagement Plan (SEP) in place for engaging relevant stakeholders at different tiers and levels and for harnessing their common efforts for their collaborative actions.

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 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 lives relatively close to construction sites.

Local households and stakeholders will be informed about 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 filed 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 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; does 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 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). 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 Proponent 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 PAPs will have unhindered access to the grievance redress office to forward and file their 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 PAPs to file the complaints to the concerned agency. PAPs 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 PAPs 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 PAP. 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 PAP can appeal to the CDC and project proponent/DOR. While lodging the complaint, the PAP 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 PAP 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 PAP, in his/her last resort, may submit its case to the court.

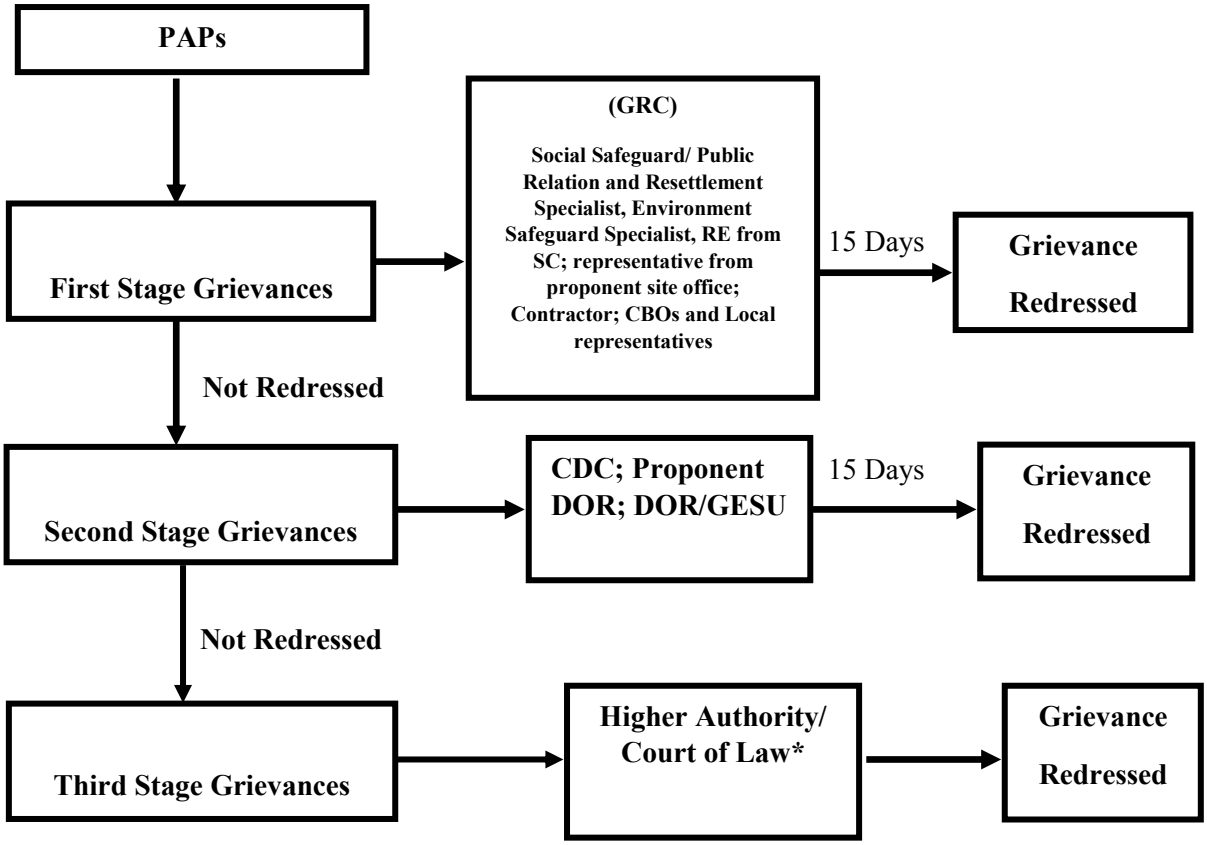

Figure 5-3: Grievance Redress Mechanism structure in the project cycle

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.

6 Chapter 6: Environmental and Social Risks and Impacts

This chapter highlights environmental and social risks and impacts during improvement of 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 6-1**.

Table 6-1: 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 improvement of road infrastructure and its technical efficiency, economic development and livelihoods of the local people. Upgrading of 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 6-2**.

Table 6-2: 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
Employment generation	High	Moderate	Opportunities for local labour-force

Beneficial Impact	Impact Rating		Rationale
	Construction	Operations	
			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 and3,711,632 man-days of unskilled work)for construction-related work for the inhabitants all along the existing alignmentsfor 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 thelocals by providing long-term employment opportunity, but also contribute to local human resource development in project areas that have limitedopportunities. 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 roadconnects withsome 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 landscapesdue 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 6-3: 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 Standard and evaluated against risk screening criteria as high, substantial, moderate or low (**Table 6-1**).

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 6-4: 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	Substantial	Low	Removal of existing protection walls for further widening along the highway is likely to aggravate landslides situation. Erosion control plan should be prior of construction.
Greenhouse Gas (GHG) Emission	Moderate	Low	GHG emission will be moderateduring 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	Potential cumulative impacts from the planned NNM road project and external stressors both covariate (natural) and idiosyncratic (anthropogenic) such as poor water drainage in the access roads, siltation in nearby streams, agricultural development and climate change, river flow regime changes, sedimentation, and barrier effects on fish etc.
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.
Air pollution	Substantial	Moderate	Air pollution due to operation of machines is likely in the vicinity of the project alignment situated within the

ESF Standards, Environmental and Social risks and impacts	Risk Rating		Rationale
	Construction stage	Operation stage	
			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 notproperly 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	The extent of economic displacement is currently unknown, but will likely be significant for the access road component, employer camp and ancillary facilities. Due to loss of private property and assets (land and housing structures including trade structures), 78 HHs are likely to be economically displaced requiring

ESF Standards, Environmental and Social risks and impacts	Risk Rating		Rationale
	Construction stage	Operation stage	
			compensation and restoration of livelihoods. Likewise, numbers of small business entrepreneurs along the NNM road alignment are also likely to be economically displaced loosing livelihoods through upgrading works. They need to be relocated at nearby public places. They are not needed to be compensated as they are conducting their businesses in private lands.
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 NNM project will not significantly impact the indigenous peoples, their traditional culture, land resources and territories. It does not require to adopt the FPIC process.
ESS 8: Cultural Heritage			
Tangible Heritage	Low	Low	The likely impact of NNM project on tangible heritage (e.g. shrines, cremation sites etc) is not found.

ESF Standards, Environmental and Social risks and impacts	Risk Rating		Rationale
	Construction stage	Operation stage	
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			
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).

Following sections summarize the environmental and social risks and impacts likely due to the project road by each relevant environmental and social standard (ESS 1- 8).

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

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 thathas 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 that 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 KNM section does not cross any protected areas. It is mostly going along mountain slopes closely to river and crossing the area of several cities, biggest of which is Mugling. 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 on 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.

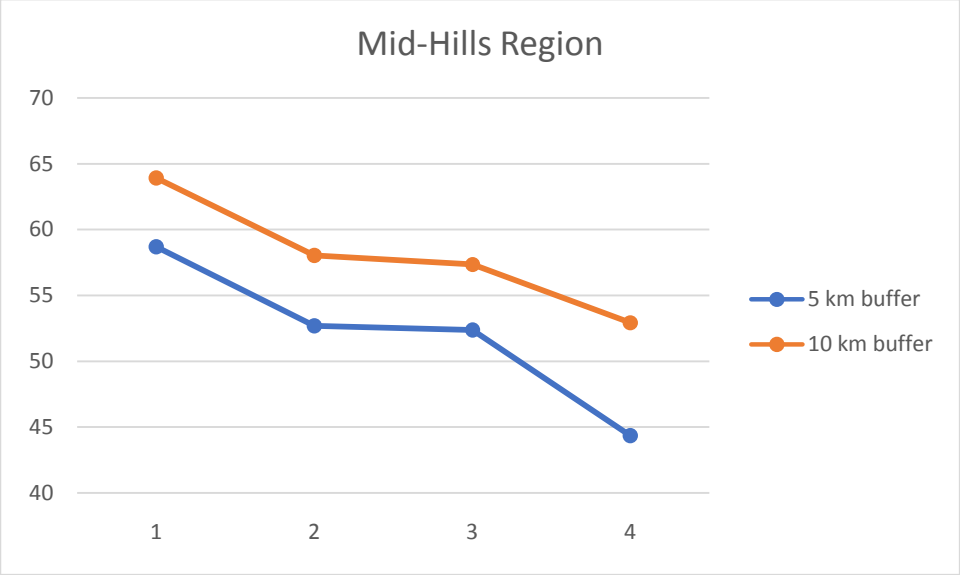

Figure 6-1: Deforestation trends along Birgung to Kathmandu Trade Corridor in Mid-Hill region.

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 condition for this project associates with three categories of project workers: Direct (hired by project), Contracted (including Migrant Workers) and Primary supply workers (those providing goods and materials). The risks includes inadequate worker accommodation; non-payment of wages; non-payment of 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 (eg.allergies, respiratory problems, musculo-skeletal disorder), communicable diseases including Sexually Transmitted Infections (STIs), 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

6.5.1.1 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 PhurkeKhola 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 of soil erosion.

The landslide and erosion prone areas after road excavation works in section wise are as illustrated in the **Table 6-5**.

Table 6-5: Highly Landslide Prone Area

Sn.	Chainage		Length (m)	Soil/Rock Type	Landslide Hazard
	From	To			
NagdhungaNaubise 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
NaubiseBaireni 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
BaireniBishaltar 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
BishaltarMugling Section					
71	56+630	56+900	0+270	Soil	High
72	56+900	58+000	1+100	80 % Weathered Rock, 20 % Hard Rock	High
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

Sn.	Chainage		Length (m)	Soil/Rock Type	Landslide Hazard
	From	To			
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

6.5.1.2 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 m^3 of spoil material will be generated and 633,143 m^3 will be reused whereas 901,765 m^3 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 6-6: Estimated volume of spoil for the disposal

S.N.	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).

6.5.1.3 Landscape disturbance and 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.

6.5.1.4 Quarry and extraction of river bed materials

Boulders gravel and sand 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.

6.5.1.5 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.

6.5.1.6 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.

6.5.2 Impacts at the Operation Stage

6.5.2.1 Increase in Dust and smoke with vehicle movement

The operation of new bridges and roads will generate dust and smoke to the ambient environment due to plying of vehicles. However, the amount of generation of dust from the proposed road will be remarkably less than that of traditional gravel and earthen roads.

6.5.2.2 Impact of Climate Change

Predicted increase in precipitation may cause the water level higher than usual in Trishuli River and its tributaries. Bridge span capacity should be designed taking into account 15-20% increase of the storm water.

6.5.2.3 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.

6.5.2.4 Noise pollution

There is minimum noise source available within the project area and even the implementation of project will not produce remarkable amount of noises in the project area. The movement of vehicle, construction activities will be the major sources of noise during construction.

Sources of noise are not available in the project area; the operation of NNM road and constructed new bridges will produce significant noise, in the project area. The frequent movement of vehicles will be the major sources of noise during operation.

6.5.2.5 Dust and air pollution

During project activities, there is possibility of minimum emission of dusts and smoke. Workers may be affected by dust and smoke from operation of crusher plant, transportation of materials, and operation of heavy equipment. There is a high chance of dust emission due to the construction work during dry season. Dust will also affect the roadside vegetation and local people.

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.

6.6.1.1 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 m^3) 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.

6.6.1.2 Impact 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.

6.6.1.3 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 6-7: List of existing bridges along the NNM highway

S.N.	Name of Bridge	Chainage
1.	Khatripauwa	4+139
2.	NaubiseKhola Bridge	12+449
3.	Ganesh khola Bridge	15+465
4.	SopyangKhola Bridge	17+596
5.	Jugekhola bridge	
6.	Agarakhola	23+380
7.	KhahareKhola	24+876
8.	FediKhola	26+953
9.	DangdungeKhola bridge	27+235
10.	KhesteKhola Bridge	30+665
11.	MachediKhola Bridge	31+984
12.	Gardo Khola Bridge	35+628
13.	JundiKhola Bridge	37+489
14.	CharaundiKhola Bridge	38+988
15.	Belkhukhola Bridge (Photo)	41+303
16.	Pokharekhola Bridge (Photo)	45+655
17.	GalaudiKhola Bridge	48+816
18.	SotiKhola Bridge	50+884
19.	MalekhuKhola 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.	HugdiKhola Bridge	74+206
24.	MowaKhola Bridge (Photo)	78+387
25.	DahakiKhola Bridge	84+844
26.	BargangKhola Bridge	85+775
27.	NagdiKhola Bridge	92+682

Source: Field Survey, 2017

6.6.1.4 Impact due to operation of borrow pits and quarries

Operation of borrows areas and quarries will cause some adverse impacts if left unrehabilitated. 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 6-8: Quarry along NNM

S.N.	Chainage	Clay %	Silt %	Sand %	Gravel %	NMC	SG	MDD	OMC %	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).

6.6.1.5 Impact from Stone Crushing Plants

Operation of Stone crushing plant will have noise pollution at vicinity. Number of crusher plant location 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, school, 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.

6.6.1.6 Health and sanitation chances of increase in transmission of disease form outside work force

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. *The impact from unawareness on camp sanitation by the labour will be low in magnitude, local and short term in nature.*

6.6.1.7 Traffic safety and traffic movement

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 close to the existing highway. *These impacts will be direct, high significance, local, and short-term in nature.*

6.6.1.8 Occupational health and safety for bridge construction work

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 arerespiratory 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 diarrhoea, dysentery and cholera.

6.6.1.8.1.1 Safety of pedestrians with the plying of vehicles

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

6.6.1.8.1.2 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.

6.6.1.8.1.3 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.

6.6.1.8.1.4 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.

6.6.1.8.1.5 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 (ESS-5)

ESS-5 highlights several generic risks, including land use change and land acquisition, including forest land and economic displacement, land use change and economic displacement could have substantial impact on communities during construction and need special mitigation measures.

6.7.1 Impacts at Construction Stage

6.7.1.1 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.

6.7.1.2 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.

6.7.1.3 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.

6.7.1.4 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 compensation of impact will be covered by the same resettlement policy framework with replacement cost. The procedure for construction induced impacts will be followed by: inventory, assessment and measurement, CDC meeting with determination of compensation replacement value.

6.7.1.5 Severely Project Affected Households

Out of total project affected HHs (78), 57 of them belong to severely project affected HHs[17]. Out of these severely project affected HHs, 34 HHs are likely to be affected by losing residence cum trade and remaining 23 households are likely to be affected by losing their residences along the NNM road alignment. Out of these severely project affected HHs (57), 42.11% belong to Brahmins followed by Janajati(IP) (40.35%), Chhetri (12.28%), Dalit (3.31%) and Muslims (1.75%).

[17] Severely project affected HHs include HHs losing private residence and residence + trade in NNM project context.

6.7.1.6 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.

6.7.1.7 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.

6.7.1.8 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.

6.7.1.9 Acquisition of land and structures for four new bridges

About 0.32 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 Chiraudikhola, 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.

6.7.1.10 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.

6.7.1.11 Disturbance in movement of local inhabitants

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

6.7.1.12 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, population growth and development already impacted the

wildlife and biodiversity in the project area. During ESIA study no critical habitat or other sensitive biodiversity receptors were found. Although vegetation clearing along ROW and bridge updates and construction will impact forest and aquatic habitats, but effect of impact is expected to be moderate. It is known from secondary sources and local stakeholders' reports about presence of some threatened and endangered wildlife species along the road corridor, but there is no specific information about their habitats, which need protection. It is expected that in the sections of road with low human population density could be movement corridors; but they are not detected either on literature sources or during ESIA surveys. 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

6.8.1.1 Construction serve as barrier to movement of migratory aquatic species

The construction of bridge foundation will 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.

6.8.1.2 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.

6.8.1.3 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.

6.8.1.4 Degradation in fish population due to construction workers involve in fishing

There will be degradation in the fish population if the construction workers 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

6.8.2.1 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.

6.8.2.2 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. Theirspawing 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)

ESS-7 in current project requires Free prior and Informed Consent (FPIC). However, the project will not impact the indigenous peoples, their traditional culture, land resources and territories. Therefore, it does not require to adopt the FPIC process.

6.9.1 Project Affected Vulnerable Houses

Out of total project affected HHs (78), 10 HHs belong to vulnerable HHs[18]. They are likely to be affected by losing their residences along the NNM road alignment. Out of these vulnerable HHs (10), 40% belong to indigenous people (IP) followed by Janajatis (30%), Dalits (20%) and Chhetri (10%). 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 NNM project context. No any adverse impacts are likely to occur in cultural heritages (tangible and intangibles) and natural resources and territories of IPs along the NNM road corridor. No FPIC is required to be obtained**.**

6.10 Cultural Heritage (ESS-8)

ESS-8 covers tangible and intangible heritage in the project area. There is no tangible heritage of archaeological and historical importance along the road, which might be directly impacted. The effect on intangible heritage will be also very low.

[18] Vulnerable groups include Janajatis (IPs), Dalits and women headed HHs in NNM project context.

7 Chapter 7: Environmental and Social Management Measures

The road improvement works will be donewithin the ROW. Mitigation measures include restitution for evaluated risks and impacts based on the mitigation hierarchy (MH) (**Figure 7-1**).

Figure 7-1: 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", Goodconstruction practices, Timing of construction, 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 plan, establishment of nurseries

7.2 Plan for Beneficial Impact Augmentation Measures

The following matrix presents Environmental and Social Management Plan for augmentation measures for the beneficial impactsundertaken (**Error! Reference source not found.2**).

Table 7-1: 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	Siie 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
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

Activities/ Impact/ Issue	Augmentation and enhancement measures	Responsible agency	Verification method
Operation phase			
Physical environment			
Improved road maintenance	Upgraded bio-engineering structure, stabilized slopes	Construction contractor, Proponent – DCID, DOR	Site visit and monitoring, interactions with local stakeholders
Improved transportation and transport efficiency	Smooth transport operations, established road furniture in place	Construction contractor, Proponent – DCID, DOR	Site visits, monitoring, interactions with locals
Improved access to services	Maintenance and operations of service centres, toilets, etc.	Construction contractor, Proponent – DCID, DOR	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 7-2: 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 Implementation and monitoring Proper restoration of affected landscape
Landscape aesthetic	Flora & Fauna and Local community	Along NNM, disturbed sites	Develop a stockpiling and excavation management plan to minimize effect during construction and rehabilitate landscape after construction. Provide plan for the recovery of vegetation. Proper relocation and restoration of all affected utilities taking the community into confidence with meaningful consultation.
Worker accommodations	Labour campsites Local community	Campsites and construction sites	• Labour camp management plan in compliance with prevailing labour act/ regulation and ESS of WB. • Develop on-site camps • Require compliance with WBG guidance on Worker Accommodations Require compliance with WBG guidance on Worker Accommodations for EPC and contracted workers
Child and Forced Labour	Children under 14-years old Laborers Construction and labour campsites Local community	Campsites and construction sites	• Provision in EPC contract prohibiting child labour in compliance with the Act related to Children (2075), • Labour Management Procedure (LMP) in place. • Code of Conduct (CoC) for workers. • Information dissemination on avoidance of child and forced labourers
Construction Stage			
Greenhouse Gas (GHG) Emission	Local communities and biodiversity Passengers and other road users Road officials	Along NNM	Recommendations for fuel efficient machinery Carbon offset by planting trees Prevent activities that increase GHG emissions
Impact on fish population	Commonly available *Caprinidae*(such as silver carp) species	Perennial Water-bodies along the NNM where bridge construction and improvement is planned	As far as possible construction activities will be avoided during migration period (May to August). Prohibit using dynamite or other hazardous chemicals by labourers to kill fish along entire stretch of NNM road.
Disturbance and	Wildlife	Around camp-sites	• Instructions and orientation to workers;

Generic risks and impacts	Sensitive receptors	Location (Chainage)	Mitigation measures for generic risks and impacts
poaching wildlife	Local communities		• 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 signs in appropriate locations; awareness to the drivers. Boards with monkeys and other animals.
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

Generic risks and impacts	Sensitive receptors	Location (Chainage)	Mitigation measures for generic risks and impacts
			• Worker Code of Conduct to avoid issues of GBV Action Plan • Establish compliant mechanisms.
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.)	• 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.
Hazardous Materials	Local communities Biological environment	Construction sites, storage yards	Develop chemical management plan prior to construction including handling and disposal of hazardous chemical and waste
Land use change and loss of productive topsoil	Local communities Biodiversity (threat of invasive plant species exposure)	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

Generic risks and impacts	Sensitive receptors	Location (Chainage)	Mitigation measures for generic risks and impacts
	Forest and water-users and farmers Local entrepreneurs		
Free Prior and Informed Consent (FPIC)	Group of indigenous people from local communities	N/A	• Assessment of ESS-7 provisions and field findings conformed that, there will not be significant impact on land and natural resources, living conditions and cultural identities of the indigenous people during this project cycle. The FPIC is not triggered.
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			
Greenhouse Gas (GHG) Emission	Local communities and biodiversity Passengers and other road users Road officials	Along NNM	Recommendations for fuel efficient machinery Carbon offset by planting trees Prevent activities that enhance GHG emissions
Disturbance and poaching wildlife	Wildlife Local communities Animals, attracted to roads (monkeys, cats, mongoose, etc.)	Around NNM	Instructions for workers, control by mangers, awareness and distributed printed materials about rules and regulations. Enforcement and control; Anti-poaching regulations; Awareness campaigns; Planning of rural development
During project cycle			
Cumulative Impacts	Ecosystem services and land use Forest and aquatic habitats, wildlife movement corridors Human well-being, residential areas	Along NNM	Planning of human development and land use Coordinated development projects Cooperation and information dissemination among interested stakeholders about climate change
Air pollution	Flora & Fauna Ecosystem services Local communities	Along NNM	Avoiding operation of drill machines, excavators, loading and unloading of waste materials during wind. Dust masks available to labour workers, sprinkling of water along the dusty road during road excavation twice a day. Avoided direct disposal of effluent from batching plant. Develop an Air Quality Management Plan to minimize vehicle emissions and manage fugitive dust.
Air pollution	Forest habitat; wildlife and biodiversity Ecosystem services	Along NNM	Develop an Air Quality Management Plan to minimize gen set/vehicle/equipment emissions and manage fugitive dust. Avoiding operation of drill machines, excavators, loading and unloading

Generic risks and impacts	Sensitive receptors	Location (Chainage)	Mitigation measures for generic risks and impacts
	Local communities		of waste materials during wind. Dust masks available to labour workers, sprinkling of water along the dusty road during road excavation twice a day. Avoided direct disposal of effluent from batching plant.
Noise pollution	Flora & Fauna Local communities Road users Road labours and other workers	Along NNM	Develop a Noise Management Plan with compliance with OHS. Barricade of construction area, provided operational schedule to local inhabitants. Monitoring noise level maintained at national standard
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
Traffic and Road Safety	Motorists and pedestrians Local community Wildlife Travelling passengers Project labourers and road workers (operations and maintenance)	Major settlements at strategic alignments. Local roads (primary supply sites and labour camp sites) Major market and business centres along the road alignment.	• 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.
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	• 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,

Generic risks and impacts	Sensitive receptors	Location (Chainage)	Mitigation measures for generic risks and impacts
			contracted workers, and supply chain workers.
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. Economic diversification programs. Identify and evaluate Project effects on ecosystem services and develop mitigation measures for any significant impacts
Gender Based Violence (GBV)	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. 9.1

Table 7-3: Matrix of 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 as Krishnabhir (69+000), Jogimara (75+500), between PhurkeKhola and Malekhu (54+500) and in other locations, which were stabilized, but can be disturbed during improvement work	Avoided haphazard excavation of slopes. Benching of slopes and excavation in piece-meal applied along the steep slope area. Management of existing natural drainage. Bioengineering and slope protection work, established engineering structures. Contractor will obey IFC EHS General Guidelines 2007 and IFC EHS Guideline for Toll Roads 2007.

Site-specific risks and impacts	Sensitive receptors	Location (Chainage)	Site-specific mitigation measures
Impact on Forest habitat, including Acquisition of forest land	Wildlife Local communities CFUGs	52 trees[19] and 2253 poles along the ROW will be cut down, mostly in the community forests.	Compensatory plantation of 25 saplings for each felled tree; selection of native trees, establishment of nurseries
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 Upland and low land	• **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.	• Compensation for the land to be acquainted. • Prepare and implement Resettlement Action Plan (RAP) • Acquire land in accordance with national legislation and complying with World Bank standards and guidelines.
Loss of productive 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	Along the Naubise-Mugling road section. **Settlements:** Dharke, Jugekhula, Belkhu, Benighat, Charaudi, and Chumlingtar	• Accurate delineation of land needed for construction, preservation of land and soil outside of ROW. • Compensation for both land and crops.
Loss of private structures	68 households are likely to lose 76 privatestructures (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;	• Resettlement, rehabilitation and compensation. • Prepare and implement Resettlement Action Plan (RAP) in accordance with international standards

[19] The number of trees may be increased 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
		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.	
Project Affected vulnerable HHs	• Out of 78 project affected HHs, 10 HHs belong to vulnerable category. • Out of total vulnerable HHs (10), 4 HHs belong to Chepangs (IPs) and women headed HHs and 2 HHs comprise Dalits. • Out of total women headed HHs(4), 3 belong to Brahmins and 1 belongs to Chhetri.	• **Locations:**Machhedikhola, Gomatikhola, Hugdi and Kuringhat • **Chainages:** 19+500, 550; 25+00; 50+100; 61+900; 62+100 and 73+540.	• Compensation • Relocation, rehabilitation and restoration. • Prepare and implement VCDP to such project affected vulnerable HHs including the women of project affected HHs.

Site-specific risks and impacts	Sensitive receptors	Location (Chainage)	Site-specific mitigation measures
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.	**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.	• Relocation, rehabilitation and restoration.
	• 1161 electric poles are likely to be affected.	**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.	Electric poles to be relocated.
	• 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: 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.	Compensation, rehabilitation and relocation.
Construction Stage			
Disposal of spoil (blockage of natural drainage systems, loss of organic fertile top soil and farmlands, loss of crops and forest, and water	Natural drainage systems Fertile topsoil Farmlands, crops, forest	Shown in map	Excavated spoil and other construction materials disposed at identified spoil disposal site. Haphazard disposal of spoil will be avoided

Site-specific risks and impacts	Sensitive receptors	Location (Chainage)	Site-specific mitigation measures
logging.			
Obstruction to natural drainage pattern due to excavation of large quantities of aggregates for construction	Natural drainage Aquatic wildlife Fish	Trishuli river and other large rivers, serving as source of construction materials for local economy	Defined legal sites for excavation of sand, gravel and aggregates. Use materials only from legal sites and plants with licenses on extraction of construction materials. This will be spelled out in the bidding documents, in work contracts and will be verified in the C-ESMP prepared by the Contractors freviewed by the CSC and approved by the DoR-DCID and the Bank.
Haphazard disposal of spoil and other construction materials	Natural drainage Aquatic wildlife	Rivers and rivulets Area around bridges Streams and brooks	Excavated spoil and other construction materials disposed at identified spoil disposal sites. Haphazard disposal of spoil will be avoided. Preparation of Spoil disposal management plan.
Pollution of Water Resources: Degradation of water quality	Fish and other aquatic life Local community (drinking water) Water quality Wildlife	Mahesh khola, and Trishuli River	Use water only if ample source of water supply existes within construction area; or buying water required for the construction. Existing water sources and supply system will not be affected. Acquired consent with the locals in order to use available water sources.
Impact due to operation of borrow pits and quarries	Local communities, including children Project labours Wildlife	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).	Avoided haphazard quarry along the riverbank and hills. Permanent barricade at quarry location for safety, established safety signage boards, and installed noise barrier. Prepared borrow pit operation plan and obtained approval from supervision engineers prior to operation of quarry.
Impact from Stone Crushing Plants producing dust, air, noise pollution and causing adverse impact at the vicinity	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 and avoid establishment of operation near schools and settlements.
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.

Site-specific risks and impacts	Sensitive receptors	Location (Chainage)	Site-specific mitigation measures
Traffic safety	Local communities in urban centres	Galchi – more chanaige for various locations	Construction of overbridge and foot-trails for local community
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 Belkhukhola at Adamghat vegetated area of 850 meters, 1300m at Phurkekhola 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
Traffic safety	Local communities in urban centres	Urban centres (add chainage for each place)	Better signage and road furniture with universal access
Management of forest nurseries and road arboriculture	CFUGs Local communities Road maintenance workers	Define places in accordance with plan	Maintenance of nurseries and road-side vegetation

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. Labour 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 note by IFC and the EBRD for the establishment of constructed related camps for labour and engineers.

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.

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 CCTV for regular monitoring and will maintain safety along the road alignment.

Table 7-4: ESMP-NNM

Sn.	Activities/ Issue	Location/s	Impact	Mitigation Measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
						Implementation	Monitoring			
Preconstruction Phase (Physical Environment)										
(i)	Land and vegetation clearance		Loss of vegetation and physical structures	-Compensation - Plant of nurseries		DCID-DOR, Construction contractor	DoR, Development Cooperation Implementation Divisions (DCID), Construction Supervision Consultant (CSC), GESU-DoR	Site visit	Resettlement Action Plan; forest clearance certificate.	Once in every 6 month
(ii)	Review of EMAP	-	-	-	-	DCID-DOR, Construction contractor	DoR, DCID, Construction Supervision Consultant (CSC) GESU-DoR	Review of EMAP prepared by Construction contractor	EMAP prepared by contractors for every package prior to construction	Every month after award of contract
(iii)	Review of access roads		Likely affected during construction	Plan for providing access to locals and immediate impact receptors.		DCID-DOR, Construction contractor	DoR, DCID, CSC, GESU-DoR	Construction Survey and review of ESIA and RAP.	Plan of access to existing link roads and adjacent settlements mentioned in bidding document.	Every month after award of contract
(iv)	Erosion control	Identified vulnerable areas and new landslide areas during excavation	Direct disposal, loss of life and property.	Erosion control measures		Construction contractor	DoR, DCID, CSC, GESU-DoR	Contractor's construction methodology for the excavation for opening new proposed alignments	Plan for erosion control	Every month

		of new roads								
(v)	Establishment of camps	Proposed sites	-	-	-	Construction contractor	DoR, DCID, CSC, GESU-DoR	Visit proposed camp sites, observation and photographs	Review ESMP and camp management plan of contractor	Every month
(vi)	Traffic Management	Along the existing roads and highway	-	-	-	Construction contractor	DoR, DCID, CSC, GESU-DoR	Review of Traffic management plan of construction contractor	Traffic management plan prepared by construction contractor in place	Every month
(vii)	Waste Management	Along the ROW	-Health issue -Pollution -Aesthetics	- Selection of sites -Instruction of labours -Managers training		Construction contractor	DoR, DCID, CSC, GESU-DoR	Field visit	Grievances from the local people.	Monthly
(viii)	Environment responsible procurement	-	-	-	-	DOR-DCID, CSC, Construction contractor	DoR, DCID, CSC, GESU-DoR	Review of tender document / BOQ	Ensure all the environment and social requirements are included in tender documents.	Monthly
(ix)	Orientation to construction contractor to address mitigation measures	-	-	-	-	DOR-DCID, project office, CSC	DoR, DCID, CSC, GESU-DoR	Review of BOQ, kick off meeting, review meetings, construction survey and EMAP from contractor's side	Mitigation measures in BOQ items, and orientation provided to contractors	Weekly
10.1.2	**Construction Phase (Physical Environment)**									
(x)	Relocation of public utilities	Along the alignment	Disruption in existing services at	Proper relocation and restoration of		Construction contractor	DoR-DCID, CSC, GESU-DoR	Site visits and observation	Planning for the relocation, respective	Monthly

			local level.	all affected utilities by the contractor.					authority consulted, acquired approval for shifting	
(xi)	Excavation and widening of existing NNM (with standard unit)	Within the 50-meter ROW along the existing NNM	Minor change in land use along the existing NNM.	Land only within the ROW will be acquired for improvement and upgrading; land acquired temporary will be rehabilitated after completion of construction. Contractor will obey IFC EHS General Guidelines 2007 and IFC EHS Guideline for Toll Roads 2007.		Construction contractor	DoR- DCID Construction and Supervision Consultant, GESU	Site visit and observation	Excavation Methodology in place	Monthly
(xii)	Excavation of hill slopes	Krishabhir, Jogimara, Simle, Belkhu, Adamghat, Phurkekhola -Dhading bridge junction, Huilingtar, Phisling,	Landslides, Slope Destabilization and Soil Erosion	Avoided haphazard excavation of slopes. Benching of slopes and excavation in piece-meal applied along the steep slope area.		Construction contractor	DoR-DCID, CSC, GESU	Site visit and observation	Excavation methodology, Slope stability and handling of excavated materials.	Monthly

		Chumlingtar ,Chumkhola , Kurintar to Mugling.		Management of existing natural drainage. Bioengineering and slope protection work, established engineering structures. Contractor will obey IFC EHS General Guidelines 2007 and IFC EHS Guideline for Toll Roads 2007.						
(xiii)	Disposal of spoil	Valley side of the road all along the alignment.	During site clearance, excavation in slopes estimated in 354,957.00 cu. m. of spoil materials	Excavated spoil and other construction materials disposed at identified spoil disposal site. Haphazard disposal of spoil will be avoided		Construction contractor	DoR-DCID, Construction and Supervision Consultant, GESU	Site visit, observation, and interview with locals	Identified disposal area; disposal area boundary maintained; landscaping and rehabilitation	Weekly
(xiv)	Disposal of excavated waste including safe disposal hazardous materials	Natural drainages along the existing NNM	Obstruction to natural drainage pattern	Avoided haphazard disposal of spoil. Labour camps will not be established close to natural		Construction contractor	DoR- DCID, Construction and Supervision Consultant, GESU	Site visit and observation	Haphazard disposal of spoil; disposal practices and plan	Weekly

				drainage and avoided direct disposal of any wastes.						
(xv)	Disposal chemical wastes, etc. into water bodies.	Along the existing Trishuli and Mahesh Khola and other water supply pipelines along the NNM.	Pollution of water resources	Use water only if ample source of water supply exists within construction area; or buying water required for the construction. Existing water sources and supply system will not be affected. Acquired consent with the locals in order to use available water sources.		Construction contractor	DoR- DCID, Construction and Supervision Consultant, GESU	Site visit, observation and test of river water quality	Test results of water quality parameters.	Weekly site visit and observation/water quality test in every six months.
(xvi)	Operation of borrow pits and quarries	Designated locations as mentioned in ESIA and approved sites	Disturbance to landscape, air and noise, accidents, ponding, increase of sedimentatio n level etc. with the operation.	Avoided haphazard quarry along the riverbank and hills. Permanent barricade at quarry location for safety, take materials from approved quarry side,		Construction contractor	DoR-DCID, Construction and Supervision Consultant, GESU	Site visit, observation and interview with locals	Borrow pits and quarry site operational plan in place; approval from engineers.	Weekly

				established safety signage boards, and installed noise barrier. Prepared borrow pit operation plan and obtained approval from supervision engineers prior to operation of quarry.						
(xvii)	Operation of stone crushing	Designated locations as mentioned in ESIA and approved sites	Dust, air and noise. Likely accident.	Avoided establishment of operation near schools and settlements.	-	Construction contractor	DoR, DCID, CSC, GESU	Site visit and observation	Operational Plans in place prior to operation and operated accordingly.	Weekly
(xviii)	Stockpiling and transportation of construction materials	Proposed stock piling area.	Dust emission, washout affect to downhill to the Trishuli, cultivated, and discomfort to locals.	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.		Construction contractor	DoR, DCID, Construction and Supervision Consultant, GESU	Site visit and observation	Grievances and complain from locals; ambient air quality adjacent to storage and construction sites.	Weekly
(xix)	Road excavation, construction activities, operation	Especially at Crusher plant,	Air pollution	Avoiding operation of drill machines,		Construction contractor	DoR, DCID, Construction and Supervision	Site visit and observation	Air quality parameters discussed above.	Quarterly during road width excavation.

	of dump trucks, etc.	batching plant sites, School, urban and settlement areas		excavators, loading and unloading of waste materials during wind. Dust masks available to labour workers, sprinkling of water along the dusty road during road excavation twice a day. Avoided direct disposal of effluent from batching plant.			Consultant, GESU			
(xx)	Use of chemicals	Campsite, workshops, natural drainage along the alignment.	Land and water pollution. Chemical hazards	Handling chemicals properly. Storage of chemicals 100 meters away from any water sources. Spillage kit in place at the construction site.		Construction contractor	DoR, DCID, Construction and Supervision Consultant, GESU	Site visit and observation, water quality of Trishuli river and tributaries lab test	List of chemicals, storage, and handling practice. Accident records; spillage of chemicals and surface and ground water contamination	Monthly
(xxi)	Disturbance due to excavation with the widening of existing highway, operation of camps	School, health posts,hotels, shops, resorts	Noise pollution	Barricade of construction area, provided operational schedule to		Construction contractor	DoR-DCID, Construction and Supervision Consultant, GESU	Site visit and observation	Regular monitoring of noise level records.	Monthly

	and other activities	situated all along the highway, settlements		local inhabitants. Monitoring noise level maintained at national standard.						
(xxii)	Operation of construction vehicles, excavation etc.	Naubise, Baireni, Pida, Gajuri, Malekhu, Benighat, Jogimara and Darechowk, etc.	Road safety	Installed safety signage boards, barricades, provide PPEs to all labour workers, managed local traffic avoiding disturbances, informed and aware locals, provided on job trainings to labours.		Construction contractor	DoR- DCID, Construction and Supervision Consultant, GESU	Site visit and observation	Accident records, safety application and facilities maintained.	Weekly
(xxiii)	Construction safety of labourer with man/days		Occupational health and safety of labourer and accident	Installed safety signage boards, barricades along the construction sites, provided PPEs to all labour workers, managed local traffic, aware and informed locals,	Included in BOQ	Construction contractor	DoR, DCID, Construction and Supervision Consultant, GESU	Site visit and observation	Group insurance of worker, all time available of PPEs to workers and engineers.	Weekly

				provided on job trainings						
(xxiv)	Physical cultural structures		Loss of physical cultural structures	Relocation of physical cultural structures		Construction contractor	DoR-DCID, CSC, GESU	Site visit and observation	Rehabilitation of affected physical cultural structures, grievances from locals.	Monthly
(xxv)	Establishment of camps(work camp sites and labor camps)		Waste and health hazards, degradation of land, streams and rivers	Prepared camp management plan prior to start of work, provided all required facilities at camp sites which will maintain health and hygiene of labour, installed temporary toilets, supply potable water, etc.		Construction contractor	DoR-DCID, Construction and Supervision Consultant, GESU	Site visit and observation	Operational Plans in place prior to operation and operated accordingly.	Monthly
(xxvi)	Change in land-use, loss of productive topsoil	Along the ROW and in DIA	-Impact on agro-production, loss of vegetation and forest	Preservation of topsoil and rehabilitation after construction; re-plantation, selected construction time to avoid severe impact on agriculture		Construction contractor	DoR-DCID, Construction and Supervision Consultant, GESU	Site visit and observation	Top soil preservation practice and overlaying of top soil during backfilling.	After construction

(xxvii)	**Operation and maintenance Phase (NNM: Physical Environment)**									
(xxviii)	Instability of the hill slopes	Krishabhir, Jogimara, Simle, BelkhuKhola, Adamghat, Phurkekhola -Dhading bridge junction, Huilingtar, Phisling, Chumlingtar, Chumkhola, Kurintar to Mugling.	Destabilization of slopes	Bio-engineering and slope protection works	-	Construction contractor	DoR-DCID, Construction and Supervision Consultant, GESU	Site visit and observation	Soil erosion, condition of structures applied for slope stability.	Monthly
(xxix)	Impacts due to Poor Drainage	Natural drainages	Flooding Soil erosion Change in hydrology sedimentation	Proper drainage structures, management of flow, management of garbage and debris	-	Construction contractor during DLP, DOR-DCID, DOR project office and DOR-GESU	DoR-DCID, Construction and Supervision Consultant, GESU	Site visit and observation	Roadside drainage discharge locations, water-pounding area during rain.	Monthly
(xxx)	Air and Noise Pollution	Along the alignment	Health problem of locals and road users	Installation of traffic signals with no horn, speed control and monitoring, establishment of vehicle emission test facility at Nagdhunga		Construction contractor, DOR-DCID, project office,	DoR, DCID, Construction and Supervision Consultant, GESU	Site visit and observation	Grievances by locals, number of patient in local health posts, record of death due to air and noise along the alignment.	Monthly

				and Mugling.						
(xxxi)	Traffic safety and accident records	Along the highway, especially at urban areas.	Accident frequency, human health, loss of property and assets	Establishment of traffic signals, GPS tracking for speed control for public buses plying the highway.		Construction contractor, DOR-DCID, project office	DoR-DCID, Construction and Supervision Consultant, GESU	Site visit and observation	Accident records; and grievances registered along the thealignemt.	Monthly
(xxxii)	Waste Management	Along the highway drain, in urban areas	Waste, health and hygiene to locals and road users.	Waste management, coordination with local municipality.		Construction contractor ,Municipality, Ward office	DoR, DCID, CSC, GESU	Site visit and observation	Record of blockage of drain due to solid waste; waste disposal practices at local level.	Monthly
	Preconstruction Phase (NNM Biological Environment)									
(xxxiii)	Tree felling	CF, RF, LF	Loss of trees of different species and vegetation, and change	Compensatory plantation of 25 saplings for each felled tree; selection of native trees, establishment of nurseries	Included in BOQ/EIA	Construction contractor DFOs, CFUGs, DoR-DCID	DoR, DCID, Project Construction and Supervision Consultant (CSC)	Site visit, tree markings of affected trees in coordination with concern authority	Compensatory plantation plan is in place prior to felling of affected trees and forest clearance certificate acquired.	Prior to construction
	Construction Phase (NNM Biological Environment)									
(xxxiv)	Clearing of forest, loss of vegetation and grazing area		Loss of trees and vegetation, disturbance	Replantation, compensation to the CFUG; providing incentives to use biogas and other alternative sources of energy		Construction contractor in coordination with CFUG, DFOs and DoR-DCID project office	DoR, DCID, Construction & Supervision Consultant (CSC), GESU-DoR	Site visits and observation	Forest clearance certificate acquired; felling of marked trees only.	During and after construction (quarterly)

(xxxv)	Disturbancein wildlife activities		Felling of tress	Instructions for workers, control by mangers, awareness and distributed printed materials about rules and regulations	-	Construction contractor, DoR-DCID project office	CSC; DFO, DoR-DCID	Field visits, Review of grievances recorded, observation at campsites.	Grievances received from locals	One time a week
(xxxvi)	Use of forest products by construction workers	In proximity of labour camps	Loss of forest products and NTFP	Instruction of workers before construction Control from management team Alternative energy sources and food	-	Construction contractor	DoR-DCID, Construction and Supervision Consultant	Observation and interaction with locals	Grievances received from locals; use of fuelwood in campsites and in other construction activities.	Weekly
(xxxvii)	Minor impacts on reptiles and fish species	Near new bridges and in proximity of natural habitats	Loss of species; impoverishment of aquatic habitats	Culverts; avoiding of construction in the fish breeding season; Avoiding pollution of water-courses	-	Construction contractor	DoR, DCID, Construction and Supervision Consultant	Observation and interaction with locals	Grievances received from locals.	Before and after construction
	Operation Phase (NNM Biological Environment)									
(xxxviii	Possible extraction of fire-wood and timber	Around settlements due to improved accessibility	Loss of forest species and NTFPs	Engagement of CFUGs in forest management; awareness materials; regular control of the area; alternative	-	Construction contractor, CSC, DFO, CFUGs, DoR-DCID	DoR-DCID; GESU-DoR, DFO	Observation and interaction with locals and affected people.	Use of fuelwoods by locals nearby; Produced and distributed awareness materials	After construction

				sources of energy						
	Preconstruction Phase (NNM Socio-economic and Cultural Environment)									
(xxxix)	Loss of private property and assets	Nagdhunga, Baadbjagyang, Chisapani, Piplmod, Khatripauwa, Kanakot, Khanikhola, Naubise etc.	Loss of assets, loss of income, businesses, effect of livelihood	Compensation Resettlements Alternative livelihood sources		DoR-DCID, project office, CSC, construction contractor	DoR-DCID, Construction and Supervision Consultant	RAP	Procedures regarding land acquisition and compensation have been properly set out and followed; preparation of RAP and VCDP, Infrastructures inventory.	Before construction and implementation of project
(xl)	Grievance raised by locals and workers	Along the road	Delay of construction or hampering of work	Grievance readdress mechanism; community consultation;	-	DoR-DCID, project office, CSC, construction contractor	DoR-DCID, GESU	Minutes of meetings; number of grievance applications	GRC in place	Responding to applications weekly
	Construction Phase (NNM Socio-economic and Cultural Environment)									
(xli)	Destruction and damage of community structures and cultural monuments			Replacement and restore of structures		Construction contractor, DoR-DCID project office	DoR-DCID, GESU	Field visits and assessment	Relocation status and condition	During construction
(xlii)	Livelihood issues			Replacement and providing specific area for businesses		DoR-DCID, project office, CSC, construction contractor	DoR, DCID, GESU	Field visits, interview and verification	Livelihood of affected people and living standard	During construction
(xliii)	Conflict with nearby host community		Disputes in community, social disorder	Security, instruction of construction workers, supervising and control by management team		Construction contractor	DoR-DCID, GESU	Protocols of each event	Grievance records, records of conflice and brawls	During construction

(xliv)	Gender based violence and human trafficking			Awareness about the situation to contractor workers, special instructions		DoR-DCID project office, Construction and Supervision Consultant, construction contractor	DoR-DCID, GESU	RAP, minutes of community meeting	Living status of Indigenous community due to implementation of project	During construction
(xlv)	HIV/AIDS and other diseases	Along the road	Human health, safety and community	Awareness program, instructions relevant to water and waste management, frequent health check of camp		DoR-DCID project office and construction contractor	DoR-DCID, GESU	Number of awareness programs and events	Regular health checkup records of workers and engineers.	Once in every Six month.
	Operation Phase (NNM Socio-economic and Cultural Environment)									
(xlvi)	Ribbon development, settlement and market places	Along the road	Pressure in community infra-structure, safety	Planning of new economic initiatives for local communities (service centres, etc.)		Local government, DoR-DCID	DoR-DCID, GESU	Proper planning	Development of shops and market places.	After construction
(xlvii)	Increase in accidents		Safety and health, loss of assets	Regulations, awareness and road infrastructure (lights, signs, zebra, etc.) and adaptive management		DoR-DCID, division road office	DoR-DCID, division road office, traffic police	Accident monitoring database	Accident records with police authority, Greivances etc.	After construction
(xlviii)	Increase in sell and use of alcohol products		Human health and well-being, accidents,	Stricter regulations, control of alcohol sale,		Municipality and central government	Municipality and central government, other NGOs	Observation and interview, communication	Comparision of availability of alcoholic products in	After construction

			violence	prohibition of alcohol advertisement on roads					shops and market area before and after implementation of project.	
(xlix)	Trafficking	Along the road especially at urban areas along the road	Human health, well-being, violence, accidents	Awareness campaigns, creation of jobs for girls and women, vocational training for women, etc.		Municipality and central government	NGOs, clubs, women groups	Number of campaigns and awareness programs, etc.		After construction
(l)	Migration and immigration	Along the road	Pressure in urban and market area, wellbeing	Integrated planning of development		Municipality and central government	Local and central government	Statistic data	Inflow of population within and close to highway	Before and after construction
(li)	HIV/AIDS and other diseases	Along the road	Health, well-being, community life	Awareness campaigns, regular health camp operations		Municipality and central government , community based organizations	Health organizations	Statistic data, number of campaigns	Records at Health Institutions.	Before and after construction

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

Table 7-5: Estimated cost for ESMP and RAP

S.N.	Particulars	Total Cost
1.	Cost of compensatory plantation and nursery establishment and trainings	22,175,113
2.	Relocation of electric poles	67,550,000
3.	Relocation of water supply pipes	1,862,400
5.	Bioengineering	49,219,137
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.	Income generation trainings focusing indigenous/vulnerable groups	600,000
8.	Compensation and resettlement costs	226,786,077
Total Environmental and Social Mitigation Cost		369,092,726

8 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 consideredwith 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 adjusted 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 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 consultationswere 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. Dataof 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 focuses 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 8-1**.

Table 8-1: 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 curvement 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 curvement 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 8-2**.

Table 8-2: 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 KhaniKhola • 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 KhaniKhola • 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 SisneKhola 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 SisneKhola 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 – Benighatto 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 2 lane new Road from SisneKhola to Dharke	• No new alignment • Tunnel 1 = 100m Cut&Cover, Tunnel 2 = 410m • Bypass 1 = 770m KhaniKhola, Bypass 2 = 596m, Naubise			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			
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

Alternative 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 requiredin 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 NisakotCF area; the area is situated with the first 5 km along the proposed alignment from Sisnekhola.

Alternative 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 hasmoderate impact on environment and also can meet the traffic demand as therefore was considered the best option.

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.

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

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

This Environmental and Social Commitment Plan (ESCP) sets out a summary of the material measures and actions. The ESCP refers to specific plans or other documents, whether they have already been prepared or are to be developed, 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 GoN of Nepal is planning to upgrade of Naghdhunga-Naubise-Mugling (NNM) Road section through Ministry Physical Infrastructure and Transport (MoPIT), Department of Roads (DOR) and Development Cooperation Implementation Division (DCID).
ii. MOPIT will implement material measures and actions through DOR-DCID so that the Project is implemented in accordance with the World Bank's Environmental and Social Standards (ESSs) under the World Bank's Environmental and Social Framework (ESF). This Environmental and Social Commitment Plan (ESCP) sets out a summary of the material measures and actions.
iii. The ESCP requires compliance with all provisions of such plans or other documents. In particular, the ESCP requires compliance with the provisions set out in the environmental impact assessments, Stakeholder Engagement Plan, Labour Management Procedures, Gender Action Plan with details of gender based violence, Resettlement Action Plan and Vulnerable Community Development Plan as identified and developed for the Project.
iv. The ESCP summarizes the material measures and actions that are required, as well as the timing of the material measures and actions. The MoPIT is responsible for compliance with all requirements of the ESCP during implementation of specific measures and actions are conducted by the DOR-DCID.
v. Implementation of the material measures and actions set out in this ESCP will be monitored and reported to the World 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.

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

Out of the 10 standards, the ESS 9- Financial Intermediation is not applicable for the upgrading of NNM road under SRCTIP project.

The ESS 1(Assessment and Management of Environmental and Social Risks and Impacts) comprise of the organizational structure, environment and social assessment, management tools and instruments, management of contractors,permit, consents and authorizations and third party monitoring. The ESS 2(Labour and Working Conditions) comprise of the labour management procedures,grievance mechanism for project workers, OHS measures, emergency preparedness and response and training to project workers. The ESS 3(Resource Efficiency and Pollution Prevention and Management) consist of management of waste and hazardous materials and management of air, noise and water pollution. The ESS 4(Community Health and Safety) includes the traffic and road safety, community health and safety, gender-based violence and social risk, gender-based violence and social risk during project implementation, emergency response measures, mechanism for the security personnel and training for the local community.

The ESS 5(Land Acquisition, Restrictions on Land Use and Involuntary Resettlement) includes land acquisition and resettlement, resettlement plans, monitoring and reporting and grievance mechanism. The ESS 6(Biodiversity Conservation and Sustainable Management of Living Natural Resources) comprise of biodiversity risks and impacts and impact to forest and water resources The ESS 7(Indigenous People) comprise of the indigenous peoples present to project area and their plan as well as grievance mechanism. The ESS 8(Cultural Heritage) comprise of the cultural heritages present at the project areas and the any chance find cases to the cultural heritages The ESS 10(Stakeholder Engagement and Information Disclosure) includes preparation and implementation of stakeholder engagement plan and details of project grievance mechanism.

Few gaps exist in the provisions in policies between government acts/policies and World Bank's ESS requirements that have been addressed by the Resettlement Policy Framework and various plans prepared. Institutional arrangement to address E&S aspects are currently relatively weak and need strengthening. GRM is decentralized and ad-hoc and requires systematic recording of grievances and redressal.

Further action needs to be taken to: i) to obtain clearances, licenses/approvals and permits under existing legal framework that are applicable to the Project from relevant national and/or local authorities; ii) describe the policy, institutional and implementation framework to guide the

compensation for loss of land and assets and ensure that no affected land is displaced without proper consultation and compensation; iii) develop mechanisms to foster greater participation of more passive members of the community, including disadvantaged persons, women and vulnerable groups; iv) develop clear procedures for disseminating information about the project to all affected communities and provide a feedback mechanism for these communities to voice their concerns and address these concerns during project implementation. Trainings on Environment and Social aspects including reporting requirements need to be prepared and administered to build capacity of the project staff.

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

Prior to Invitation of bid

Resettlement Action Plan for this corridor
Biodiversity and Habitat Management Plan

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, VCDP and Vulnerable Community Development 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.TheMoPIT 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.

Table 9-1: Environment and Social Commitment Plan (ESCP)

Material Measures and Action		Timeframe	Responsible Entity / Authority
Monitoring and Reporting			
A	**REGULAR REPORTING**: Prepare and submit regular monitoring reports on the implementation of the ESCP.	Trimester reporting during construction phase of the project	DOR-DCID, DOR-GESU, Project Office, Supervision Consultants
B	**INCIDENTS AND ACCIDENTS NOTIFICATION**: Prepare and implement an incident reporting procedure as part of a project level Environmental and Social Management Plan (ESMP), indicating details of the incident, immediate measures to address the reported incident	Reporting within 24-48 hours of the incident/accident and full report preparation within one month of the incident/accident	DOR-DCID, DOR-GESU, Project Office, Supervision Consultants
C	**Contractors Monthly Report:** Prepare and submit the monthly progress report	Every first week of the next month	Contractors, Supervision Consultants, Project Office, DOR-DCID
ESS 1: ASSESSMENT AND MANAGEMENT OF ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS			
1.1	**ORGANIZATIONAL STRUCTURE**: The DOR-DCID to hire qualified environmental specialist, social safeguard specialist and health and safety specialist to be embedded in DOR-DCID DoR-GESU to hire Environmental Adviser and Social Safeguards Adviser in-charge of advising and implementing a capacity building program for DoR	Prior to loan Effectiveness Prior to loan effectiveness	DOR-DCID DOR-GESU
1.2	**ENVIRONMENTAL AND SOCIAL ASSESSMENT:** NNM Road: Updated, consulted and publicly disclosed environmental and social impact assessment to meet ESF requirements. KDP Road: Updated Environmental and Social Assessment (ESA) for Kakarbhitta – Pathlaiya Corridor that included KDP	Prior to appraisal Prior to appraisal	DOR-DCID, DOR-GESU, ESIA Consultant

Material Measures and Action		Timeframe	Responsible Entity / Authority
	section to assess environmental and social risks based on ESF. This is based on existing information sans final routing and detailed design of the KDP Road. KDP Road: Prepare site-specific ESIA based on the ESA and side by side with the detailed engineering design.	During detailed design preparation of the KDP Road	
1.3	**MANAGEMENT TOOLS AND INSTRUMENTS:** NNM Road: ESIA/ESMP KDP Road: ESA KDP Road: Site-specific ESIA/ESMP, including cumulative impact assessment Other works: Updated ESMF Strategic Environmental & Social Assessment of East West Highway (including KDP road)	Prior to appraisal Prior to appraisal During detailed engineering phase Prior to appraisal During project implementation	DOR-DCID, DOR-GESU, ESIA Consultant, Supervision consultant
1.4	**MANAGEMENT OF CONTRACTORS:** Develop procedures for managing contractorstoinsurepreparation and implementation of ESF-related plans for the contractors Bidding documents and contracts to include relevant measures in the ESMP Preparation of C-ESMP and other plans such as Waste Management Plan, OHS Plan, CHS Plan, Traffic Management Plan, Waste Management Plan, Workers' Camp Management	Before the EOI notice for contractors During preparation of bidding documents Prior to site mobilization	Project Office, DOR-DCID,

Material Measures and Action		Timeframe	Responsible Entity / Authority
	Plan, etc.		
ESS 2: LABOR AND WORKING CONDITIONS			
2.1	**LABOR MANAGEMENT PROCEDURES**: Labor Management Procedures (LMP) in accordance with GoN'sLabor Law requirement and the ESS 2. This LMP is applicable to direct workers, contracted workers, primary supply workers.	Before the appraisal	Project Office, DOR-DCID,DOR-GESU
2.2	**GRIEVANCE MECHANISM FOR PROJECT WORKERS**: Develop and maintain a GRMfor direct and contracted workers	Before the EOI notice for contractors	DOR-DCID, DOR-GESU, Project office
2.3	**OHS MEASURES**: Develop occupational, health and safety (OHS) measures for projectworkers	Prior to site mobilization by contractor	Project Office DOR-DCID, Supervision Consultant, Contractors
ESS 3: RESOURCE EFFICIENCY AND POLLUTION PREVENTION AND MANAGEMENT			
3.1	**Waste Management Plan :** Prepare, adopt, and implement Waste Management Plan	Before bidding of project	Project Office,DOR-DCID, GESU Contractor, Supervision Consultant
3.2	**Pollution Prevention and Management** Develop measures and actions for management of impacts of pollution	Before bidding of project	Project Office,DOR-DCID, GESU Contractor, Supervision Consultants
ESS 4: COMMUNITY HEALTH AND SAFETY			
4.1	**TRAFFIC AND ROAD SAFETY**: Develop measures and actions to assess and manage traffic and road safety risks	Before the contractors mobilization	Project Office DOR-DCID, Contractor
4.2	**COMMUNITY HEALTH AND SAFETY:** Develop measures and action to assess and manage specific risks and impacts to the community arising from project activities	Before the contractors mobilization	Project Office,DOR-DCID, Contractor

Material Measures and Action		Timeframe	Responsible Entity / Authority
4.3	**GBV AND SEA RISKS**: Develop measures and actions to assess and manage the risks due to gender-based violence (*GBV*) and sexual exploitation and abuse (*SEA*)	Before the signing of the contract	Project Office,DOR-DCID, GESU , Supervision Consultant
4.4	**GBV AND SEA RISKS DURING PROJECT IMPLEMENTATION**: Implement measures as per GBV action plan	inform immediately and refer to GBV and SEA risk management committee	Project Office,DOR-DCID, Supervision Consultant, Contractors
ESS 5: LAND ACQUISITION, RESTRICTIONS ON LAND USE AND INVOLUNTARY RESETTLEMENT			
5.1	**RESETTLEMENT PLANS**: Develop resettlement action plans (RAP) and Resettlement Policy Frameworkto meet the requirements of the Government of Nepal and WB-ESS5.	Before the appraisal	Project Office DOR-DCID, DOR-GESU, ESIA consultant
5.2	**GRIEVANCE MECHANISM**: Develop the arrangements for the grievance mechanism for resettlement and relocation	Before the appraisal	Project Office DOR-DCID, GESU, Supervision Consultant, local authority
ESS 6: BIODIVERSITY CONSERVATION AND SUSTAINABLE MANAGEMENT OF LIVING NATURAL RESOURCES			
6.1	**BIODIVERSITY RISKS AND IMPACTS**: Biodiversity assessment and management plan for KDP road	Detailed design phase of KDP road	Project Office DOR-DCID, DOR-Consultant
ESS 7: INDIGENOUS PEOPLES			
7.1	**INDIGENOUS PEOPLES PLAN**: Develop Vulnerable Community Development Plan (VCDP) consistent with the requirements of the Government of Nepal and WB-ESS7	Before contract award	Project Office DOR-DCID, DOR-GESU, Supervision Consultant
7.2	**GRIEVANCE MECHANISM:** Develop the arrangements for the grievance mechanism for IPs	Before the appraisal	Project Office DOR-DCID, Supervision Consultant
ESS 8: CULTURAL HERITAGE			

Material Measures and Action		Timeframe	Responsible Entity / Authority
8.1	**CHANCE FINDS**: Develop the possible measures for chance finds (outstanding cases occurred during project execution) in the ESMP of the Project	Before the appraisal	MoPIT, MoI, DoA, DOR-DCID, DOR-GESU Project Office
ESS 10: STAKEHOLDER ENGAGEMENT AND INFORMATION DISCLOSURE			
10.1	**Stakeholder Engagement Plan Prepared and Implementation:** Develop the Stakeholder Engagement Plan	Before the appraisal	Project Office DOR-DCID, DOR-GESU, Supervision Consultant,
10.2	**PROJECT GRIEVANCE MECHANISM**: Prepare the project level grievance handling mechanism raised from different stakeholders	Before the project implementation	Project office DOR-DCID, Supervision Consultant, Contractors
Capacity Support			
Specify Training to be provided		**Specify Targeted Groups and Timeframe for Delivery**	**Specify Training Completed**
See capacity building program identified in the E&S capacity assessment report		During project implementation	DOR-DCID

10 Chapter 10: Institutional Arrangements

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 Institutionsandtheir rolesinE&Sriskmanagementofroadsandbridgesproject

Theprincipalresponsibility forthedevelopmentandimplementationofnational roadprojectsinNepalis vestedintheDepartment of Roads(DoR)oftheMinistryofPhysical Infrastructure andTransport (MoPIT).DoRisalsothusdirectlyresponsibleformanagingtheE&Srisksofindividualprojectsunder theprogram,i.e., from assessment,mitigationplanning,implementationtomonitoring.ItisalsoDoR'sresponsibilityto accessor involve theservicesofotheragenciesandauthorities.

10.1.1 Department of Roads

DoRhasfive(5)deputy directorships/branchesthatdevelopandimplementprojects.Theseare:(1)the Policy andDesignBranch whichdevelopsandimplementsallGoN-fundedroads;(2)theBridgesBranch which is inchargeof the developmentofbridges;(3) the MaintenanceBranchwhich is inchargeofthe repairand rehabilitationof roadsandbridges;(4) theDevelopment Cooperation Implementation Divisionwhichhandlesdonor-fundedprojects;and,(5)theADBDeputyDirectoratewhichhandlesallroadsandbridgesprojects fundedby ADB.To implementaproject,aprojectoffice(PO)orprojectmanagementunit(PMU) in the caseofdonor-fundedprojects isusually createdwithinthesebranches. Tofacilitate fieldimplementation, DoRalsomaintains33 DivisionalRoadOffices(DROs).

10.1.2 ProjectOffice/ProjectManagementOffice(PO/PMU).

Forpurely government-fundedprojects,thePO usuallyrequeststheservicesoftheGESUtoundertakethepreparationofEIAorIEEandcarrythe projectthroughtheprocessofreviewandapprovalbytheMoPITinthecaseofIEEorMoFEinthecase ofEIAs.Afterapproval,thePO isthenresponsible fortheimplementationof theEMPs/EMPsonthe groundaswellastoundertakeland/ROWclearance/acquisition,following thestandardgovernment process,without the benefitofaRAP.Fordonor-fundedprojects,theProjectManagementUnits (PMU) whichareorganizedaccording tospecificationsagreedwiththedonor,usually preparetheirownESIAs, RAPsandotherE&SRiskManagementPlansbyhiringtheirownconsultants.PMUshoweverwould oftenseekGESU'sinvolvement tofulfillegalrequirements,particularlyinbringingtheIEE/ESIA throughtheformalreview-approvalprocesswith MoPITandMoFEand,dependingonthespecifications agreedwith thedonor,thePMUsmaytapGESU toundertaketheEIA/IEEpreparationprocessfortheir projectsand/orprovidecompliancemonitoringandauditinthefield.

10.1.3 Geo-EnvironmentandSocialUnit(GESU).

ThefocalpointfortheE&SriskmanagementatDoR isGESU.GESUiscurrentlyunderthePlanningandDesign DeputyDirectorGeneral(DDG). GESUprovidesadvisoryservicesto unitsof DoRon geological,

environmentalandsocialsafeguardsmatters.ItsmainroleistoprepareIEEsandEIAsfortheDoR projectsandhavethemapprovedbytheMoPITinthe caseofIEEsandbytheMoFEinthecaseofEIAs. Becauseof thisrole,GESUinteractswith theEnvironmentUnitofMoPITaswellas thatofMoFE.For somedonor-fundedprojects,theGESUalsoundertakescompliancemonitoring andauditingofprojects, andasresultalsointeractswithProjectManagementUnits(PMUs). The roleof theGESU isveryimportantnotonlyin socialanalysisand ensuring stakeholders'participation intheplanning andimplementationprocessbutalso for improvedefficiency, effectivenessandsustainabilityof theprojects. Althoughtheneedforrightofway acquisitionisidentified inEIA/ESIA,GESUisnotnormally involved inthe landacquisitionandhencerarely ifatall interactswiththelandagencies.Sometimes,RAPsfrom donor-fundedprojectare submittedto theGESUforreview.

10.1.4 DivisionalOfficesofDoR.

DoRhas4FederalRoad MonitoringUnitswhicharegeographicallysituated and33DivisionalOffices. TheseofficeswillserveasthehomebaseforFederalGovernment'sroad projectimplementationwherecoordinationofthelocalgovernmentagenciesandfieldofficesofother lineagencieswilloccur, particularlyforRoW/landacquisition.

10.1.5 Ministry of PhysicalInfrastructure andTransport(MoPIT)

MoPITis the motheragency ofthe DoRand is mandatedby theEPAct to reviewandapproveIEEsfor projectsinpublicworksandtransportsector.Italso reviewsandendorsesEIA reportsforreviewand approvalof theMoFE. TheMinistrywillalsobe theonetoauthorizetheProjectManagementOffice (PMU)toinitiatepreliminaryactionforlandacquisition.ThisfunctionishandledbytheEnvironment andSocialsection underthePlanning,MonitoringandEvaluationDivision.

10.1.6 EIAUnit underMinistryof Forest and Environment (MoFE)

Thisunit is tasksto undertakereviewand approveEIAs.Itis reportingdirectly to the Ministry and not part of the Department of Environment. This unit convenes and engages multidisciplinaryteam toconstitutetheEIAReviewCommitteeforeachEIAsubmittedfrom approval.
TheEIAapprovalstypicallyincludeconditionswhichtheprojectmustcomplyorimplementinaddition to theEMP/ESMP.

10.1.7 EnvironmentalImpactand Compliance MonitoringUnit under DepartmentofEnvironment'sEnvironmental(DoE)

The DoE servesunderMoFE. TheDoEhassix (6) branches: (1) AdministrationPlanning and Promotion; (2) EnvironmentalPollutionControland Monitoring;(3)EnvironmentalImpactAssessmentandMonitoring;and,(4) EnvironmentalImpact Compliance;(5)EconomicAdministrationBranch;and(6)Laboratory Branch. TheEIAandMonitoring branchistheoneinvolvedincompliancemonitoringofprojectsbasedontheESMPandtheEIA approvalconditionssetbyMoFEEIAunitwhilethe EnvironmentalPollutionControlandMonitoringis theoneresponsibleforenforcingairquality,waterqualityandemissionsandeffluentsstandards.Note

thattheEIAandMonitoringBranchisdifferentfrom theEIAunitofMoFEwhoseresponsibilities are to reviewand recommendapprovalofEIAs.

10.1.8 DepartmentofForestryandSoilConservation(DoFSC)

DoFSCunderthe MoFEreviewsandapprovesapplicationsforRoW ofroadsectionsfallingwithinareas classifiedaspublicforest. TheDoFSC imposesconditionsontheacquisitionof rightofway onforest lands,such as replacementofcut trees. Aftercomplying with the requirements, theownership of rightof wayistransferredtotheconcernedagency(forroads:MoPIT).

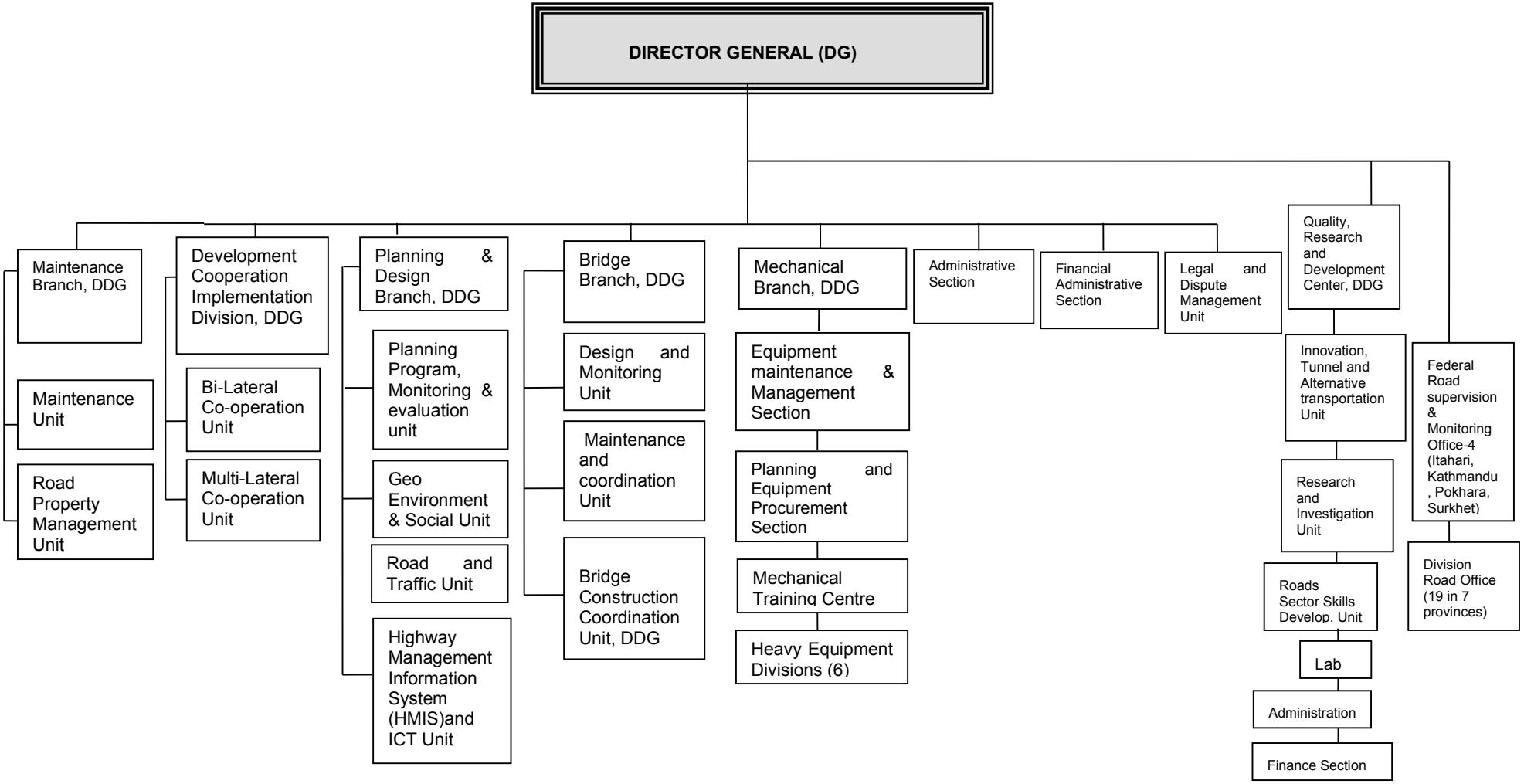

Figure 10-1: Organizational Chart of the Department of Roads and the embedding of the Geo-Environment & Social Unit

10.1.9 DepartmentofNationalParksandWildlifeConservation(DNPWC)

DNPWC underMoFEreviews and approvessectionsofroadswithin Parksandprotectedareas.

10.1.10Department of Labour and OccupationalSafety(DoLOS)

DoLOSundertheMinistryofLabourandSocial Securityis currently notinvolvedintheE&Sriskmanagement (i.e.ithasno rolein theEIAprocess)ofdevelopment projects.Itsroleismainly ontheregulatoryside.Itcanformulateandissuepolicies,rulesandstandards forOHS consistentwith the law. As such, it canoccasionallyconductmonitoringand audit ofworkplaces,constructionsitesandofficesofcontractorsandprojectmanagement.Itcanalsoprovide an expertreview oftheoccupational andcommunityhealthandsafetyaspectsoftheIEE/EIA or theESMP.

10.1.11Ministry of FederalAffairsand GeneralAdministration

TheMinistryofFederalAffairsandGeneralAdministration (MoFAGA)is thegovernmentalbody of Nepalmainlyresponsiblefordeliveringcriticalservicesto thecitizensandmaintainingsecurity in the nation.Itisinchargeofeminentdomainlandacquisition i.e.theimplementation oftheLandAcquisition Actwhich itdelegatesto the localgovernments.

10.1.12District CoordinationCommittees (DCC).

DCCscan regulatesoilandwater conservationactivities. DCCsarealsoresponsibleforreviewingapplicationsofeminentdomainlandacquisitionsandconfirming public use. It willberesponsibleforthe issuance oflandacquisitionnotice; theformationofCompensationFixingCommitteewhichwouldderminefaircompensation;finalize thelistofland ownerstoreceivecompensation; andreceivesgrievancesforsubmission tothe MinistryofHomeAffairs.

10.1.13MunicipalitiesandRuralMunicipalities(Gaunpalikas)

Thereare nowa totalof293 municipalitiesor citiesand460 ruralmunicipalitiesorGaunpalikas, formerly VillageDevelopmentCommittees(VDCs).The respectiveMunicipalitycan regulatesoiland water conservationactivitiesthatsupporttostabilizetheroad slopesandminimizelikely adverseimpacts ontheroadandby the road(DoR (2018) and developmentplansfortheindigenouspeople. The municipalitiesareresponsibletoconductpublichearingsoftheEIAresultsandbasedonit endorsetheproject.TheMoFEwillnotapproveEIAswithoutthe endorsementofmunicipalities.

10.1.14 DepartmentofLocalInfrastructure(DoLI)

DoLIisa departmentundertheMinistryofFederalAffairsandGeneralAdministration.isresponsible for assisting local governmentsin the Districtsintheengineering aspects ofcivilconstruction.

10.1.15Department of Archaeology

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.

10.2 Implementation Arragemement 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 the Department of Roads (DOR) as the Executing Agency. The World Bank will be as a financial institution of the investment. The Development Cooperation Implementation Divisions (DCID) of Department of Road (DOR) is the Implementing Agency (IA) for NNM Road and Bridge Project. Upon completion of construction of the NNM, Development Cooperation Implementation Divisions (DCID)-DOR, will carry out the operation, management, and maintenance.

The implementation of the ESMP will be the responsibility of the construction contractor/s supervision and overseen by a Project Management and Supervision Consultancy (SC) and environment unit established as Geo-Environment and Social (GESU) of DOR. The construction contractor/s will be responsible for implementing mitigation requirements in the construction specifications.

Overall construction and environmental management of the NNM will be under the DCID-DOR and will be supported by GESU-DOR. Environmental and Social staffs of the GESU will oversee the environmental and social aspects of the project during the time of construction and operation of the project.

A Supervision Consultancy (SC) will support DCID and GESU, and provide consultancy for monitoring and supervision during the time of construction. A SC will be responsible for implementing the project activities, training employees and contractors on commitment, analysing the results, implementing adaptive management.

Tentative staffing of SC team (**Table 10-1**) will include Highway engineer as a Team Leader with anEnvironmental Safeguard Specialist and a Social Safeguard Specialist in order to safeguard construction works of the NNM and proposed new alignments. The SC will be responsible to monitor and supervise dam construction works and its associated safeguard works related to the construction of access roads, spoil disposal, bridge construction, camp establishment, stock piling, quarry sites established, felling of trees and compensatory replantation etc. The SC will also be responsible to monitor and supervise safety works carried out by the construction contractor during construction, and monitor actual impacts predicted in the ESIA report for the construction stage of the project.

The SC environment specialist will support the GESU environmentalist in implementing the ESMP. The SC environmental specialist will provide training in environmental monitoring, evaluation and assessment to the contractor staffs and also to make them aware and familiar with the measures of mitigations mentioned in the Bidding document and ESIA. This will consist as mitigation measures presented in the ESIA including safety due to construction works. Besides, the SC environmentalist will support in monitoring, evaluation, and reporting to senior level staffs.

Table 10-1: Supervision Consultant staffing

	Team Leader
	Deputy Team Leader

RE- Civil and IOW-Civil Junior Engineer	Environment Specialist	Health and Safety Specialist	Traffic safety management specialist	Social Safeguard/Public Relation and Resettlement Specialist	Account and Junior Finance Officer
	Admin Officer				

There will be a supporting environmental staff under SC for monitoring, evaluation, and construction supervision, to fulfil all the ESIA and EMP requirements, and ensure proper implementation of mitigation measures during the time of construction. The Social Safeguard Specialist has also been proposed and will be responsible to settle all the social issues and any unforeseeable issues encountered during the time of construction. The roles and responsibilities for different agencies are summarized in**Table 10-2**.

Table 10-2: 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
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 Supervision Consultant (SC)	-Oversee environmental mitigation measures as per ESIA and EMP are incorporated into the final design. Update the EMP as required during detailed design.	During final design
	-Supervision and impact and compliance monitoring of the construction contractor's activities and environmental	As per EMP

Organizations	Responsibilities	Schedule
	mitigation measures as per EMP and provisions of inspection reports.	
	Conduct environmental monitoring and prepare periodic monitoring reports for submission to WB and DOR.	As per EMP
	-Assist IA in the implementation and supervision of environmental compensation and enhancement programs and their monitoring and auditing.	As per EMP
	-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 EMP (CEMP/EMAP) before construction and get it approved from DOR. -Implement mitigation measures as specified in the CEMP/EMAP updated by the DOR as necessary during detailed design.	As per EMP during construction
	-Monitoring and record keeping of environmental mitigation measures	As per EMP during construction
	-Implementation of the corrective actions as recommended by the supervising consultants	As per EMP during construction
	-Ensure public participation and involvement in project construction	Construction stage
Independent Environment Monitoring Consultant	- Review safeguards documents including ESIA and EMP and request changes if and when required	Project Period
	- Oversee and periodically monitor Contractor's implementation of the EMP 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 EMP 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 EMP.	Project Period

10.1 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 obtained for implementation of the construction works.

Table 10-3: 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 Muglinghas 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 whereasDoR 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 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. MoFEhas 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 10-4: Institutional Mandate and Responsibility in Road Development Projects

Sn	Name	Mandate	Project Responsibility
1	Ministry of Physical Infrastructure and	Enhance the economic and social development of country by linking various	Transport and transit management and its operation related plans, policies and

Sn	Name	Mandate	Project Responsibility
	Transport (MoPIT)	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.	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, constructing, operating and maintaining all generation, transmission and distribution facilities	Transmission and distribution/ end users poles and wires to be managed in the roads sector
11	Department of	Enforce the labour laws including	Labour related grievances to be resolved

Sn	Name	Mandate	Project Responsibility
	Labour	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.	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.

10.2 Safeguard Capacity and StaffingTechniques

The proponent, DOR-DCID has 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 things

- 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.

Following staffing plan including administrative and technical E&S staff for the PMU and GESU will be arranged:

(a) A 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;

(b) An 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;

(c) A Social Safeguards expert to be based at PMU;

(d) An Environmental Safeguard Specialist to be based at PMU;

(e) A Health & Safety Specialist to be based at PMU;

(f) One Administrative Staff at GESU to supplement existing administrative staff

Table 10-5: 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 the program	Full time up to the close of the program	12,000

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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 reqional/ernipircal methods (Table 4-3).

Table 11-1: 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)*

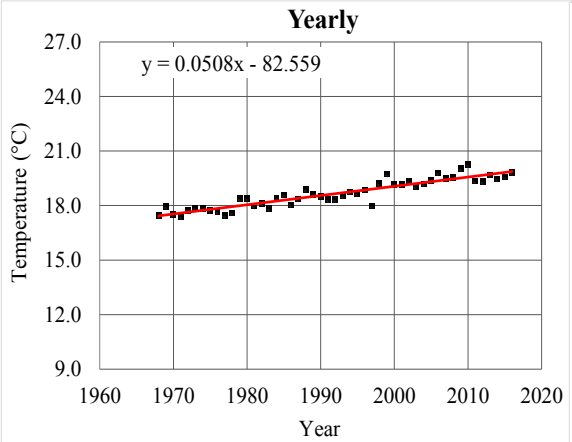
Cross drains will be designed for 50 years return period flood (DoR, 2017). Using rational formula for discharge estimation of cross drains, this study pointed out the necessity of new crossing structures along with replacing of existing culverts which are inadequate to pass design discharge.

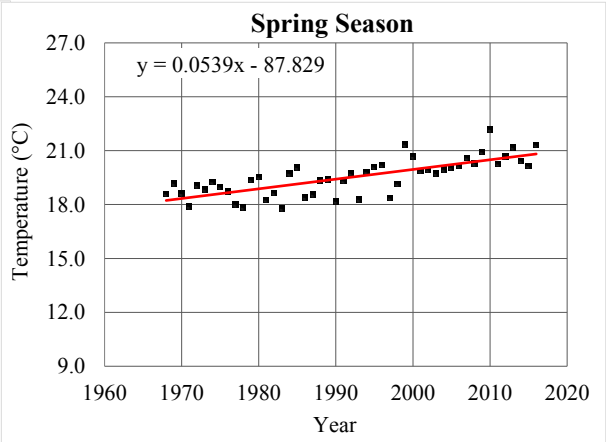
DoR (2017) also found that the existing side drains are more or less adequate for 25 years return period flood but might to be increased for increased return period of flood. In any case during the

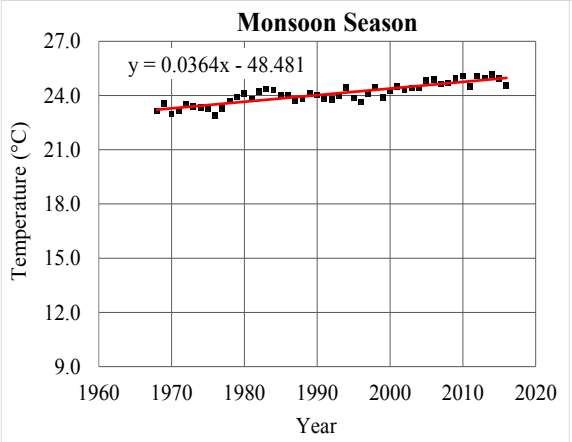
improvement works, these side drains will be dismantled and the new side drains will be constructed.

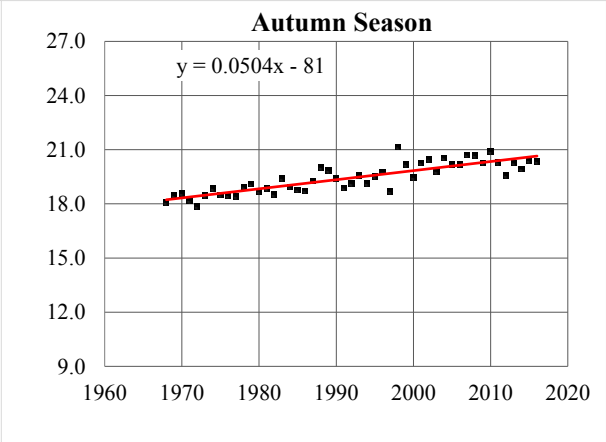
ANNEX 2: Baseline Information

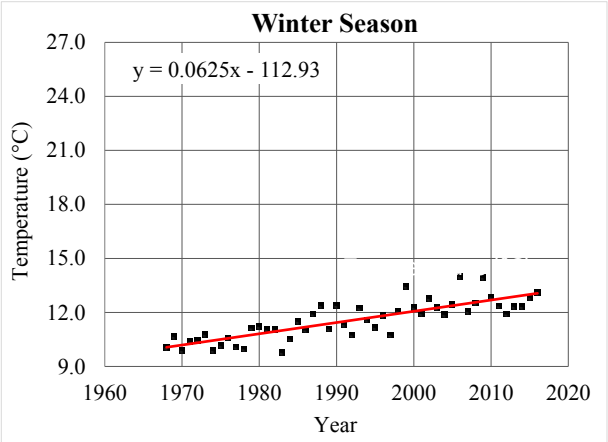
Annex 2.1 Annual, spring, monsoon, autumn and winter patterns of temperature



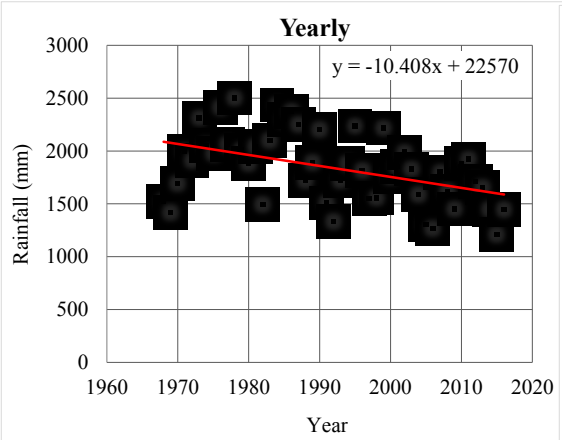


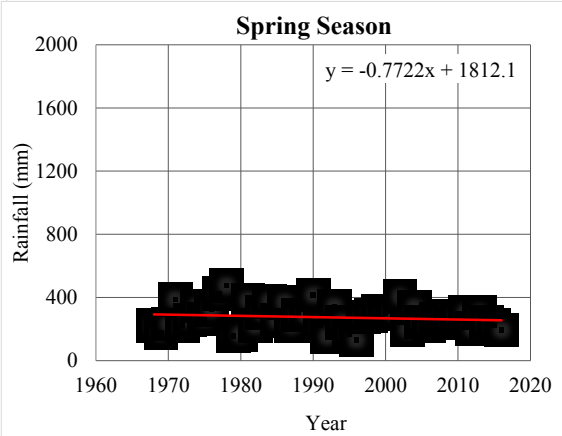


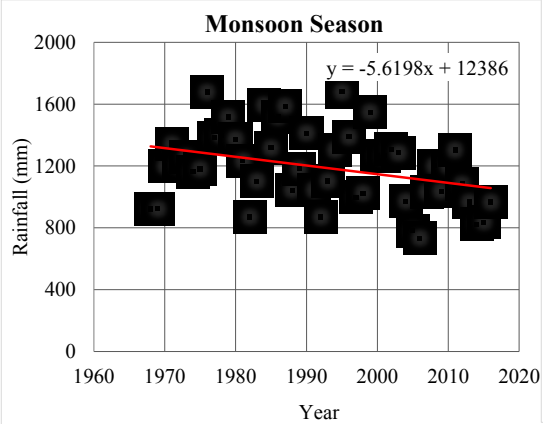


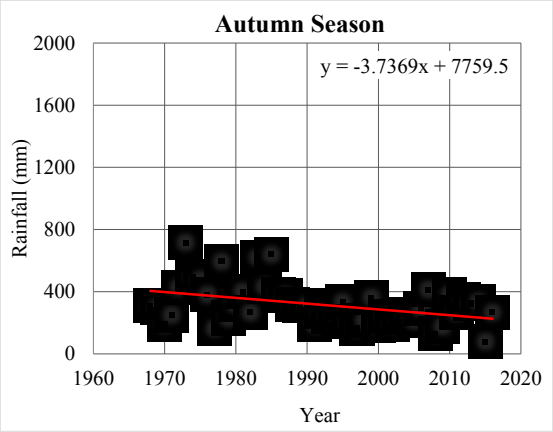


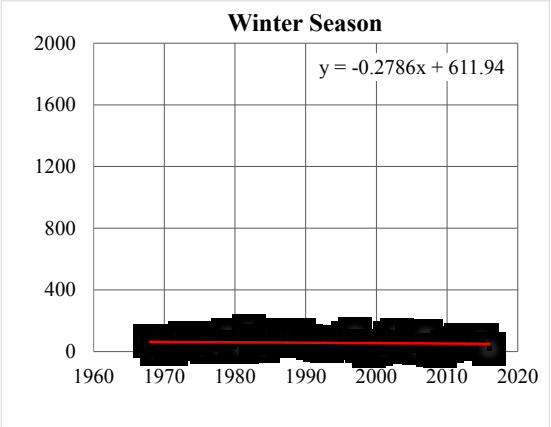
Annex 2.2: Annual, spring, monsoon, autumn and winter patterns of rainfall in the study area



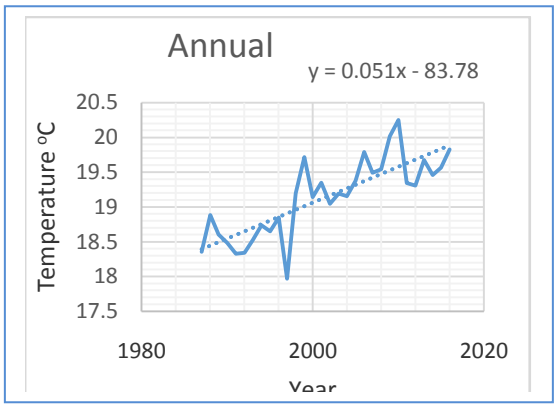


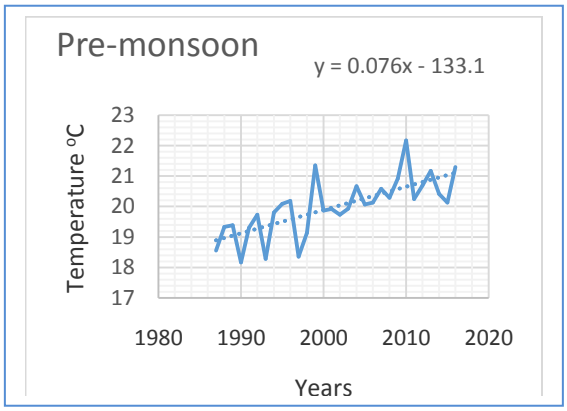


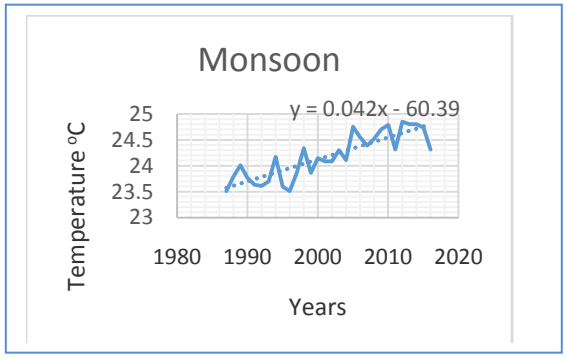


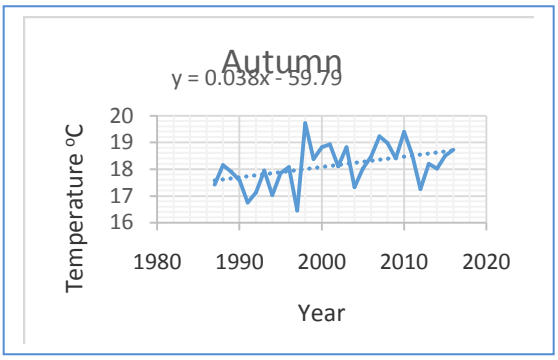


Annex 2.3: The temperature in different season (Source: SESA/Sustainability Study, 2017)

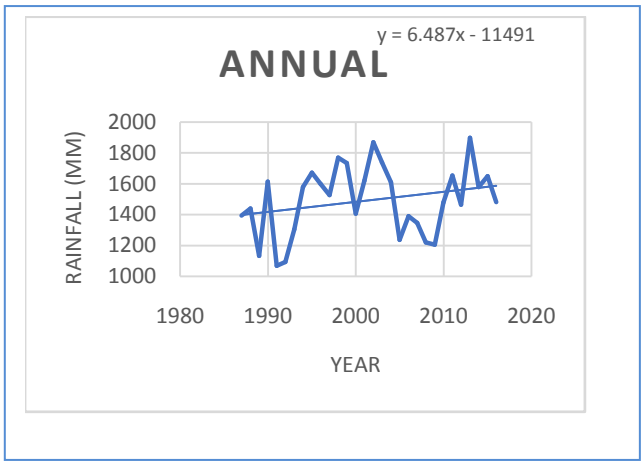


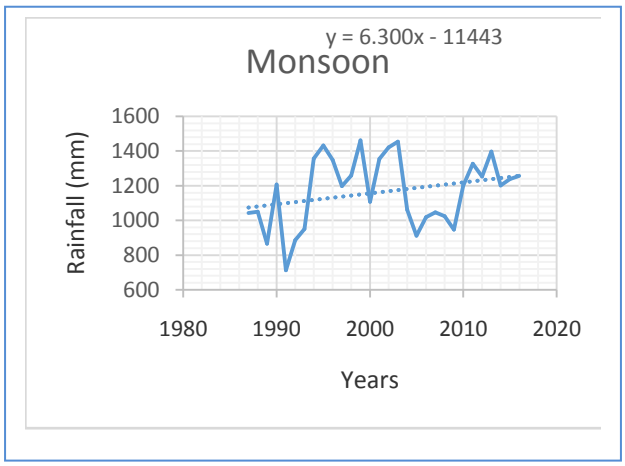


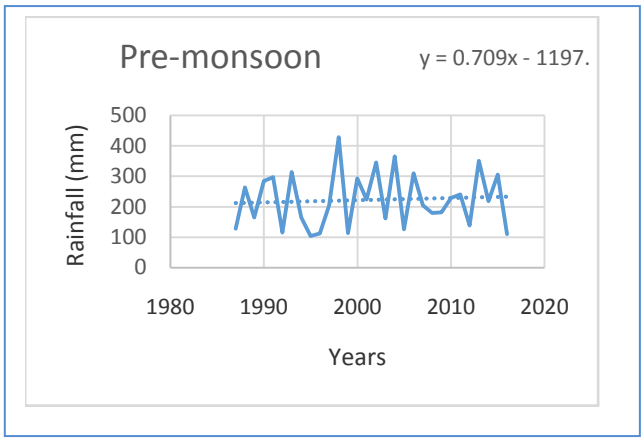


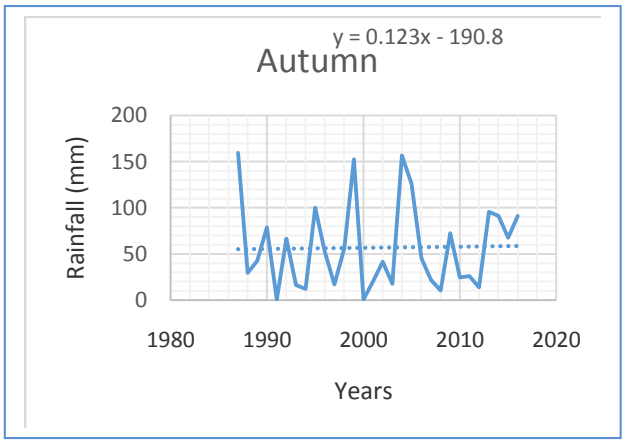


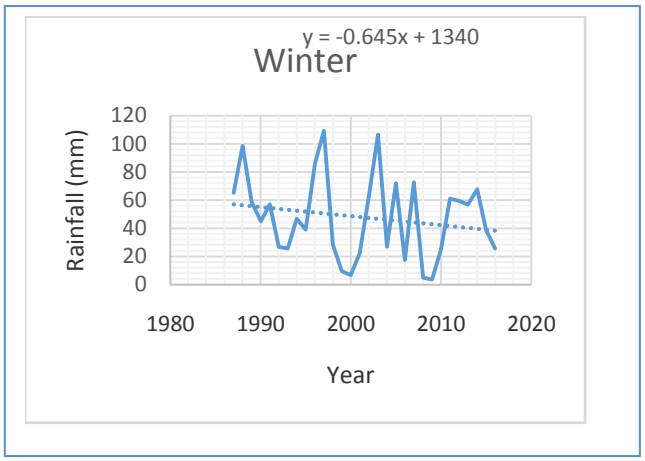
Annex 2.4: The annual rainfall of NNM corridor











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
	ShiprinKhola (Sp)	Schist	1000	
	Udayapur		1500	
	Markhu (Mr)	Marble/schist	2000	
	SorangKhola (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	Pre-Cambrian
	Naudanda Quartzite (Nd)	Quartzite	400	
	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:

$A_{eff}=R*A_{max}/980$

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
$A_{eff}=R*A_{max}/980$

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)	µg/m3	Annual -	-	
		24-hours*	230	High Volume Sampling and Gravimetric Analysis
PM10	µg/m3	Annual	-	High Volume Sampler and Gravimetric Analysis, TOEM, Beta Attenuation
		24-hours*	120	
Sulphur Dioxide	µg/m3	Annual**	50	Ultraviolet Fluroscence, Waste and Geake method
		24-hours*	70	Same as annual
Nitrogen Dioxide	µg/m3	Annual	40	Chemiluminescence
		24-hours*	80	Same as annual
Carbon Monoxide	µg/m3	8 hours*	10,000	Non dispersive Infra-Red spectrophotometer (NDIR)
Lead	µg/m3	Annual**	0.5	High volume sampling, followed by atomic absorption spectrometry.
Benzene	µg/m3	Annual **	5	Gas chromatographic Technique
PM 2.5	µg/m3	24-hours*	40	PM2.5 sampling gravimetric analysis
Ozone	µg/m3	8 hours*	157	UV spectrophotometer

*24 and 8 hourly values shall be met 95% of the time in a year. 18 days per calendar year, the standard may be exceeded but not on two consecutive days.

** The above indicators are prepared by the 104 data taken yearly average in a fixed location in one week by observing two times in 24 hours.

Annex 2.8: Water quality test results

Parameters	Units	NDWQS	Result																					
			SisneKhola	SikreyKhola	KhaniKhola	NaubiseKhola	100m Downstream of Dhunikhola	Mahesh Khola	Agra Khola	KhesteKhola	BelkhuKhola	GalaudiKhola	MalekhuKhola	CharaudiKhola	HugdiKhola	MauwaKhola	BarbanKhola	Majhimtar Across at	Pang Khola	PasupatiKhola	KaudiKhola	DhaubadiKhola	LamuKhola	Near Shree Chandrodaya 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.	^{0}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
Phosphae	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	0.3	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.	74.2	<5	28.	57.7	57.7	63.5	<5.0
Sulphid	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 Hardnes	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 Ca2++	**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**

Parameters	Units	NDWQS	Result																					
			SisneKhola	SikreyKhola	KhaniKhola	NaubiseKhola	100m Downstream of Dhunikhola	Mahesh Khola	Agra Khola	KhesteKhola	BelkhuKhola	GalaudiKhola	MalekhuKhola	CharaudiKhola	HugdiKhola	MauwaKhola	BarbanKhola	Majhimtar Across at	Pang Khola	PasupatiKhola	KaudiKhola	DhaubadiKhola	LamuKhola	Near Shree Chandrodaya H. S. School at Trisuli River
Fluoride	**mg/l**	**0.5 -**	**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
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	<0.01	<0.01	<0.01	<0.01	<0.01	<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(ln 95% Sample)	

Note: (*) Value Given in the bracket is applicable only if no alternative is available * Indicates minimum and maximum limits. *Source: Nepal GazettedAshad 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 (Neapl Gazette (Number 10.16 June 2008))
- Nepal Water Quality Guidelines for Aquaculture; Department of Irrigation, Ground Water Projcet (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	Natioan l Status
1	Black Francolin	*Francolinusfrancolinus*	Survey	Yes	Forest	Resident	LC	LC
2	Hill Partridge	*Arborophilatorqueola*	Literature	No	Forest	Resident	LC	NT
3	Red Junglefowl	*Gallus gallus*	Survey	Yes	Forest	Resident	LC	LC
4	Kalij Pheasant	*Lophuraleucomelanos*	Survey	Yes	Forest	Resident	LC	LC
5	Bar-headed Goose	*Anser indicus*	Literature	No	Wetland	Winter visitor	LC	NT
6	Ruddy Shelduck	*Tadornaferruginea*	Literature	No	Wetland	Winter visitor	LC	NT
7	Gadwall	*Anas strepera*	Literature	No	Wetland	Winter visitor	LC	LC
8	Eurasian Wigeon	*Anas penelope*	Literature	No	Wetland	Winter visitor	LC	LC
9	Mallard	*Anas platyrhynchos*	Literature	No	Wetland	Winter visitor	LC	LC
10	Common Teal	*Anas crecca*	Literature	No	Wetland	Winter visitor	LC	LC
11	Red-crested Pochard	*Rhodonessarufina*	Literature	No	Wetland	Winter visitor	LC	LC
12	Common Pochard	*Aythyaferina*	Literature	No	Wetland	Winter visitor	VU	NT
13	Ferruginous Pochard	*Aythyanyroca*	Literature	No	Wetland	Winter visitor	NT	VU
14	Common Merganser	*Mergus merganser*	Literature	No	Wetland	Winter visitor	LC	LC
15	Speckled Piculet	*Picumnusinnominatus*	Literature	Yes	Forest	Resident	LC	LC
16	Rufous Woodpecker	*Celeusbrachyurus*	Literature	Yes	Forest	Resident	LC	LC
17	Bay Woodpecker	*Blythipicuspyrrhotis*	Literature	Yes	Forest	Resident	LC	NT
18	Fulvous-breasted Woodpecker	*Dendrocoposmacei*	Literature	Yes	Forest	Resident	LC	LC

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migration status	Conservation Status	Natioan l Status
19	Crimson-breasted Woodpecker	*Dendrocoposcathpharius*	Literature	Yes	Forest	Resident	LC	LC
20	Lesser Yellownape	*Picuschlorolophus*	Literature	Yes	Forest	Resident	LC	LC
21	Greater Yellownape	*Picusflavinucha*	Literature	Yes	Forest	Resident	LC	LC
22	Grey-headed Woodpecker	*Picuscanus*	Survey	Yes	Forest	Resident	LC	LC
23	Great Barbet	*Megalaimavariens*	Survey	Yes	Forest	Resident	LC	LC
24	Lineated Barbet	*Megalaimalineata*	Survey	Yes	Forest	Resident	LC	LC
25	Golden-throated Barbet	*Megalaimafranklinii*	Survey	Yes	Forest	Resident	LC	LC
26	Blue-throated Barbet	*Megalaimaasiatica*	Survey	Yes	Forest	Resident	LC	LC
27	Coppersmith Barbet	*Megalaimahaemacephala*	Survey	Yes	Forest	Resident	LC	LC
28	Common Hoope	*Upupsepops*	Literature	No	Grassland	Resident	LC	LC
29	Chestnut-headed Bee-eater	*Merops leschenaultia*	Literature	No	Forest	Summer visitor	LC	LC
30	Green Bee-eater	*Meropsorientalis*	Literature	No	Forest	Summer visitor	LC	LC
31	Common Kingfisher	*Alcedoatthis*	Survey	Yes	Wetland	Resident	LC	LC
32	White-throated Kingfisher	*Halcyon smyrnensis*	Survey	Yes	Wetland	Resident	LC	LC
33	Crested Kingfisher	*Megaceryleluguhris*	Literature	Yes	Wetland	Resident	LC	LC
34	Pied Kingfisher	*Cerylerudis*	Literature	Yes	Wetland	Resident	LC	LC
35	Large Hawk Cuckoo	*Hierococcyxsparverioides*	Literature	Yes	Forest	Resident	LC	LC
36	Common Hawk Cuckoo	*Hierococcyxvarius*	Literature	Yes	Forest	Summer visitor	LC	LC
37	Indian Cuckoo	*Cuculusmicropterus*	Literature	Yes	Forest	Summer visitor	LC	LC
38	Eurasian Cuckoo	*Cuculuscanorus*	Literature	Yes	Forest	Summer visitor	LC	LC
39	Oriental Cuckoo	*Cuculus saturates*	Literature	Yes	Forest	Summer visitor	LC	LC
40	Lesser Cuckoo	*Cuculuspoliocephalus*	Literature	Yes	Forest	Summer visitor	LC	LC
41	Grey-bellied Cuckoo	*Cacomantis passerines*	Literature	Yes	Forest	Summer visitor	LC	LC
42	Drongo Cuckoo	*Surniculuslugubris*	Literature	Yes	Forest	Summer visitor	LC	LC
43	Asian Koel	*Eudynamyssclopacae*	Literature	Yes	Forest	Resident	LC	LC
44	Sirkeer Malkoha	*Phaenicophaeus leschenaultia*	Survey	Yes	Forest	Resident	LC	LC
45	Green-billed Malkoha	*Phaenicophaeustristis*	Survey	Yes	Forest	Resident	LC	LC
46	Greater Coucal	*Centropussinensis*	Survey	Yes	Forest	Resident	LC	LC
47	Alexandrine Parakeet	*Psittaculaeupatria*	Survey	Yes	Forest	Resident	LC	NT
48	Rose-ringed Parakeet	*Psittaculakrameri*	Survey	Yes	Forest	Resident	LC	LC
49	Slaty-headed Parakeet	*Psittaculahimalayana*	Literature	Yes	Forest	Resident	LC	LC
50	Plum-headed Parakeet	*Psittaculacyanocephala*	Survey	Yes	Forest	Resident	LC	LC
51	Himalayan Swiftlet	*Collocaliabrevirostris*	Literature	No	Forest	Resident	LC	LC
52	House Swift	*Apus nipalensis*	Survey	Yes	Settlement	Resident	LC	LC
53	Barn Owl	*Tyto alba*	Literature	Yes	Settlement	Resident	LC	VU
54	Brown Hawk Owl	*Ninoxscutulata*	Literature	Yes	Forest	Resident	LC	LC
55	Collared Scops Owl	*Otusbakkamoena*	Literature	Yes	Forest	Resident	LC	LC
56	Eurasian Eagle Owl	*Bubo bubo*	Literature	Yes	Forest	Resident	LC	DD
57	Brown Wood Owl	*Strixleptogrammica*	Literature	Yes	Forest	Resident	LC	VU

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migration status	Conservation Status	Natioan l Status
58	Collared Owlet	*Glaucidium brodiei*	Literature	Yes	Forest	Resident	LC	LC
59	Asian Barred Owlet	*Glaucidium cuculoides*	Survey	Yes	Forest	Resident	LC	LC
60	Jungle Owlet	*Glaucidium radiatum*	Literature	Yes	Forest	Resident	LC	LC
61	Spotted Owlet	*Athene brama*	Survey	Yes	Forest	Resident	LC	LC
62	Rock Pigeon	*Columba livia*	Survey	Yes	Settlement	Resident	LC	LC
63	Speckleted Wood Pigeon	*Columba hodgsonii*	Literature	Yes	Forest	Resident	LC	LC
64	Oriental Turtle Dove	*Streptopeliaorientalis*	Survey	Yes	Forest	Resident	LC	LC
65	Spotted Dove	*Streptopeliachinensis*	Survey	Yes	Forest	Resident	LC	LC
66	Red Collared Dove	*Streptopeliatranquebarica*	Literature	Yes	Forest	Resident	LC	LC
67	Eurasian Collared Dove	*Streptopeliadecaocto*	Literature	Yes	Forest	Resident	LC	LC
68	Yellow-footed Green Pigeon	*Treronphoenicoptera*	Survey	Yes	Forest	Resident	LC	LC
69	Wedge-tailed Green Pigeon	*Treronsphenurus*	Survey	Yes	Forest	Resident	LC	LC
70	White-breasted Waterhen	*Amaurornisphoenicurus*	Literature	Yes	Wetland	Resident	LC	LC
71	Common Greenshank	*Tringanebularia*	Survey	No	Wetland	Winter visitor	LC	LC
72	Common Sandpiper	*Actitishypoleucos*	Survey	No	Wetland	Winter visitor	LC	LC
73	Little Stint	*Calidrisminuta*	Literature	No	Wetland	Winter visitor	LC	LC
74	Ibisbill	*Ibidorhynchastruthersii*	Survey	No	Wetland	Resident	LC	EN
75	Little Ringed Plover	*Charadriusdubius*	Survey	No	Wetland	Resident	LC	LC
76	Northern Lapwing	*Vanellusvanellus*	Literature	No	Wetland	Winter visitor	NT	NT
77	River Lapwing	*Vanellusduvaucelii*	Survey	Yes	Wetland	Resident	NT	NT
78	Red-wattled Lapwing	*Vanellus indicus*	Survey	Yes	Wetland	Resident	LC	LC
79	Grey-headed Lapwing	*Vanellus indicus*	Literature	No	Wetland	Winter visitor	LC	LC
80	Black-bellied Tern	*Sterna acuticauda*	Literature	No	Wetland	Summer visitor	EN	CR
81	Black Kite	*Milvus migrans*	Survey	Yes	Forest	Resident	LC	LC
82	Brahminy Kite	*Haliasturindus*	Literature	No	Forest	Resident	LC	CR
83	Egyptian Vulture	*Neophron percnopterus*	Survey	Yes	Forest	Resident	EN	VU
84	White-rumped Vulture	*Gyps bengalensis*	Survey	Yes	Forest	Resident	CR	CR
85	Himalayan Griffon	*Gyps himalayensis*	Survey	No	Forest	Resident	NT	VU
86	Cinereous Vulture	*Aegypiusmonachus*	Literature	No	Forest	Winter visitor	NT	EN
87	Red-headed Vulture	*Sarcogyps calvus*	Literature	Yes	Forest	Resident	CR	EN
88	Crested Serpent Eagle	*Spilornischeela*	Survey	Yes	Forest	Resident	LC	LC
89	Black Eagle	*Ictinaetusmalayensis*	Literature	Yes	Forest	Resident	LC	LC
90	Northern Goshawk	*Accipiter gentilis*	Literature	No	Forest	Winter visitor	LC	LC
91	Shikra	*Accipiter badius*	Survey	Yes	Forest	Resident	LC	LC
92	Besra	*Accipiter virgatus*	Literature	Yes	Forest	Resident	LC	LC
93	Oriental Honey-buzzard	*Pernisptilorhyncus*	Literature	No	Forest	Resident	LC	LC
94	Common Buzzard	*Buteo buteo*	Survey	No	Forest	Winter visitor	LC	LC
95	Long-legged Buzzard	*Buteo rufinus*	Survey	No	Forest	Winter visitor	LC	LC
96	Greater Spotted Eagle	*Aquila clanga*	Literature	No	Forest	Winter visitor	VU	VU

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migration status	Conservation Status	Natioan l Status
97	Steppe Eagle	*Aquila nipalensis*	Survey	No	Forest	Winter visitor	EN	LC
98	Bonelli's Eagle	*Hieraaetusfasciatus*	Literature	No	Forest	Winter visitor	LC	LC
99	Bootted Eagle	*Hieraaetuspennatus*	Literature	No	Forest	Winter visitor	LC	LC
100	Mountain Hawk Eagle	*Nisaetusnipalensis*	Literature	No	Forest	Resident	LC	LC
101	Collared Falconet	*Microhieraxcaerulescens*	Literature	Yes	Forest	Resident	LC	LC
102	Common Kestrel	*Falco tinnunculs*	Survey	Yes	Forest	Resident	LC	LC
103	Eurasian Hobby	*Falco subbuteo*	Literature	No	Forest	Winter visitor	LC	LC
104	Peregrine Falcon	*Falco peregrinus*	Literature	Yes	Forest	Resident	LC	LC
105	Great Cormorant	*Phalacrocorax carbo*	Survey	No	Wetland	Winter visitor	LC	LC
106	Little Egret	*Egrettagarzetta*	Survey	Yes	Wetland	Resident	LC	LC
107	Cattle Egret	*Bubulcus ibis*	Survey	Yes	Agriculture land	Resident	LC	LC
108	Grey Heron	*Ardeacinerea*	Literature	Yes	Wetland	Resident	LC	LC
109	Indian Pond Heron	*Ardeolagrayii*	Survey	Yes	Wetland	Resident	LC	LC
110	Little Heron	*Butoridesstriatus*	Literature	Yes	Wetland	Summer visitor	LC	LC
111	Black-crowned Night Heron	*Nycticoraxnycticorax*	Literature	Yes	Wetland	Summer visitor	LC	LC
112	Asian Woollyneck	*Ciconia episcopus*	Survey	Yes	Wetland	Resident	VU	NT
113	Indian Pitta	*Pitta brachyura*	Literature	Yes	Forest	Summer visitor	LC	LC
114	Long-tailed Broadbill	*Psarisomusdalhousiae*	Literature	Yes	Forest	Resident	LC	LC
115	Golden-fronted Leafbird	*Chloropsisaurifrons*	Literature	Yes	Forest	Resident	LC	LC
116	Orange-bellied Leafbird	*Chloropsishardwickii*	Survey	Yes	Forest	Resident	LC	LC
117	Brown Shrike	*Laniuscristatus*	Literature	No	Forest	Winter visitor	LC	LC
118	Long-tailed Shrike	*Laniusschach*	Survey	Yes	Forest	Resident	LC	LC
119	Grey-backed Shrike	*Laniustephronotus*	Survey	No	Forest	Winter visitor	LC	LC
120	Eurasian Jay	*Garrulus glandarius*	Literature	Yes	Forest	Resident	LC	LC
121	Black-headed Jay	*Garrulus lanceolatus*	Literature	Yes	Forest	Resident	LC	LC
122	Red-billed Blue Magpie	*Urocissaerythrorhyncha*	Survey	Yes	Forest	Resident	LC	LC
123	Common Green Magpie	*Cissachinensis*	Literature	Yes	Forest	Resident	LC	LC
124	Rufous Treepie	*Dendrocittavvagabunda*	Survey	Yes	Forest	Resident	LC	LC
125	Grey Treepie	*Dendrocittaformosae*	Survey	Yes	Forest	Resident	LC	LC
126	House Crow	*Corvussplendens*	Survey	Yes	Forest	Resident	LC	LC
127	Large-billed Crow	*Corvusmacrorhynchos*	Survey	Yes	Forest	Resident	LC	LC
128	Ashy Woodswallow	*Artamusfuscus*	Survey	Yes	Forest	Resident	LC	LC
129	Indian Golden Oriole	*Oriolusoriolus*	Literature	Yes	Forest	Summer visitor	LC	LC
130	Maroon Oriole	*Oriolustrailli*	Survey	Yes	Forest	Resident	LC	LC
131	Large Cuckooshrike	*Coracinamacei*	Survey	Yes	Forest	Resident	LC	LC
132	Black-winged Cuckooshrike	*Coracinamelaschistos*	Literature	Yes	Forest	Resident	LC	LC
133	Long-tailed Minivet	*Pericrocotusethologus*	Survey	Yes	Forest	Resident	LC	LC
134	Scarlet Minivet	*Pericrocotusflammeus*	Survey	Yes	Forest	Resident	LC	LC
135	Bar-winged Flycatcher-shrike	*Hemipuspicatus*	Survey	Yes	Forest	Resident	LC	LC

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migration status	Conservation Status	Natioan l Status
136	White-throated Fantail	*Rhipiduraalbicollis*	Survey	Yes	Forest	Resident	LC	LC
137	Yellow-bellied Fantail	*Rhipidurahypoxantha*	Literature	No	Forest	Resident	LC	LC
138	Black Drongo	*Dicrurusmacrocercus*	Survey	Yes	Forest	Resident	LC	LC
139	Ashy Drongo	*Dicrurusleucophaeus*	Survey	Yes	Forest	Resident	LC	LC
140	Bronzed Drongo	*Dicrurusaeneus*	Survey	Yes	Forest	Resident	LC	LC
141	Lesser Racket-tailed Drongo	*Dicrurusremifer*	Literature	Yes	Forest	Resident	LC	LC
142	Spangled Drongo	*Dicrurushottentottus*	Literature	Yes	Forest	Resident	LC	LC
143	Asian Paradise Flycatcher	*Terpsiphone paradise*	Literature	Yes	Forest	Summer visitor	LC	LC
144	Common Iora	*Aegithinatiphia*	Survey	Yes	Forest	Resident	LC	LC
145	Brown Dipper	*Cincluspallasii*	Literature	Yes	Forest	Resident	LC	LC
146	Blue-capped Rock Thrush	*Monticolacinclorhynchus*	Literature	Yes	Forest	Summer visitor	LC	LC
147	Chestnut-bellied Rock Thrush	*Monticolarufiventris*	Survey	No	Forest	Resident	LC	LC
148	Blue Rock Thrush	*Monticola solitaries*	Literature	No	Forest	Resident	LC	LC
149	Blue Whistling Thrush	*Myophonus caeruleus*	Survey	Yes	Forest	Resident	LC	LC
150	Pied Thrush	*Zootherawardii*	Literature	Yes	Forest	Summer visitor	LC	LC
151	Orange-headed Thrush	*Zootheracitrina*	Literature	Yes	Forest	Summer visitor	LC	LC
152	Scaly Thrush	*Zootheradauma*	Literature	No	Forest	Winter visitor	LC	LC
153	White-collared Blackbird	*Turdusalbocinctus*	Literature	No	Forest	Resident	LC	LC
154	Grey-winged Blackbird	*Turdusboulboul*	Survey	No	Forest	Resident	LC	LC
155	Dark-throated Thrush	*Turdusruficollis*	Survey	No	Forest	Winter visitor	LC	LC
156	Dark-sided Flycatcher	*Muscicapasibirica*	Literature	No	Forest	Summer visitor	LC	LC
157	Rufous-gorgeted Flycatcher	*Ficedulastrophiata*	Survey	No	Forest	Resident	LC	LC
158	Taiga Flycatcher	*Ficedulaalbicilla*	Survey	No	Forest	Winter visitor	LC	LC
159	Ultramarine Flycatcher	*Ficedulasuperciliaris*	Literature	No	Forest	Summer visitor	LC	LC
160	Grey-headed Canary Flycatcher	*Culicicapaceylonensis*	Survey	Yes	Forest	Resident	LC	LC
161	Verditer Flycatcher	*Eumyiasthalassina*	Survey	Yes	Forest	Resident	LC	LC
162	Small Niltava	*Niltavamacgrigoriae*	Survey	Yes	Forest	Resident	LC	LC
163	Rufous-bellied Niltava	*Niltavasundara*	Literature	No	Forest	Resident	LC	LC
164	Blue-throated Flycatcher	*Cyornisrubeculoides*	Literature	No	Forest	Summer visitor	LC	LC
165	Siberian Rubythroat	*Luscinia calliope*	Literature	No	Forest	Winter visitor	LC	LC
166	White-tailed Rubythroat	*Luscinia pectoralis*	Literature	No	Forest	Resident	LC	LC
167	Bluethroat	*Lusciniasvecica*	Literature	No	Forest	Winter visitor	LC	LC
168	Indian Blue Robin	*Lusciniabrunnea*	Literature	No	Forest	Resident	LC	LC
169	Orange-flanked Bush Robin	*Tarsigerrufilatus*	Literature	No	Forest	Resident	LC	LC
170	Golden Bush Robin	*Tarsigerchrysaeus*	Literature	No	Forest	Resident	LC	LC
171	Oriental Magpie Robin	*Copsychussaularis*	Survey	Yes	Forest	Resident	LC	LC
172	White-tailed Robin	*Cinclidiumleucurum*	Literature	No	Forest	Resident	LC	LC
173	Black Redstart	*Phoenicurusochruros*	Survey	No	Forest	Resident	LC	LC
174	Hodgson's Redstart	*Phoenicurushodgsoni*	Survey	No	Forest	Winter visitor	LC	LC

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migration status	Conser vation Status	Natioan l Status
175	Blue-fronted Redstart	*Phoenicurus frontalis*	Survey	No	Forest	Resident	LC	LC
176	White-capped Water Redstart	*Chaimarrornisleucocephalus*	Survey	Yes	Wetland	Resident	LC	LC
177	Plumbeous Water Redstart	*Rhyacornisfuliginosus*	Survey	Yes	Wetland	Resident	LC	LC
178	Little Forktail	*Enicurusscouleri*	Literature	No	Wetland	Resident	LC	LC
179	Slaty-backed Forktail	*Enicurusschistaceus*	Survey	Yes	Wetland	Resident	LC	LC
180	Spotted Forktail	*Enicurus maculatus*	Survey	Yes	Wetland	Resident	LC	LC
181	Black-backed Forktail	*Enicurusimmaculatus*	Survey	Yes	Wetland	Resident	LC	LC
182	Common Stonechat	*Saxicola torquata*	Survey	Yes	Grassland	Resident	LC	LC
183	Pied Bushchat	*Saxicola caprata*	Survey	Yes	Grassland	Resident	LC	LC
184	Grey Bushchat	*Saxicola ferrea*	Survey	No	Grassland	Resident	LC	LC
185	Chestnut-tailed Starling	*Sturnus malabaricus*	Survey	Yes	Forest	Resident	LC	LC
186	Brahminy Starling	*Sturnus pagodarum*	Literature	Yes	Forest	Resident	LC	LC
187	Common Myna	*Acridotherestristis*	Survey	Yes	Settlement	Resident	LC	LC
188	Jungle Myna	*Acridotheresfuscus*	Survey	Yes	Settlement	Resident	LC	LC
189	Hill Myna	*Gracula religiosa*	Literature	Yes	Forest	Resident	LC	LC
190	Chestnut-bellied Nuthatch	*Sittacastanea*	Survey	Yes	Forest	Resident	LC	LC
191	Velvet-fronted Nuthatch	*Sitta frontalis*	Literature	Yes	Forest	Resident	LC	LC
192	White-tailed Nuthatch	*Sittahimalayensis*	Literature	No	Forest	Resident	LC	LC
193	Wallcreeper	*Tichodromamuraria*	Survey	No	Settlement	Winter visitor	LC	LC
194	Great Tit	*Parus major*	Survey	Yes	Forest	Resident	LC	LC
195	Green-backed Tit	*Parusmonticolus*	Survey	Yes	Forest	Resident	LC	LC
196	Black-lored Tit	*Parusxanthogenys*	Survey	Yes	Forest	Resident	LC	LC
197	Black-throated Tit	*Aegithalosconcinnus*	Survey	Yes	Forest	Resident	LC	LC
198	Yellow-browed Tit	*Sylviparusmodestus*	Literature	No	Forest	Resident	LC	LC
199	Barn Swallow	*Hirundorustica*	Survey	Yes	Settlement	Resident	LC	LC
200	Red-rumped Swallow	*Hirundodaurica*	Survey	Yes	Settlement	Resident	LC	LC
201	Black-crested Bulbul	*Pycnonotusmelanicterus*	Literature	Yes	Forest	Resident	LC	LC
202	Himalayan Bulbul	*Pycnonotusleucogenys*	Survey	Yes	Forest	Resident	LC	LC
203	Red-vented Bulbul	*Pycnonotuscafer*	Survey	Yes	Forest	Resident	LC	LC
204	Mountain Bulbul	*Hypsipetesmcclellandii*	Survey	Yes	Forest	Resident	LC	LC
205	Black Bulbul	*Hypsipetesleucocephalus*	Survey	Yes	Forest	Resident	LC	LC
206	Ashy Bulbul	*Hemixosflavala*	Survey	Yes	Forest	Resident	LC	LC
207	Striated Prinia	*Priniacriniger*	Survey	Yes	Grassland	Resident	LC	LC
208	Grey-crowned Prinia	*Priniacinereocapilla*	Literature	Yes	Grassland	Resident	VU	VU
209	Zitting Cisticola	*Cisticola juncidis*	Literature	Yes	Agriculture land	Resident	LC	LC
210	Oriental White-eye	*Zosteropspalpebrosus*	Survey	Yes	Forest	Resident	LC	LC
211	Winter Wren	*Troglodytes troglodytes*	Literature	No	Forest	Resident	LC	LC
212	Grey-bellied Tesia	*Tesiacyaniventer*	Literature	Yes	Forest	Resident	LC	LC
213	Chestnut-headed Tesia	*Tesiacastaneocoronata*	Literature	No	Forest	Resident	LC	LC

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migration status	Conservation Status	Natioan l Status
214	Common Tailorbird	*Orthotomussutorius*	Survey	Yes	Bushes	Resident	LC	LC
215	Aberrant Bush Warbler	*Cettiaflavolivacea*	Literature	No	Bushes	Resident	LC	LC
216	Grey-sided Bush Warbler	*Cettiabrunnifrons*	Literature	No	Bushes	Resident	LC	LC
217	Common Chiffchaff	*Phylloscopuscollybita*	Literature	No	Bushes	Winter visitor	LC	LC
218	Dusky Warbler	*Phylloscopusfuscatus*	Survey	No	Bushes	Winter visitor	LC	LC
219	Tickell's Leaf Warbler	*Phylloscopusaffinis*	Literature	No	Forest	Resident	LC	LC
220	Blyth's Leaf Warbler	*Phylloscopusreguloides*	Survey	No	Forest	Resident	LC	LC
221	Buff-barred Warbler	*Phylloscopuspulcher*	Literature	No	Forest	Resident	LC	LC
222	Greenish Warbler	*Phylloscopustrochiloides*	Survey	No	Forest	Winter visitor	LC	LC
223	Ashy-throated Warbler	*Phylloscopusmaculipennis*	Literature	No	Forest	Resident	LC	LC
224	Hume's Warbler	*Phylloscopushumei*	Survey	No	Forest	Resident	LC	LC
225	Lemon-rumped warbler	*Phylloscopuschloronotus*	Literature	No	Forest	Resident	LC	LC
226	Whistler's Warbler	*Seicercuswhistleri*	Literature	No	Forest	Resident	LC	LC
227	Golden-spectacled Warbler	*Seicercusburkii*	Literature	No	Forest	Resident	LC	LC
228	Grey-hooded Warbler	*phylloscopusxanthoschistos*	Survey	Yes	Forest	Resident	LC	LC
229	Chestnut-crowned Warbler	*Seicercuscastaniceps*	Literature	No	Forest	Resident	LC	LC
230	Black-faced Warbler	*Abroscopusschisticeps*	Literature	No	Forest	Resident	LC	LC
231	White-throated Laughingthrush	*Garrulaxalbogularis*	Literature	Yes	Forest	Resident	LC	LC
232	White-crested Laughing Thrush	*Garrulaxleucolophus*	Survey	Yes	Forest	Resident	LC	LC
233	Striated Laughingthrush	*Garrulaxstriatus*	Literature	Yes	Forest	Resident	LC	LC
234	Chestnut-crowned Laughingthrush	*Garrulaxerythrocephalus*	Literature	Yes	Forest	Resident	LC	LC
235	Streaked Laughingthrush	*Garrulaxlineatus*	Literature	No	Forest	Resident	LC	LC
236	Puff-throated Babbler	*Pellorneumruficeps*	Survey	Yes	Forest	Resident	LC	LC
237	Rusty-cheeked Scimitar Babbler	*Pomatorhinuserythrogenys*	Survey	Yes	Forest	Resident	LC	LC
238	Streak-breasted Scimitar Babbler	*Pomatorhinusruficollis*	Survey	Yes	Forest	Resident	LC	LC
239	Scaly-breasted Wren Babbler	*Pnoepygaalbiventer*	Literature	No	Forest	Resident	LC	LC
240	Pygmy Wren Babbler	*Pnoepygapusilla*	Literature	Yes	Forest	Resident	LC	LC
241	Nepal Wren Babbler	*Pnoepyga immaculate*	Literature	No	Forest	Resident	LC	LC
242	Black-chinned Babbler	*Stachyrispyrrhops*	Survey	Yes	Forest	Resident	LC	LC
243	Grey-throated Babbler	*Stachyrisnigriceps*	Literature	Yes	Forest	Resident	LC	LC
244	Striped Tit Babbler	*Macronousgularis*	Survey	Yes	Forest	Resident	LC	LC
245	Spiny Babbler	*Turdoidesnipalensis*	Survey	Yes	Bushes	Resident	LC	LC
246	Jungle Babbler	*Turdoidesstriatus*	Literature	Yes	Forest	Resident	LC	LC
247	Red-billed Leiothrix	*Leiothrix lutea*	Literature	Yes	Forest	Resident	LC	LC
248	Whiskered Yuhina	*Yuhina flavicollis*	Literature	Yes	Forest	Resident	LC	LC
249	Striped-throated Yuhina	*Yuhina gularis*	Literature	No	Forest	Resident	LC	LC
250	White-bellied Erpornis	*Erporniszantholeucais*	Literature	Yes	Forest	Resident	LC	LC
251	Rufous-winged Fulvetta	*Alcippecastaneceps*	Literature	No	Forest	Resident	LC	LC

S. N	Common Name	Scientific name	Current survey / Literature review	Possibly Breeding	Habitat	Migration status	Conservation Status	Natioan l Status
252	Nepal Fulvetta	*Alcippenipalensis*	Survey	Yes	Forest	Resident	LC	LC
253	Rufous Sibia	*Heterphasiacapistrata*	Literature	No	Forest	Resident	LC	LC
254	Plain Flowerpecker	*Dicaeum concolor*	Survey	Yes	Forest	Resident	LC	LC
255	Fire-breasted Flowerpecker	*Dicaeumignipectus*	Survey	Yes	Forest	Resident	LC	LC
256	Thick-billed Flowerpecker	*Dicaeum agile*	Literature	Yes	Forest	Resident	LC	LC
257	Purple Sunbird	*Nectariniaasiatica*	Survey	Yes	Forest	Resident	LC	LC
258	Green-tailed Sunbird	*Aethopyganipalensis*	Literature	No	Forest	Resident	LC	LC
259	Black-throated Sunbird	*Aethopyga saturate*	Survey	Yes	Forest	Resident	LC	LC
260	Crimson Sunbird	*Aethopygasiparaja*	Survey	Yes	Forest	Resident	LC	LC
261	Mrs Gould's Sunbird	*Aethopygagouldiae*	Literature	No	Forest	Resident	LC	LC
262	Fire-tailed Sunbird	*Aethopygaignicauda*	Literature	No	Forest	Resident	LC	LC
263	House Sparrow	*Passer domesticus*	Survey	Yes	Settlement	Resident	LC	LC
264	Eurasian Tree Sparrow	*Passer montanus*	Survey	Yes	Settlement	Resident	LC	LC
265	White Wagtail	*Motacilla alba*	Survey	No	Wetland	Winter visitor	LC	LC
266	White-browed Wagtail	*Motacillamaderaspatensis*	Survey	Yes	Wetland	Resident	LC	LC
267	Grey Wagtail	*Motacillacinerea*	Survey	No	Wetland	Resident	LC	LC
268	Paddyfield Pipit	*Anthusrufulus*	Survey	Yes	Agriculture land	Resident	LC	LC
269	Olive-backed Pipit	*Anthushodgsonii*	Survey	No	Forest	Resident	LC	LC
270	Rosy Pipit	*Anthusroseatus*	Literature	No	Wetland	Resident	LC	LC
271	Baya Weaver	*Ploceusphilippinus*	Survey	Yes	Agriculture land	Resident	LC	LC
272	Scaly-breasted Munia	*Lonchurapunctulata*	Survey	Yes	Agriculture land	Resident	LC	LC
273	White-rumped Munia	*Lanchurastriata*	Survey	Yes	Agriculture land	Resident	LC	LC
274	Yellow-breasted Greenfinch	*Carduelisspinoides*	Literature	No	Agriculture land	Resident	LC	LC
275	Common Rosefinch	*Carpodacuserythrinus*	Literature	No	Forest	Resident	LC	LC
276	Crested Bunting	*Melophuslathami*	Survey	No	Agriculture land	Resident	LC	LC

Annex 2.12: Fish Fauna of the Study Area (based on literature sources and survey)

S. N	Species	Common and Local Name	Family	Status		Remarks
				IUCN	Nepal	
1	*Acanthocobotis*(*Nemacheilus) botia*(Hamilton-Buchanan)	Sand Loach Pate gadela, Baghe	*Cobitidae*	LC	DD	Pristine Rare Decorative
2	*Anguilla bengalensisbengalensis*(Gray)	Indian mottled eel; Rajbam, Rem	*Anguillidae*	NT	VU	Cited
3	*Sperata (Mystus) aor* (Hemilton-Buchanan)	Long-whiskered catfish; Kanti	*Bagridae*	LC	LC	Uncommon

S. N	Species	Common and Local Name	Family	Status		Remarks
				IUCN	Nepal	
4	*Sperata (Mystus) seenghala*	Gaint river catfish, Sujah, Tengra	*Bagridae*	LC	LC	Uncommon
5	*Balitora brucei* (Gray)	Gray's stone loach Pathertata	*Balitoridae*	NT	CD	Rare
6	*Bariliusbarna*(Hamilton-Buchanan)	Barnabaril; Titerkanefaketa	*Cyprinidae*	LC	LC	Common Photo evidence
7	*Bariliusbendelisis*(Hamilton-Buchanan)	Hamilton's barila; Chiplefaketa, Gurder, Khasreechala	*Cyprinidae*	LC	LC	Common Photo evidence
8	*Bariliusshacra*(Hamilton-Buchanan)	Shacrebaril; Faketa	*Cyprinidae*	LC	LC	Uncommon
9	*Bariliusvagra*(Hamilton-Buchanan)	Vagrabaril; Lam faketa	*Cyprinidae*	LC	LC	Uncommon
10	*Botiaalmorhae*(Gray)	Yoyo; Baghi, Baghuwa	*Cobitidae*	LC	DD	Pristine Rare Ornamental Photo
11	*Botia lochachata* (Chaudhuri)	Y-loach, Tiger loach Baghi, Getu	*Cobitidae*	LC	LC	Uncommon
12	*Chaguniuschagunio*(Hamilton-Buchanan)	Chaguni; Patharchatti, Kasree	*Cyprinidae*	LC	VU	Cited
13	C*hannagachua*(Hemilton-Buchanan)	Dwarf snakehead; Garahi, Bhoti	*Channidae*	LC	LC	Common; Photo evidence
14	*Channastriata*(Bloch)	Asian snakehead; Helae	*Channidae*	LC	LC	Common
15	*Tariqilabeolatiuslatius*(Hamilton-Buchanan)	Gangetic laita, Lohari, Mate buduna	*Cyprinidae*	LC	LC	Uncommon Photo evidence
16	*Cyprinionsemiplotus*(McClelland)	Assamese kingfish; Khurpe, Chepti	*Cyprinidae*	NA	LC	Uncommon
17	*Parachiloglanishodgarthi*(Hora)	*Torrent catfish* Telkapre	*Sisoridae*	LC	CD	Rare
18	*Eutropichthysvacha*(Hamilton-Buchanan)	Batchwavacha Cherki, Bachawa	*Schilbeidae*	NA	LC	Uncommon
19	*Garraannandalei*(Hora)	Annandale garra; Laharebuduna	*Cyprinidae*	LC	LC	Photo evidence; common
20	*Garragotylagotyla*(Gray)	Gotyla; Dhumkebuduna	*Cyprinidae*	LC	LC	Common; Photo

S. N	Species	Common and Local Name	Family	Status		Remarks
				IUCN	Nepal	
21	*Garramullya*(Sykes)	Mullyagarra, Khurpebuduna	*Cyprinidae*	LC	LC	Common
22	*Garrarupecula*(McClelland)	Mishmi Garra; Buduna	*Cyprinidae*	LC	LC	Common
23	*Glyptothoraxtelchitta*(Hamilton-Buchanan)	Telcapre	*Sisoridae*	LC	CD	Rare
24	*Glyptothoraxtrilineatus*(Blyth)	Three-lined catfish; Telcapre	*Sisoridae*	LC	CD	Rare
25	*GlyptothoraxCavia*(Hamilton-Buchanan)	Vedro	*Sisoridae*	LC	CD	Photo evidence; Rare
26	*Glyptothorax indicus* (Talwar)	Capre	*Sisoridae*	LC	CD	Rare
27	*Glyptothoraxpectinopterus*(McClelland)	Capre	*Sisoridae*	LC	LC	Uncommon Photo evidence
28	*Heteropneusteusfossilis*(Bloch)	Stinging catfish; Singhi	*Heteropneustidae*	LC	LC	Common
29	*Homalopterabilineata*(Blyth)	Burmese loach; Patherchatti	*Balitoridae*	LC	DD	Pristine Rare Ornamental
30	*Labeobata*(Hamilton-Buchanan)	Minor carp; Bata labeo	*Cyprinidae*	LC	LC	Common; Photo evidence
31	*Bangana dero* (Hamilton-Buchanan)	Kalabans, River Rohu; Gurdi	*Cyprinidae*	LC	LC	Common
32	*Labeo dew* (Hamilton-Buchanan)	Gardi	*Cyprinidae*	NA	LC	Common
33	*Monopteruscuchia*	Chuchia, Gangetic mud eel; Andhbam, Anahi, Anali	*Synbranchidae*	LC	LC	Uncommon
34	*Nemacheiluscorica*(Hamilton-Buchanan)	Stone loach; Raigadero	*Cobitidae*	LC	DD	Pristine Rare Ornamental
35	*Neolissochilushexagonalepis*(McClelland)	Copper mahseer; Katle, Vadalke	*Cyprinidae*	NT	VU	Photo evidence
36	*Pseudecheneiseddsi*(Ng)	Gotel, Kabre	*Sisoridae*	DD	DD	Rare Ornamental Pristine
37	*Pseudecheneisserracula*(Ng &Edds)		*Sisoridae*	LC	DD	Pristine Rare Ornament

S. N	Species	Common and Local Name	Family	Status		Remarks
				IUCN	Nepal	
						al
38	*Pseudecheneissulcata*(McClelland)	Sulcatus catfish; Kabre	*Sisoridae*	LC	CD	Rare; Photo evidence
39	*Psilorhynchusbalitora*(Hamilton-Buchanan)	Balitora minnow; Titari	*Psilorhynchidae*	LC	DD	Pristine Rare Ornamental
40	*Puntius terio*(Hamilton-Buchanan)	One-spot barb; Pothi	*Cyprinidae*	LC	LC	Uncommon Photo evidence
41	*Schistura beavani* (Gunther) *Nemacheilus beavani*	Dharkeegadero, Kholsegadero	*Balitoridae*	LC	DD	Pristine Rare Ornamental
42	*Schisturamultifaciata* (Day)	Gadelo, Kachhinya (Newari language)	*Balitoridae*	LC	DD	Pristine Rare Ornamental
43	*Schisturasavona*(McClelland) *Nemacheilussovana*	Ring loach; Gadela	*Balitoridae*	LC	LC	Uncommon Photo evidence
44	*Schizopygerniger*(Heckel)	Snowtrout; Kalotilke	*Cyprinidae*	NA	NT	Rare
45	*Schizothoraxprogastus*(McClelland)	Dinnawahsnowtrout, Pointed-snout snowtroutChucheasla	*Cyprinidae*	LC	VU	Cited
46	*Schizothoraxplagiostomus*(Heckel)	Golden snowtrout/ spotted snowtrout; Sun asla	*Cyprinidae*	NA	VU	Photo evidence
47	*Schizothoraxrichardsonii*(Gray)	Blunt-nosed snowtrout, Bucheasla	*Cyprinidae*	VU	LC	Common
48	*Naziritorchelynoides*(McClelland)	Dark mahseer; Halundae	*Cyprinidae*	VU	LC	Uncommon
49	*Tor putitora*(Hamilton-Buchanan)	Putitor mahseer, Golden Pahalesahar, Mahseer, Ratar	*Cyprinidae*	EN	EN	Photo evidence
50	*Tor tor*(Hamilton-Buchanan)	Falamesahar; Deep bodied mahseer	*Cyprinidae*	NT	EN	Cited

Annex 2.13: Critical Habitat Criteria[20]

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 ≥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 ≥ 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	No equivalent criteria (Criterion 5: Areas associated with key	No set criteria

[20] International Finance Corporation. (2019). Biodiversity Conservation and Sustainable Management of Living Natural Resources. *Guidance Note 6*. 6 (GN52), 16.

biodiversity values described above in (a) to (d).	evolutionary processes)	

Notes:*Endemic Species*: an endemic species is one that has ≥ 95 percent of its global range inside the country or region of analysis[21];

Restricted-range Species: Species with world distributions of less than 50,000km[21];

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	*Aquila clanga*	Greater Spotted Eagle	VU	Yes	No	No
2	*Aquila nipalensis*	Steppe Eagle	EN	Yes	No	No
3	*Aythyaferina*	Common Pochard	VU	Yes	No	No
4	*Ciconia episcopus*	Asian Woollyneck	VU	Yes	No	No
5	*Gyps bengalensis*	White-rumped Vulture	CR	Yes	No	Yes
6	*Neophron percnopterus*	Egyptian Vulture	EN	Yes	No	No
7	*Priniacinereocapilla*	Grey-crowned Prinia	VU	Yes	No	No
8	*Sarcogyps calvus*	Red-headed Vulture	CR	No	No	No
9	*Sterna acuticauda*	Black-bellied Tern	EN	Yes	No	No
10	*Manis pentadactyla*	Chinese Pangolin	CR	Yes	No	No
11	*Panthera pardus*	Common Leopard	VU	No	No	No
12	*Schizothoraxrichardsonii*	Blunt-nosed snowtrout, Bucheasla	VU	Yes	No	Yes
13	*Naziritorchelynoides*	Dark mahseer; Halundae	VU	Yes	No	Yes
14	*Tor putitora*	Himalayan (Golden) Mahseer	EN	Yes	No	No

[21] 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	*Aegypiusmonachus*	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 22,400,000km2. The population is estimated at 15,600 – 21,000 and considered decreasing.	Considering the very large EOO in comparison to the proportionally small EAA[22], 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	*Aquila clanga*	Greater Spotted Eagle	VU	No	No	No	Species widely distributed in Eurasia and occurs in Nepal and other countries of Southeast Asia only	Considering the very large EOO in comparison to the proportionally small EAA, it is unlikely that the EAA would

[22]EEA 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).

							during seasonal migrations or wintering. The global population is estimated in 3,300 – 8,800 individuals.	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	*Aquila nipalensis*	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 12,500,000km2. The species has an estimated 50,000 – 75,000 mature individuals globally.	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.
4	*Aythyaferina*	Common Pochard	VU	No	No	No	This migratory species has is found through most of	Considering the very large EOO in comparison to the

							Europe and northern Asia, but also found in parts of southern Asia and Africa. The EOO is 27,800,000km2. The global population is estimated at 1,950,000- 2,250,000 individuals.	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	*Aythyanyroca*	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 25,900,000km2. 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.
	Ciconia episcopus	Asian Woollyneck	VU	No	No	No	This species is found throughout parts of	The Asian Woollyneck is unlikely to become endangered

							southern Asia and parts of Southeast Asia. The EOO for this species 18,900,000km2. The global population is estimated up to 35,000 individuals. The species uses a wide range habitat types.	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
6	*Gyps bengalensis*	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 7,370,000km2. 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
7	*Gyps himalayensis*	Himalayan Griffon	NT	No	No	No	The EOO of the species is 6,220,000 km2 spread over western China, Central Asian highlands and	Considering the very large EOO species in comparison to the proportionally small Project EAA and large population size,

							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 between 1,000 to 4,999.9 individuals.	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
8	*Neophron percnopterus*	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 51,600,000km2. 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
9	*Priniacinereocapilla*	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 adjoining areas of Parsa Wildlife Reserve and a small area of Bardia National Park and buffer zone. The EOO of the species is 162,000km2. The population size is preliminarily estimated to fall into the band 10,000-19,999 individuals	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.
10	*Sarcogyps calvus*	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 5,230,000km2 and is a resident of Nepal. The global population of mature individuals is	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

							estimated at 2,500-9,999.	accordance with the precautionary principle it is possible that that the Project EAA contains critical habitat for this species.
11	*Sterna acuticauda*	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 4,490,000km2. There is an estimated 6,700 – 17,000 mature individuals globally	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.
Mammals								
12	*Manis pentadactyla*	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.
13	*Naemorhedus goral*	Himalayan Goral	NT	No	No	No	This species range is	Considering the very large EOO

							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.	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.
14	*Panthera pardus*	Common Leopard	VU	No	No	No	The leopard is widely distributed throughout Africa, Central Asia, South East Asia and North Asia. Panthera pardusorientalis, 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 considered to be decreasing.	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.
15	*Semnopithecus hector*	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	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

							villages. Roaming langurs can be seen in small groups time to time along the road.	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								
16	*Anguilla bengalensis*	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
17	*Balitora brucei*	*Slender Stone Loach*	NT	No	No	No	Species is known in India and not described for Nepal. Species occurs in plain areas: wetlands and	Species occurrence in the project area needs confirmation.

							rivers.	
18	*Schizothoraxrichardsonii*(Gray)	Blunt-nosed snowtrout, Bucheasla	VU	No	No	No	Species widely distributed in South-East Asia in freshwater reservoirs. The EOO of this species is unknown. The global population is unknown, although considered quite common within South-East Asia.	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
19	*Naziritorchelynoides*(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.
20	*Tor putitora*(Hamilton-Buchanan)	Putitor mahseer, Golden Pahalesahar, Mahseer, Ratar	EN	Yes	No	No	*Tor putitora* is naturally distributed throughout the rivers (and associated reservoirs) of the South Himalayan drainage	This species is known from literature sources. No other contemporary records were identified of the species in the watershed during survey. Given

							(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 1,305,202km2. No comprehensive range-wide population studies have been carried out on the species, although there are studies available from many individual river systems and reservoirs that make up the Himalayan landscape, which have observed declines.	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.
21	*Tor tor*(Hamilton-Buchanan)	Falamesahar; 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	Sanysi	Chepang	Dalit	Janajati	Muslim	Madheshi	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
	BenighatRorang RM-3 & 5	423	1	5	9	97	9	2	13	559
	BenighatRorang RM-7 & 8	68	1	2	1	14	3		5	94
	BenighatRorang 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
	BenighatRorang RM	72.0
	BenighatRorang RM	59.7
	BenighatRorang 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 likely 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
Chepang	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	Chandragari	3	7	Kalanki
Black Topped	Patale Ban	Sisort	Chandragari	3	3	Resort
Black Topped	Chisapani	Dhading			1	Dhading
Black Topped	Tile-ghar	Cement Factory			3	Cement Factory
Black Topped	KhaniKhola	Jeevanpur			10	Jeevanpur
Black Topped	KhaniKhola	MayalDhara	Naubise	7	4	MayalDhara
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	Phurkekhola	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	Darechowk	3	8	Kurintar(Way to Mankamana)
Black Topped	Muglin	Tamil Gau	Darechowk	4	6	Tamil Gau
Black Topped	East West Highway (Linked to Prithvi Highway)		Darechowk	4	8	
Gravel	Pipalamode	Sallaghari	Chandragari	3	3	Tileghar
Gravel	Sigrekhola	DhungaKhani			1	DhungaKhani
Gravel	Sigrekhola	KhaniKhola			2	KhaniKhola
Gravel	Tileghar	Sitapaila			2	Sitapaila
Gravel	Naubise	Ganesthan	Naubise	6	3	Ganeshthan
Gravel	KhaniKhola	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	Dhakal Chowk			3	Dhakal Chowk
Earthen	Pipalamode	Dhading			3	Dhading
Earthen	Sikrekhola	Khukure Chowk			2	Khukure Chowk
Earthen	Khatri Pauwa	Khadi	Naubise	4	4	Khadi
Earthen	Kanakot	Kanakot			4	KanakotGau
Earthen	Kanakot	Pauwa School			3	Pauwa School
Earthen	Kanakot	Maran Ghat			1	Maranghat
Earthen	Kanakot	Kanakot			2	KanakotGau
Earthen	Sigrekhola	DhungaKhani			1	DhungaKhani
Earthen	Tileghar	Sigrekhola			4	Sigrekhola
Earthen	KhaniKhola	KharkeDaanda			1	KharkeDaanda

Earthen	KhaniKhola	Naubise	Naubise	2	15	Naubise
Earthen	KhaniKhola	Naubise	Naubise	6	5	Naubise
Earthen	KhaniKhola	Bhanjyang	Naubise	7	3	Bhanjyang
Earthen	KhaniKhola	Bhatta Gau	Naubise	7	2	Bhattagau
Earthen	KhaniKhola	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	Majhimtar	Pipaldaanda	Jogimara	9	10	Pipaldaanda
Earthen	Majhimtar	Baluwakhani	Jogimara	9	10	Baluwakhani
Earthen	Jogimara	JogimaraBhanjyang	Jogimara	1	5	JogimaraBhanjyang
Earthen	Kurintar	Lamidanda	Darechowk	3	10	Lamidaanda
Earthen	Kurintar	Lamidanda	Darechowk	3	8	Lamidaanda

Annex 3: Stakeholder Engagement and Public Consultation

ANNEX 5.1: Public Consultation during ESIA Scoping (22 Aug- 6 Sep 2016):

SN	Settlement, Municipality/Rural Municipality	Date	Participant			Issues raised	Response	Responsible Agency
			Male	Female	Total			
1	LapshiKhola, 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, 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 conduct equally in each side.	Consideration will be given for road safety measures and other issues during design	GRM, Project, Contractor
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, 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	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, 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	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, 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
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, Contractor
						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, Contractor
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, 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
						Road safety sign i.e. Zebra crossing sign in Adhamghat bazar area.	Consideration will be given for road safety measures and other	Project, Contractor

							issues during design	
7	Gajuri Bazar, Gajuri-1	28/Aug/2016 (2073/5/12)	10	5	15	Only 75 fit structures clear during the road improvement/widening	Clear information will be provided	GRM, Project, Contractor
						Frequently changed ROW rule create confusion in local level	Clear information will be provided	Project, Contractor
						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, Contractor
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, Contractor
						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, 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	GRM, Project, Contractor
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, Contractor
						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, Contractor
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, Contractor
						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, Contractor
12	HugdiKhola , 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, Contractor
						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, Contractor
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, Contractor
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, Contractor
						Business hold households should be resettled within commercial location within the road alignment.	Appropriate compensation will be provided	Project, Contractor
						Constructed of the new road should be 4-lane wide.	Clear information will be provided	Project, Contractor
						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, Contractor
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, Contractor
						Reasonable compensation 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.	Clear information will be provided	Project, Contractor
						Entire sector will be developed if the proposed alignment approved.	Appropriate Trainings, in coordination with the local people will be brough	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	Appropriate Trainings, in	Project,

						alignment approved.	coordination with the local people will be brought	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 5.2a: Public Consultation during ESIA phase (26-30 Jan 2017)

SN	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)	32	3	35	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 conduct 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)	26	4	30	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)	32	4	36	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	JogiMara, Majhi tar (Chepangscommunity)	30/Jan/2017 (2073/10/17)	14	-	14	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	104	11	115			

Source: Field Survey, 2017

Annex 5.2b: 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	LoknathLamsal	Officer	BaireniIllaka Ban	16-03-17
5	Ram Sharan Adhikari	President	Indrayeni CF	17-03-17
6			Chiraudi CF	17-03-17
7	Raju Karakheti	President	SutkeriDhunga 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	-	Kankalidevi CF	19-03-17
16	Dev Raj Tripathi	President	Falepakho CF	19-03-17
18	Kesab Raj Naharki	Member	BishalSamyukta 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	JwangMauwaKhola 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	-	Muglingillka ban	23-03-17

ANNEX 5.3: Public Hearing (9-12 April 2019)

SN	Settlement, Municipality /Rural Municipality	Date	Participant			Issues raised	Response	Responsible Agency
			Male	Female	Total			
1	New Activities Youth Club, Ward 9, Khatripauwa, Dhunibesi Municipality.	9/Apr/2018 (2074/12/26)	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 case 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	
2	RIMS Hall, Jintetar, Baireni Ward 6, Galchhi Rural Municipality	10/Apr/2018 (2074/12/27)	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 Municipality	11/Apr/2018 (2074/12/28)	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	Appropriate	Project,

						per the current market rates prior to commencing any construction activities.	measures will be taken	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	Agricultural Hall, Phisling, Gandaki Rural Municipality	12/Apr/2018 (2074/12/29)	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
						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 5.4: Consultation for Footbridge and Public Toilet (26-31 June 2018)

SN	Settlement, Munici	Date	Participant			Proposed Struc	Issues raised	Response	Responsible Agency
			M	F	T				

	pality/ Rural Municipality/chainage		ale	emale	otal	ture			
1.	Ryale, Dhunibesi 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
2.	Ryale, Dhunibesi 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.	Dharke, Dhunibesi 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	Supports of local people are	Project,

							of construction of foot-over bridge	highly appreciated	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
							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.	Mathillo Bazar, 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
12.	Purano Malekh	29/Jun/2018 (2075/03/15	-	14	14	Foot-Over	Design and drawing of foot-over bridge has been shared with local people	Supports of local people are highly appreciated	Project, Contractor,

	u Bazar, Gajuri RMP-2, (43+400)	)				Bridge			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, BenighatRorang 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, BenighatRorang 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, BenighatRorang 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, BenighatRorang RMP-5, (53+325)	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
							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.	Charaudi/ Khatritar,	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

	Benighatrorang RMP-7, (56+150)								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.	Majhitar, Benighatrorang 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.	Muglin g Bazar, Ichchakamana RMP-5, (82+300)	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
							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	220	316				

Source: Field Survey, 2019

ANNEX 5.5: First Supplementary Public Consultation (16 June -11 Aug 2019)

SN	Rural MP / Municipality	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 JungeKhola	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
						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 5.6: Second Complimentary consultation (December 2019)

SN	Settlement /Rural MP / Municipality	Date	Participant			Issues raised	Response Given	Responsible Agency
			Male	Female	Total			
1	Khatripauwa, Dhunibesi	8/Dec/2019	-	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 labour 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/Dec/2019	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/Dec/2019	-	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/Dec/2019	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.2019	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	Transportation Agency	15/Dec.2019	1	-	1	Facebook and Viber groups are mostly used for information sharing	Appropriate measures will be taken	Project, Contractor, DoR
						Proper traffic management	Appropriate measures will be	Project, Contractor, DoR

							taken	
7	Media	16/Dec.2019	1	-	1	Proper resource person to dissimilate 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	Construction workers	16/Dec.2019	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.2019	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	12	50			

Source: Field Survey 2019