



Government of Nepal

Ministry of Physical Infrastructure and Transport

Department of Roads

**Development Cooperation Implementation Division
(DCID)**

Babarmahal, Kathmandu

Strategic Road Connectivity and Trade Improvement Project (SRCTIP)

**Environmental and Social Impact Assessment (ESIA) of East
West (Mahendra) Highway (Kamala-Dhalkebar-Pathlaiya
Section)**

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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 the 2-lane Asian Highway standard; and (b) Upgrading of the Kamala-Dhalkebar-Pathlaiya (KDP) road of the East West (Mahendra) Highway from 2-lane to 4-lane. This Environmental and Social Impact Assessment (ESIA) report assesses the environmental and social risks and impacts of the Kamala-Dhalkebar-Pathlaiya 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). A standalone biodiversity management plan (BMP) and rapid cumulative impact assessment (CIA) have been developed as part of the ESIA study.

Project description

Road Transport has been proven to be the most important infrastructure component in lifting the country's economic condition from the beginning. Nepal has made considerable progress in the improvement and development of roadways. The most important highway in the country is East-West (Mahendra) Highway.

The East-West (Mahendra) Highway was constructed in 1970. The highway at that time was designed and constructed for the then nominal traffic capacity. The carriageway width was only 3.5m wide. Similarly, the bridges along the highway from Kamala to Dhalkebar are 7.0m wide and that from Dhalkebar to Pathlaiya are only 5.5m wide and as a result, the bridges have now become bottlenecks to the traffic.

Therefore, considering the increasing traffic volume and enhancement of regional trade among the member countries, the Government of Nepal has planned to upgrade 130 Km long Road from Kamala (chainage 236+698) to Pathlaiya (chainage 366+773), part of East West (Mahendra) Highway to Asian Highway Standards (Class I).

The road stretch lies in 6 Districts that is Siraha, Dhanusha, Mahottari, Sarlahi, Rautahat, and Bara of Madhesh Province. Also, it is passing through 16 municipalities (including 1 sub-metropolitan city) and 78 wards. There are many caste/ethnic group communities such as Tharu, Bote/Majhi, Bhujel, Magar, Gurung, Newar, Sunwar, etc. along the road alignment settlements of different wards. Some of these major settlements are Portaha, Godar, Birendra bazar, Bhiman, Dharapani, Kanchibazar, Puspapur, Bishrampur, Dhalkebar, Ranatol, Badahari, Lalgah, Bardibas, Raniganj, Lalbandi, Nawalpur, Harion, Naya Road, Karmaiya, Bagmati (east and west), Chapur, Nijgadh and Pathlaiya.

The existing 2-lane Kamala Dhalkebar Pathlaiya (KDP) road has been proposed to be improved into the 4-lane Asian Highway Standard (Class I). The road will be widened to 18 m width (7 m on either side with 4 m center median). Service roads of width 6.5 m each will also be constructed in either side in urban areas. Total 60 bridges will be upgraded to four lane capacity. Also 122 culverts and 23 causeways will be converted into box culverts. The estimated project cost is NPR 36.924 billion as mentioned in Detailed design Report of KDP 2023.

Project Proponent

The Development Corporation Implementation Division (DCID) of DOR, Ministry of Physical Infrastructure and Transport (MoPIT), Government of Nepal (GoN) is the proponent for upgrading

the KDP road section of East West (Mahendra) Highway. The government of Nepal is taking loan from World Bank under the Strategic Road Connectivity and Trade Improvement Project (SRCTIP).

Scope of ESIA

The scope of the ESIA is to: i) establish 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 entire cycle i.e. from preconstruction to construction to operation & maintenance; iii) consider all Environment, Health and Safety (EHS) risks likely in the project for further usage towards preparation of Stakeholder Engagement Plan (SEP), Labour Management Procedure (LMP), Gender Based Violence (GBV) Action Plan. Also, preparation of Biodiversity Assessment Plan (BMP) and Cumulative Impact Assessment (CIA) is in the scope of ESIA study.

Environmental Clearance Requirement

The proposed KDP road attracts the provisions of Environmental clearance and require environmental clearance (EIA) from Ministry of Forests and Environment, Government of Nepal.

Legal and Institutional Framework

Nepal's national legislative framework, WB ESF and ESHS guidelines forms the legal and institutional framework for this ESIA at different stages including the 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 KDP 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), there is National Gender Equality Policy 2077 BS which addresses unequal treatment to men and women. 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 Environment

Baseline data on environmental attributes has been collected from primary and secondary sources. The baseline environmental conditions will help in comparing and monitoring of the predicted negative and positive impacts resulting from the project during construction and operation phases. Accordingly, mitigation measures / management plan has been suggested for the project. The baseline physical, biological and social set up of project area is described in following sections.

Land use: The KDP road is passing through flat topography. Within Right of Way (ROW) i.e. 25 m buffer from central line, out of total 650.91 ha of land, 48.71 percent is forest followed by public use including road (19.13), agricultural land (14.92%), residential area (8.75%), commercial area (4.59%), riverine and lake area (3.05%), industrial area (0.25%), cultural and archaeological area (0.21%), mining and minerals (0.1%) and others 0.29%). All the proposed permanent structures will be constructed within this ROW and as per the declaration published in Gazette in 2034 BS. (1977 AD), all the land within this ROW is under DOR. Hence no permanent land acquisition is required for this project.

Meteorology and Air Quality: The climate of the study area belongs to the tropical climatic zone. The climate is characterized by a distinct monsoon period from June to September, a mild winter period from November to March and a hot summer from April to September. The annual minimum temperature is 18.22°C and Annual maximum temperature is 31°C. The annual rainfall is 1871.45 mm. The annual average wind speed varies from 1.31 m/s to 2.57 m/s.

The baseline air quality of the project area was monitored in the month of October 2022 to establish the air quality of the project area. The five air quality stations were identified to represent the entire project area. These stations were Dhalkebar, Lalbandi, Paurahi, Nijgadh and Dudhaura. It results indicates that all the monitored parameters were within National Air Quality Standard (NAQS), Ministry of Forests and Environment, 2012. The main source of air pollution within project area is vehicular emissions, construction activities, industrial pollution, loading and unloading of sand from riverbeds.

Noise Levels: Baseline noise levels of the project area was monitored in the month of October 2022 to establish the baseline noise levels of the project area. The five noise monitoring stations were identified to represent the entire project area. These stations were Dhalkebar, Lalbandi, Paurahi, Nijgadh and Dudhaura. The day and night time noise levels were calculated separately for all monitoring stations. It is noticed from the results of noise that equivalent noise level at Dhalkebar and Lalbandi exceeded National Standard for Noise Level 2069 for urban residential area for night time only and daytime the noise levels are within the limit for Lalbandi and slightly exceeding for Dhalkebar station. The Day and night time Leq for other stations are within limit of residential area. The main source of noise in the project area is vehicular, construction activities, industries, loading and unloading activities from riverbeds etc.

Hydrology and Water Quality: The project road is crossing 76 rivers and rivulets and most of these rivers and streams depends upon rainfall for their runoff. Among these, three rivers viz. Kamala River, Bagmati River and Bakaiya River are considered to be major rivers originating from Mahabharat range and having larger catchment/watershed area. Also, there are seven ponds along the alignment. The availability of ground water is not an issue in the project area. The ground water is available at 1 meter depth in project area. The quality of ground water was monitored at seven locations, and it was observed from water quality results that ground water is suitable for drinking at Bagmati and Pathlaiya area, however at other locations E. coli contamination was observed in ground water. The surface water was also monitored at six locations along the alignment, and it was observed from test results that there is presence of total coliform in surface water except the Bagmati River. Other parameters are within limit of were within NDWQS.

Soil and Geology: The soil is in general alluvial and fine to medium textured in the project area which is suitable for agriculture. The baseline soil quality was monitored at five locations along the project area. The soil is of acidic nature.

The KDP road alignment lies at the Gangetic Zone just pass the Siwalik Zone. This area is mostly composed of quaternary sediments (alluvium deposits) that consists of sandy gravel with boulder, bobble, pebble, silt and clay. Large alluvial fan deposits occur along the main streams. As per

National Building Code (NBC 105:2020), the project area lies within seismic zoning factor (Z) equal to 0.3. The risk of seismic hazard in the vicinity of the project area is of moderate nature.

Flora: As described in land use of the project area, KDP alignment is passing through 54 percent forest land (but within the ownership of DOR). The road alignment adjoins the boundary of Parsa National Park (forming the southern boundary of the National Park), Forest area of Sagarnath Forest Development Project, 21 community forests, 9 collaborative forests and national forests. The dominant species of tree in project area are of Khair and Simal. It is noticed that there are in total 4,914 saplings (with diameter 4.0425 cm to 14.56 cm), 8,954 poles (with diameter 14.56 to 24.26 cm) and 19,166 trees (with diameter greater than 24.26 cm) within ROW of the proposed road section that may need to be felled down due to widening of existing road. This vegetation grows in human disturbed environment, and there will be moderate impact from the road improvement to forest habitats. Also, there will be compensatory replantation in 1:10 ratio of tree and pole cutting. Some of the tree species are under threatened category as per IUCN. However, Satsal (*Dalbergia latifolia*) tree is under vulnerable category. During biodiversity study of the project area total 30 species were recorded in 41 quadrat samples. Among them, Sal (*Shorea robusta*) is the highest number with density of approximately 72 trees per hectare. However, Sal (*Shorea robusta*); Satsal (*Dalbergia latifolia*); Sisoo (*Dalbergia sissoo*) and Khair (*Senegalia catechu*) trees are banned by Government of Nepal felling, transport, or export of timber of these trees.

Critical Habitat: Parsa National Park is a protected area in the Inner Terai lowlands of south-central Nepal. It covers an area of 627.39 km² in the Parsa, Makwanpur and Bara districts. Wide variety of threatened and endangered species are reported in the Parsa National Park. Elephant movement was noted between the road stretch of km 363+100 to km 334+500. By connecting the information gathered by all possible sources estimated population was between 6-7 individuals which are partial migrants within the Parsa National Park and associated community reserves. Unprecedented travel movement of elephant was noticed near the village Puluwa Village which is 300 m distance from the km 357+800, Tangia Basti 2.5 km distance from the km 351+000.

It is found that tiger population within Parsa National Park was increased from 18 to 41 individuals from the year 2018 to 2022. With reference to the project road, as per the recent tiger census, it was noticed that range distribution of two Tigers namely FT-79 & FT-78 were reported part of the project road. These locations were identified between the chainage 333+100 to 327+700, this section is outside the Parsa National Park. Map illustrating the distribution of tigers near the project road (Pathlaiya) as per the recent tiger census (2022).

Fauna: The IBAT data was generated for 50 km buffer surrounded the KDP project and IBAT generated list of 1229 species of fauna. Among them, 35 species are considered critical. Further, as per field observation and consultations, major fauna found within the project area. Leopard is in vulnerable category; however, elephant and tiger are in Endangered category as per IUCN and Government of Nepal. Common Leopard (*Panthera pardus*) and Himalayan griffon vulture (*Gyps himalayensis*) are listed as Vulnerable as per IUCN and Government of Nepal. Near the project road Movement of higher vertebrates is more evident for namely Asian elephant (*Elephas maximus*) and Royal Bengal Tiger (*Panthera tigris*).

Social and Cultural Environment: The major section of the road is predominantly passing through the forest and agricultural land. The project area lies within 16 municipalities (including 1 sub-metropolitan city and 15 municipalities) and 6 districts of Madhesh Province. The socio-economic profile of the project area was established by conducting socio-economic survey and secondary sources. As per Population Census (CBS-2021), the total populations of project affected municipalities are 963,829, followed by male population is 475,474 and female population is 488,355 whereas percent of male population is 49.3 % and female population is 50.7%. The average family

size is 4.8 in the project area, which is higher than the national (4.32) average and province (Madhesh) level average (5.15) according to Census 2021.

The predominant occupation is trade and business followed by agriculture, livestock and household work. The literacy rate of project area is 92.2 which is more than literacy rate of Madhesh province (63.5%). The dominant religion of people living in project area is Hinduism that is approximately 89 percent followed by Buddhism that is approximately 10 percent and rest is Muslims and Christians.

Tamang, Magar, Newar, Bhujel, Tharu, Rai, Gurung, Bote, Sunuwar, Danuwar and Majhi are major indigenous groups within project area. Among these indigenous groups, Majhi, Bote and Danuwar are ‘highly marginalized’, Tamang, Gurung, Rai and Sunuwar are categorized as ‘marginalized’, Magar categorized as ‘disadvantaged’ and Newar is categorized as ‘advanced’ groups that based on indicators such as literacy and education, income, wealth, land holding and ownership of other assets. No endangered indigenous populations were noticed within the project area.

Tamang, Gurung, Maithili, Magar, Newari, Tharu and Rai languages are spoken as mother tongue but the Nepali language is mostly speaking language followed by Maithili. Nepali is spoken by more than 57 percent population whereas Maithili is spoken by 34 percent population.

According to focus group discussion (FGD) findings, early marriages, poor socio-economic status, dependency and low level of literacy rates are the common characteristics seen in the project area. Gender status in the project area has also been assessed through the household survey. About 71.44 percent surveyed households opined that the status of both men and women is equal, and in very few cases it is unequal (8.51%). The women are engaged into the household activities is 11.89 percent of surveyed households, whereas 4.08 percent households are involved in public services and community works.

Different types of industries have been reported within the project area, mainly located in the market centers like Dhalkebar, Bardibas, Harion etc. Majority of the industries include carpet, grill, crusher, rice mill, oil mill, noodle, vehicle repair, furniture, garment, bakery, soap, cement and brick block, dalmoth, spice, incense stick and candle, hume pipe, oxygen gas, bag, dairy, poultry, plywood, bamboo product, banana product, toothpick, water processing, paper, pickle, and sawmill etc. Though, some of these industries are using raw materials from Nepal itself, tools and technology are brought from other countries mainly India. Further, some industries like oxygen gas use both raw materials and tools from other countries. At present, most of Indian products are sold out within the country. After up gradation of the East West (Mahendra) highway along with KDP road section, it is hoped the trade and business will expansion to other countries like India, Pakistan, Bangladesh, Bhutan etc. in the future.

Transportation facilities are available within the project area in all seasons. The bus, tractor, truck, motorcycle, ambulance, auto rickshaw, tempo, magic/van and so on are available in the project area. The public transport to reach district headquarters, municipality and ward offices, police stations, education institutions, health posts/hospitals are available. However, there are some difficulties in accessibility mainly for children, elderly persons and persons with disabilities due to unmanaged footpath, inadequate junction/intersection design, lack of traffic signs and road safety measures.

There are numerous historical and cultural site and places of importance in the project area. These are Shiva Mandir (temple), Kali Mandir, Hanuman Mandir and Radhakrishna Mandir are main religious places in Dhalkebar area. Also, Kamalamai is the place where people come to take religious bath in Chat, Teej and Maghe sakranti festivals from remote areas. Bagmati River and its Dam are of religious importance.

Major festivals and ceremonies include Jurshital, Chaurchan, Jitiya /Jivitputrika, Sama Chakeva, Fagu Purnima/holi, Shivaratri, etc. besides other national festivals like Dashain, Tihar/Deepawali, Teej,

Lhosar, festival of Muslim community (Ramadan, Eid-ul-Fitar, Eid-ul-Adaha, Eid-Milad-un-Nabi, Moharram, Shab-i-Qadar and Shab-i-Barat), etc.

Project benefits

Project benefits are improved road infrastructure with other facilities like VUP, PUP, service roads etc. as traffic forecast in detailed design report (for ex. maximum AADT 70591 for the year 2046 AD at Chapur-Nijgadh section), inclusive design with improved road safety measures, economic development, and livelihoods of the local people, employment generation, market expansion, increase industry, increase in land and property value, reduction in travelling time and cost along with carbon emission savings/reduction in GHG emissions.

Environmental and Social Risks & Impacts

Beneficial impacts of the KDP 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, project after completion will bring the carbon savings due to efficiency in road use. Extrapolation of the carbon savings shows that approximately 30 percent of carbon emission will be saved between 2022 to 2046.

All impacts were categorized as per WB ESF and ranked against 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 KDP will be confined within the existing ROW. As per the declaration published in Gazette of GoN in 2034 BS (1977 AD), the RoW of entire section of MRM (EWH) has been declared 25m on either side with the ownership of DoR that allows KDP road to expand 25m on either side so there is not required additional land acquisition as per approved detailed design. Hence no permanent land acquisition is required for this project. Impacts mainly relate to loss of some private and public properties (residential/trade structures/temple/well/waiting shed). Altogether 40 project affected vulnerable households have also been identified. Livelihood restoration trainings is provisioned in resettlement action plan as part of mitigation measure. Beside this 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 labour influx such as gender-based violence and child labour all expected to take place during construction. The tree cutting and habitat disturbance are assessed to have moderate to substantial risks and impacts that are largely construction-related and short-term. The identified risk level for these is within substantial category during construction phase and low during operation phase.

For the improvement of KDP road, the cumulative impacts are also assessed on social side, there is not seen any significant anticipated direct impact because KDP road as well as other project intervention mostly, confined within the existing RoW and public lands. So, there is no land acquisitions but loss of private properties. However, increasing number of proposed infrastructures development projects like railway, fast track and Nijgadh airport project may create pressure on agricultural land and increase roadside encroachment and population growth and highly crowded in that area. Beside this, there may be high chance of establishment of commercial building hotels, and economic boom or may transfer into economic hub after completion of all project's intervention. We can observe or experience that ribbon settlement development is already practiced in Nepal after completion of road project. In case of this improvement works in KDP 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 strong local level authorities by power.

Labour and Working Conditions (ESS - 2):

It is noticed that approximately a total of 1000 workers will be deployed for three years for the construction work. This estimates 600 migrant workers have to be accommodated in labour camps. As mentioned in the disclosed LMP documents the minimum requirement should be fulfilled either the labours will be accommodated in the rented house or in labour camps. The possible location for labour camps and construction camps are shown in **Figure 1.9** and **Figure 1.10** respectively. This project will employ direct, contracted and primary supply workers who might be exposed to risks such as inadequate accommodation; non-payment of wages; non-payment of benefits, discrimination at employment, child labour, forced labour, prostitution and human trafficking. The project more likely to have an engagement of migrant, seasonable and female workers at various level of work including hazardous work. Occupational Health and Safety (OHS) issues including workplace accident and work-related diseases, communicable diseases including Sexually Transmitted Infections (STIs), grievances related to workers and GBV. The contracted workers are more susceptible to such risks. The risks identified are within moderate to substantial. The Labour Management Procedure (LMP) prepared for SRCTIP project has been updated for addressing KDP anticipated impacts associated with labour and working condition highlighting measures to be adopted for occupational health and safety, minimum requirements for labour camps and accommodations, prohibition of child labour and forced labour, avoidance of GBV, control of communicable diseases, etc.

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

ESS-3 covers generic risks and impacts such as land use change and landscape aesthetic, air and noise pollution, chemical hazards and solid waste management, and pollution of water sources. The project's impacts and risk would be of significance on sensitive receptors due to muck disposal; flooding and water logging; sedimentation on rivers and streams; construction water demand; stressing water sources used by community (absence of perennial water sources); emission from construction vehicles, operation of equipment and plants; dust from earth works, 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.

Air quality within the project area is found to be within National Air Quality Standard (NAQS). It is noticed that equivalent noise level at Dhalkebar and Lalbandi exceeded National Standard for Noise Level 2069 for urban residential area for night time only and daytime the noise levels are within the limit for Lalbandi and slightly exceeding for Dhalkebar station. The Day and night time Leq for other monitoring locations are within limit of residential area. The main source of noise in the project area is vehicular, construction activities, industries, loading and unloading activities from riverbeds etc.

Ground water is major source of drinking in project area. The ground water depth along project alignment ranges from 1 m to 13 m. In some cases, ground water level was not available. It is noticed that among sampled ground water all samples except that from Bagmati and Pathlaiya had E. coli contamination. Also surface water from rivers and ponds indicates that E. coli contamination is there in all surface water samples. Turbidity was found to be high in Kamala and Bakaiya rivers and wetland surface water.

It is estimated that around 32,000 litres/day of wastewater will be generation by workers in the project. Similarly, 210 kg/ day of solid waste will be generation by workers in the project.

Though during project construction there will be emission of Green House Gases (GHSs), during operation, the upgraded 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.

The risk identified are within low to substantial in range. For minimizing impact on land use, vegetation clearance will be confined only within formation width. Greenery will be maintained within median and roadside. Fertile topsoil will be collected and stored properly and reused during turfing/bioengineering along road embankment and maintaining greenery along median. Quarry and borrow pit management plan has been prepared and need to be elaborated by contractor during its implementation. Similarly, waste management plan and soil and erosion control plan has been proposed. For controlling air pollution, water will be sprayed along the dusty road during construction at least twice a day. Proper barricading of construction area, proper scheduling of construction works, timely lubrication and servicing of machineries and equipment etc. will be done. For use of toxic and hazardous chemicals, standard operating procedures for pollution spills and management of fuels and hazardous substances has been proposed. Specific procedure for spoil/muck disposal, stockpiling and transportation of construction materials, operation of crusher plant, hot mix plant and batching plants etc. have been proposed.

Community Health and Safety (ESS - 4):

Transporting construction materials will cause nuisance to community. The project activities such as river protection works, road excavation, use of vibratory equipment might result in soil erosion 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 adjoining 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 indicates moderate level. 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.

The risk identified for traffic management and traffic and road safety during construction are high whereas low to moderate during operation. Similarly risks for community exposure to health issues due to labour influx and emergency preparedness and response to disasters lie within substantial. Risks associated with human trafficking and gender-based violence are identified as substantial. For efficient traffic during construction, traffic management plan has been proposed. So as to avoid accidents and mishaps, proper road safety has been considered in design and road will be constructed accordingly. For this, establishment of traffic signals, speed control mechanisms such as zebra cross, speed breakers, speed limits etc. at crowded places have been proposed. Community awareness and sensitization programs will be conducted for awareness of workers as well as local communities with regard to health and safety issues, human trafficking, GBV and SH etc.

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

There is no land acquisition in this project and road will be developed within the existing RoW that is 50 meters. As per the declaration published in Gazette of GoN in 2034 BS. (1977 AD)¹. Hence no permanent land acquisition is required. There are occupiers and encroaches within the RoW. However, there are informal inhabitants, private, community and public structures and utilities that will be damaged due to proposed road widening. It is noticed that in total there are 66 private structures of 64 HHs within ROW and the project will directly affect these structures. Among 64 projects affected HHs, 25 are losing residence, 35 losing business huts, 4 HHs are losing both residential cum business structures. Further, 204 other extended housing structures (Sheds like) with having varied size that made of iron pillar with zinc roof needed removal or shifting from the ROW. There are 216 community/public structures including 69 waiting sheds, 35 small temples/shrines, 55 Bar-Peepal chautara, 4 police post, extended parts of 2 schools, 3 market sheds/hat bazar sheds, 1 army check post, 2 police waiting sheds, 1 traffic building, 3 public toilets, 11 boundary walls, 5 gates, 8 wells and 1 wall structure of road side garden and 16 different structures of army barrack at Dharapani (Dhanusha). Most of the private and public structure types are temporary sheds not big housing structures, and the APs have other alternatives of housing facilities nearby project area or village. Construction related resettlement impacts during project implementation will be managed as per Resettlement Action Plan (RAP) developed in accordance with the Resettlement Planning Framework (RPF) prepared as per provisioned in World Bank's ESF and DoR's ESMF. As provisioned in RAP, all APs will receive cash compensation for their all types of loss and livelihood restoration training to maintain their pre-displacement level. Considering those all facilities, the impact as rated at "substantial" level.

Further, proposed road widening is going to affect 2221 electric poles (including 140 solar poles) that lie within proposed formation width. Similarly, 33.16 km of drinking water supply pipelines is noticed to be affected due to road widening. All these electric poles and water supply pipelines will be shifted by the line department and cost will be borne by project proponent.

The risk identified for economic displacement and impact on community structures and public utilities lie within "substantial" category. A separate Resettlement Action Plan (RAP) has been prepared for compensation to affected households and rehabilitation of affected community and public structures and public utilities.

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

One of the major impacts to forest and biodiversity along KDP is that there are 28,120 number of trees and poles within ROW that may need to be felled. As removal of these trees can't be avoided due to upgrading of road, therefore these will be compensated by planting 10 trees in lieu of one tree.

Some of the tree species are under threatened category as per IUCN. Satal (*Dalbergia latifolia*) tree is under vulnerable category. Similarly, Sal (*Shorea robusta*); Satal (*Dalbergia latifolia*); Simal (*Bombax ceiba*); Sisoo (*Dalbergia sissoo*) and Khair (*Senegalia catechu*) trees are banned by Government of Nepal for commercial felling, transport, or export of timber of these trees.

KDP Road section lies towards the southern boundary (14 km stretch, from Chainage km 350+00 to km 366+420) of Parsa National Park (PNP) near Pathlaiya. Parsa National Park serves as a wildlife

¹ As per the declaration published in Gazette of GoN in 2034 BS. (1977 AD) The RoW of entire section of MRM(EWH) has been declared 25m. on either side with the ownership of DoR, That allows KDP road to expand 25 m. on either side so there is not required additional land acquisition as per approved detailed design ,

corridor and habitat for tigers, elephants, and other flagship species. Elephant movement was noted between the road stretch of km 363+100 to km 334+500. By connecting the information gathered by all possible sources, the estimated population was between 6-7 individuals which are partial migrants within the Parsa National Park and associated community reserves. Unprecedented travel movement of elephants was noticed near the village Piluwa Village, which is 300 m distance from the Ch 357+800, Tangia Basti 2.5 km distance from the Ch 351+000 of KDP road.

Tiger (*Panthera tigris*) is a flagship species that inhabits a wide range of interconnected habitats, it has been listed as 'Endangered' in the IUCN's Red List. In monsoon season a group of 12-18 were noticed expected to be seasonal migration from the Chitwan National Park which is connected with west of Parsa National Park. It was also noticed that range distribution of two Tigers namely FT-79 & FT-78 were reported part of the project road. These locations were identified between the chainage 333+100 to 327+700, this section is outside the Parsa National Park.

A total of 38 species were screened as per the IBAT assessment report which includes Reptiles 12 species, Birds 44 species and Mammals 10 species. Out of 38 species 2 species namely Asian elephant and Royal Bengal Tiger were reported near the project area.

There will impact on the movement of Elephants and other mammals. There will be minimum direct effect on them, but construction noise and pollution can affect them indirectly. Illegal hunting and poaching can take place in natural forests by road workers. Where the road stretch is adjoining to forests (Parsa National Park and other Forests) concealing wildlife including game value.

Impact due to spread to invasive alien species is found to be low whereas impacts due to loss of forest area, threat to aquatic habitat, hunting and poaching of wildlife and use of forest resources are found to be within moderate range while impacts due to loss of vegetation and wildlife movement is found to be substantial. Separate Biodiversity Management Plan has been prepared for addressing all the issues related with biological environment. Trees to be felled will be compensated by planting trees in the ratio 1:10. No Net loss/ Net gain approach: As per the Recommended compensatory afforestation rate for the removal of 28120 trees and poles. A total of 281200 compensatory afforestation trees will be planted in which a net gain of 253080 tree will be achieved. The compensatory afforestation will require a total area of 290 ha. Net gain of 261 ha is obtained through afforestation program. *Shorea robusta* regeneration plan is proposed with appropriate budget.

Eight (08) bridges namely 329+666 Amu – 1, 333+842 Lamaha, 339+381 Dhansar, 347+272 Bakeya 353+612 Terhakilo, 357+337 Pasaha, 361+003 Balganga & 363+687 Dudhaura were proposed for elephant, tiger and undulate crossings and Ten (10) bridges/culverts at CH 271+514 (Gadhanta), 274+925 (Belgachhi /Dhungre Khola), 275+630 (Tuteshwor-1), 277+266 (Maraha), 278+913 (Dholan), 282+758 (Bankhe), 285+721 (Amuwa), 292+703 (Kalinjor – 2), 317+698 (Paurahi), 322+553 (existing causeway) were proposed for medium size animal crossings like tiger and undulates. Other best practices such as providing Noise barriers, Light barriers, annual maintenance of river depth other improvement proposals required to facilitate wildlife to walk along the banks and avoid crossing through the road are proposed. For wildlife movement monitoring, setting up a Wildlife Monitoring Team coordinating with Parsa National Park is proposed during construction and operation phase with appropriate budget.

Overall, an offsets strategy in the project road is aimed to achieve a balance between the infrastructure development and the protection of the environment and communities affected by the project. It involves a combination of proactive planning by proposing underpasses, guideline fences, speed restrictions and development implementation of appropriate measures to minimize, offset negative impacts and Net gain of 290 ha additional forest area development through afforestation program.

Indigenous People (ESS - 7):

Indigenous People (IP) are classified into 5 categories namely, endangered, highly marginalized, marginalized, disadvantaged, and advanced by Nepal Federation of Indigenous Nationalities (NEFIN,

2004). According to the sampled household survey, endangered categories of indigenous peoples are not found in the KDP road corridor. However, the Indigenous People found in project area are mainly of marginalized category.

The KDP project will have - both positive and negative impacts to the indigenous peoples. Positive impacts due to project include provision of enhanced and safe transportation facilities. Negative impact includes damage to housing structures of 14 IPs among 64 households. Among 14 IP households, 12 IP households belong to marginalized category (Bhujel, and Tamang), 2 IP household (Rai and Magar) belong to disadvantaged category and 7 are female-headed household also falls in vulnerable category. Beside normal compensation to affected structures along with additional cost of assistance for relocation and livelihood restoration, no any extra measures are required. Separate IPDP has been prepared for addressing the additional support required for IP settlements within DIA.

Cultural Heritage (ESS - 8):

There is not any direct impacts and risk on tangible and intangible heritage by project intervention. The alignment of KDP road does not have any ancient monuments and tangible religious, with high cultural value, historical, and archaeological sites. The upgrading works is confine within Right of Way (RoW) and is almost clear and GoN ownership. It is noticed that there are 35 small temples/shrines within ROW of KDP road section that will be affected due to widening of proposed road. Apart from temples, sacred Bagmati & Kamala Rivers, Bar-Pipal Trees with Chautara (55 nos.) will be affected. That will be managing through RAP with required consultation with local concerned people. So, in case of chance finding, the existing procedure, GoN legislations for management of impacts will be applied.

Financial Intermediary (ESS - 9):

Since no financial intermediary is involved in this project, ESS - 9 is not applicable.

Stakeholder engagement and Information Disclosure (ESS - 10):

SRCTIP Stakeholder Engagement Plan (SEP) has been developed during NNM ESIA preparation in April 2020. The engagement of stakeholder (citizen) is done throughout the project cycle, especially in project design phase, project implementation and operation phase and update with required new information. Stakeholders' consultation was carried out during KDP ESIA preparation stage from May 2022 to August 2023. The consulted stakeholders are local governments, 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, local user groups (forest, water, irrigation etc.), local journalists, security personnel (traffic police and army), travel agency, drivers, and road users (travelling passengers). The consultation was done through Transect Walk, Focus Group Discussion (FGD), Key Informants Interview (KII) and mixed group discussions were tools for consultations with different stakeholders.

First level of consultation done was during scoping phase where 46 group discussions and 44 KII were conducted (25th April to 20th June 2022). Further, public notice seeking issues/impacts due to project and suggestions were pasted among different stakeholders and similar notice was also published in national daily newspaper (Janakpur Express on 30/06/2022 and Sourya National Daily on 05/07/2022). Household survey covering 20 percent (as per ToR) of households within DIA of the Project was done to identify the baseline scenario of the project area during the month of October 2022. At the same time, 12 focused group discussions and 64 census household surveys were conducted with project affected households to identify their baseline condition and view on project based on which resettlement plan has been prepared. Further, nine focused group discussions were also carried out among indigenous settlements within the project area from 30th January 2023 to 3rd February 2023 for identifying their view on the project and based on which IPDP has been prepared.

After preparation of ESIA, public hearing was conducted at seven different locations from 22nd May 2023 to 25th May 2023 for information dissemination and collection of public view on the project along with their suggestions.

Major issues of locals include need of crossing structures as CUP, VUP, Service roads, shelters, safety measures as signs & markings, railings, wildlife crossing structures etc. The major issues noted during consultations are safety provision with universal access and inclusive designs for school children & elderly people, women, cattle crossings, requirement of VUP & PUP, temples, shrines, waiting sheds, Haat bazar, bus stops, zebra crossings, lights, gender/child/differently able friendly public toilets, management of eight wells (Innar), cycle lane, electric poles and other facilities should be rebuilt in consultation with of local administration and local people. The issues raised by public are mostly considered in the design documents. Service roads in 26 places, five numbers of VUP/PUP, 127 no of culverts, 18 no of cattle crossings and enhancement of Haat bazar at Lalbandi, bathing ghats at Bagmati and Kamala Rivers has also been proposed. Establishment of project level GRM along with two parallel GRM (CSEA/SH and Workers related) as provisioned in SEP. Priority in local employment and promotion of local products will be applied during project implementation phase and was also concerns of local people.

Environmental and Social Management Measures

For the project impact mitigation, prevention or avoidance of impact is better than mitigation of impact. Hence avoid, minimize, mitigate and compensate are the approaches were adopted during the design stage through continued interaction between the design and environmental teams. This is resulted with designs having least environmental and social impacts.

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 stakeholders for planning of local development which will help mitigate cumulative impacts associated with uncoordinated development of road network.

An Environmental and Social Management Plan (ESMP) applying the mitigation hierarchy has been prepared to manage project'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. 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 proposed widening. All losses (private and public assets) will be compensated at 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 ESMP (C-ESMP), which shall be prepared prior to the commencement of construction activities. The C-ESMP shall include OHS plan, GBV Risk mitigation action plan, Water and waste management plan, Influx management plan, Worker's 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 advocacy materials for community awareness and sensitization with emphasis to women and young girls, promoting health seeking behaviour. The RAP and IPDP has been

prepared to highlight issues, associated with affected vulnerable and IP HHs. The Compensation Plan for the non-title holders have been prepared to compensate the affected persons.

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. No 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 10 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.

The total cost of environmental and social mitigation measures as per ESMP is NR 464,123,756. The cost mainly consists of implementation of mitigation measures not included in BOQ items, implementation of BMP, RAP, IPDP, trainings and monitoring. Cost for relocation of community and public structures and utilities including water supply pipelines and electric poles are included in BOQ and are responsibilities of Contractor.

Institutional Arrangement

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

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

The other institutions such as Department of Forestry and Soil Conservation (DoFSC), Department of National Parks and Wildlife Conservation (DNPWC), Department of Labour and Occupational Safety (DoLOS) and project affected municipalities 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. Some of the identified and suggested gaps are strengthen institutional capacity such as office set up, mobilization of needed human resources and engage in capacity enhancement training and capacity building activities include: awareness to labours on communicable diseases (including HIV/AIDs), awareness to workers on material handling, waste management, awareness/ capacity building to workers, local communities and traffic police on road and traffic safety, awareness to local communities and workers on Occupational Health and Safety, awareness to local communities on trafficking, coordination with anti-trafficking organizations and community sensitization and orientation on GBV/CSEA/SH.

कार्यकारी सारांश

भूमिका

नेपाल सरकारले क्षेत्रीय व्यापारिक मार्ग विस्तार आयोजना मार्फत मुलुकको अर्थतन्त्र र क्षेत्रीय पहुँचका लागि महत्वपूर्ण रहेका विद्यमान सडकको स्तरोन्नतिको कार्यमा विश्व बैंकलाई ऋण सहायताका लागि प्रस्ताव पेश गरि सो कार्यान्वयनको चरणमा रहेको छ । यस आयोजनाले: (क) विद्यमान नागदुङ्गा-नौबिसे-मुग्लिन सडक (काठमाडौँ र वीरगञ्ज जोड्ने महत्वपूर्ण उत्तर-दक्षिण व्यापारिक करिडोरको ९४.७ कि.मी.) लाई २ लेनको एशियाली राजमार्गको मापदण्डमा सुधार गर्न र (ख) पूर्व-पश्चिम (महेन्द्र) राजमार्गको कमला-ढल्केबर-पथलैया सडकलाई २ लेनबाट ४ लेनमा स्तरोन्नति गर्न सहयोग गरेको छ । यस वातावरणीय तथा सामाजिक प्रभाव मूल्याङ्कन (ई.यस.आइ.ए.) प्रतिवेदन कमला-ढल्केबर-पथलैया सडकको वातावरणीय तथा सामाजिक जोखिम र प्रभावको मूल्याङ्कन नेपाल सरकारको वातावरणीय अध्ययनको आवश्यकता तथा विश्व बैंकको वातावरणीय तथा सामाजिक ढाँचा र वातावरणीय तथा सामाजिक मापदण्ड बमोजिम तयार गरिएको छ । वातावरणीय तथा सामाजिक प्रभाव मूल्याङ्कन सँगसँगै जैविक विविधता व्यवस्थापन योजना र समष्टिगत तथा संचयी प्रभाव मूल्यांकन प्रतिवेदन पनि तयार गरिएको छ ।

आयोजनाको परिचय

देशको आर्थिक अवस्था वृद्धि गर्न सडक पूर्वाधार सबैभन्दा महत्वपूर्ण घटक रहेको छ । सडक मार्गको सुधार र विकासमा नेपालले उल्लेखनीय प्रगति गरेको छ । पूर्व-पश्चिम (महेन्द्र) राजमार्ग देशको सबैभन्दा महत्वपूर्ण राजमार्गको रूपमा रहेको छ ।

पूर्व-पश्चिम (महेन्द्र) राजमार्ग सन् १९७० मा निर्माण भएको थियो । त्यस समयमा उक्त राजमार्ग न्यून यातायात क्षमताको लागि डिजाइन र निर्माण गरिएको थियो । क्यारिजवे चौडाई केवल ३.५ मीटर चौडाई थियो । कमलादेखि ढल्केबरसम्मको राजमार्गको पुल ७.० मिटर चौडा र ढल्केबरदेखि पथलैया सम्मको पुल ५.५ मिटर मात्र चौडाइका भएकाले अहिले ती पुल यातायातका लागि असहज बनेका छन् ।

तसर्थ, बढ्दो यातायातको मात्रा र सदस्य राष्ट्रहरू बीच क्षेत्रीय व्यापारको वृद्धिलाई ध्यानमा राख्दै नेपाल सरकारले पूर्व-पश्चिम (महेन्द्र) राजमार्गको कमला (चेनेज २३६+६९८) देखि पथलैया (चेनेज ३६६+७७३) सम्मको १३० किलोमिटर लामो सडक खण्डलाई एशियन हाइवे स्ट्यान्डर्ड (क्लास-१) मा स्तरोन्नति गर्ने योजना बनाएको छ ।

यो सडक खण्ड मधेश प्रदेशको सिरहा, धनुषा, महोत्तरी, सर्लाही, रौतहट र बारा गरी ६ जिल्लामा पर्छ । यसका साथै १६ वटा नगरपालिका (१ उपमहानगरपालिका सहित) र ७८ वटा वडा भएर पनि यो सडक जान्छ । थारू, बोट्टे/माझी, भुजेल, मगर, गुरुङ, नेवार, सुनवार लगायत विभिन्न वडाका सडकसंग जोडिएका बस्तीहरूमा धेरै जातजाति/जातीय समूह छन् । पोर्ताहा, गोदार, वीरेन्द्रबजार, भिमान, धारापानी, कान्छीबजार, पुष्पलपुर, विश्रामपुर, ढल्केबर, रानाटोल, बडहरी, लालगढ, बर्दिवास, रानीगञ्ज, लालबन्दी, नवलपुर, हरिवन, नयाँसडक, कर्मैया, वाग्मती (पूर्व र पश्चिम), चन्द्रनिगाहपुर, निजगढ र पथलैया यस सडकमा पर्ने मुख्य बस्ती हुन् ।

हालको दुई लेनको कमला ढल्केबर पथलैया सडक खण्डलाई चार लेनको एशियन हाइवे स्ट्यान्डर्ड (क्लास १) मा स्तरोन्नति गर्न प्रस्ताव गरिएको छ । सडकलाई १८ मिटर चौडाइ (दुवैतर्फ ७ मिटर र मध्यभाग ४ मिटर) चौडा गरिनेछ । सहरी क्षेत्रका दुवैतर्फ ६.५ मिटर चौडाइका सर्भिस रोड पनि निर्माण गरिनेछ । कूल ६० वटा पुललाई चार लेन क्षमतामा स्तरोन्नति गरिनेछ । त्यस्तै १२२ कल्भर्ट र २३ कजवेलाई बक्स कल्भर्टमा परिणत गरिनेछ ।

कमला-ढल्केबर-पथलैया सडक खण्डको विस्तृत डिजाइन प्रतिवेदन (२०२३) अनुसार आयोजनाको अनुमानित लागत रु ३६ अर्ब ९२ करोड ४० लाख रहेको छ ।

आयोजना प्रस्तावक

पूर्व-पश्चिम (महेन्द्र) राजमार्गको कमला-ढल्केबर-पथलैया सडक खण्डको स्तरोन्नतिका लागि नेपाल सरकार, भौतिक पूर्वाधार तथा यातायात मन्त्रालयको विकास सहायता कार्यान्वयन महाशाखा प्रस्तावक हो। नेपाल सरकारले प्रस्ताव गरे बमोजिम क्षेत्रिय व्यापारिक मार्ग विस्तार आयोजना अन्तर्गत विश्व बैंकबाट ऋण स्वीकृत भएको छ ।

सामाजिक तथा वातावरणीय प्रभाव मुल्यांकन प्रतिवेदन (ई.यस.आइ.ए.)को दायरा

ई.यस.आइ.ए. को दायरा यस प्रकार रहेका छन् : क) कोरिडोरको प्रभाव र आयोजना प्रभाव क्षेत्रको आधारमा विद्यमान वातावरणीय तथा सामाजिक अवस्थाको पहिचान र निक्क्योल् गर्ने; ख) निर्माण पूर्व देखि निर्माण, सञ्चालन र मर्मत चरण सम्मको सम्पूर्ण चक्रमा प्रभावित आयोजनाको कारणले थप सम्भावित वातावरणीय र सामाजिक प्रतिकूल र सकारात्मक जोखिम र प्रभावहरू पहिचान गर्ने; ग) आयोजनामा सम्भावित सबै वातावरण, स्वास्थ्य र सुरक्षा सम्बन्धि जोखिमहरूको बारेमा विचार गर्दै सरोकारवाला संलग्नता योजना, श्रम व्यवस्थापन प्रक्रिया, लैङ्गिक हिंसा सम्बन्धि कार्य योजना तयार गर्ने तथा जैविक विविधता व्यवस्थापन योजना र समष्टिगत तथा संचयी प्रभाव मूल्याङ्कन पनि यस ई.यस.आइ.ए. अध्ययनको दायरामा रहेका छन्।

वातावरणीय प्रभाव मुल्यांकन प्रतिवेदन स्वीकृतीको आवश्यकता

प्रस्तावित कमला-ढल्केबर-पथलैया सडकले वातावरणीय स्वीकृतिको प्रावधानलाई आकर्षित गर्दछ र नेपाल सरकारको वन तथा वातावरण मन्त्रालयबाट वातावरणीय प्रभाव मुल्यांकन प्रतिवेदन स्वीकृत गर्न आवश्यक छ।

कानूनी र संस्थागत संरचना

नेपालका कानूनी रूपरेखा विश्ववैकको वातावरणीय तथा सामाजिक रूपरेखा, वातावरणीय स्वास्थ्य तथा सुरक्षा सम्बन्धी निर्देशिका अनुरूप वातावरण तथा सामाजिक प्रभाव मुल्यांकन प्रतिवेदन (ई.यस.आइ.ए.) तयार पारिएको छ । यसै अनुरूप सामाजिक तथा वातावरणीय व्यवस्थापन विभिन्न चरणमा गरिने छ । यस वातावरणीय तथा सामाजिक प्रभाव मुल्यांकन अध्ययनमा आयोजना कार्यान्वयनको लागि आवश्यक सामाजिक क्षेत्र तथा वातावरणसंग सम्बन्धित नीतिनियम तथा संस्थागत रूपरेखा समावेश छ । कानूनी तथा संस्थागत रूपरेखा नेपालको संविधान २०७२ मा आधारित रहेको छ । जसले सफा तथा स्वस्थ वातावरणमा वस्न पाउने अधिकारका साथै प्राकृतिक सम्पदाको संरक्षण र दिगो उपयोगका बारेमा चर्चा गरेको छ ।

यसको अतिरिक्त विद्यमान नीति नियम, विकास योजना तथा रणनीतिक नीति ऐन तथा नियमको विस्तृत विश्लेषण गरिएको छ । राष्ट्रिय नीति नियम, म्यानुअल, र मापदण्डहरूले उपयोगी तथा व्यावहारिक औजार प्रदान गरि आयोजना कार्यान्वयनको स्तरमा नियामक ढाँचाका आवश्यकताहरू पूरा गर्न मद्दत गर्दछ ।

विद्यमान नियामक ढाँचालाई कमला-ढल्केबर-पथलैया सडक खण्डको ई.इस.आई.ए. मा मुख्य प्रावधानहरूको सान्दर्भिकता हाइलाइट गर्दै विश्लेषण र तालिकाबद्ध गरिएको थियो । समीक्षा गरिएका केही महत्वपूर्ण कानून र नियमहरू निम्न प्रकारले समावेश गरिएको छ (तर सीमित छैनन्):

सडक सुरक्षा कार्य योजना (२०१३-२०२०), नेपाल राष्ट्रिय जैविक विविधता कार्य योजना, (२०१४-२०२०), नेपाल राष्ट्रिय वातावरण नीति (२०७६), वन नीति, (२०७२), श्रम नीति, (२०७३), भूमि अधिग्रहण, पुनर्वास र पुनर्स्थापना नीति, (२०७२), वातावरण संरक्षण ऐन, (२०७६), वन ऐन, (२०७६), लोपोन्मुख वन्यजन्तुको अन्तर्राष्ट्रिय व्यापार नियन्त्रण र वनस्पति ऐन, (२०१७), श्रम ऐन (२०७४), बाल श्रम (निषेध र नियमन) नियमावली (२०५४) र जग्गा प्राप्ति ऐन (२०३४) (परिमार्जन सहित), श्रम नियमावली (२०७५), जलस्रोत नियमावली (२०५०), औद्योगिक नीति (२०६७)। यसमा राष्ट्रिय लैङ्गिक समानता नीति २०७७ समावेश छ जसले महिला र पुरुषलाई गरिने असमान व्यवहारलाई सम्बोधन गर्दछ ।

नेपाल धेरै अन्तर्राष्ट्रिय महासन्धिहरू र अन्य सन्धिहरूका लागि हस्ताक्षरकर्ता पक्ष भएकोले, प्रदूषण, जलवायु परिवर्तन र जैविक विविधता संरक्षण जस्ता अत्यावश्यक वातावरणीय र सामाजिक मुद्दाहरूलाई सीमापार वा विश्वव्यापी प्रकृतिको रूपमा सम्बोधन गर्न बाध्य छ । ई.इस.आई.ए. प्रक्रियामा अन्तर्राष्ट्रिय सन्धिका प्रावधानहरूलाई समेत ध्यानमा राखिएको छ ।

विद्यमान वातावरणीय अवस्था

प्राथमिक र माध्यमिक स्रोतहरूबाट वातावरणीय विशेषताहरूमा आधारभूत तथ्यांक सङ्कलन गरिएको छ । आधारभूत वातावरणीय अवस्थाहरूले निर्माण र सञ्चालन चरणहरूमा आयोजनाबाट उत्पन्न हुने अनुमानित नकारात्मक र सकारात्मक प्रभावहरूको तुलना र अनुगमन गर्न मद्दत गर्नेछ । तदनुसार, आयोजनाको लागि न्यूनीकरण उपायहरू तथा व्यवस्थापन योजना सुझाव गरिएको छ । आयोजना क्षेत्रको आधारभूत भौतिक, जैविक र सामाजिक अवस्थालाई निम्न खण्डहरूमा वर्णन गरिएको छ ।

भूमिको प्रयोग: कमला-ढल्केबर-पथलैया सडक समतल समतल भूमि भएर जान्छ । सडक सीमा (राइट अफ वे) भित्र अर्थात् केन्द्रीय रेखाबाट २५ मिटर बफरमा, कूल ६५०.९१ हेक्टर जमिन पर्दछ जसमध्ये (४८.७१ %) वन, सडक सहित सार्वजनिक प्रयोग (१९.१३ %), कृषि भूमि (१४.९२%), आवासीय क्षेत्र (८.७५%), व्यापारिक क्षेत्र (४.५९%), नदी र ताल क्षेत्र (३.०५%), औद्योगिक क्षेत्र (०.२५%), सांस्कृतिक तथा पुरातात्विक क्षेत्र (०.२१%), खानी तथा खनिज (०.१%) र अन्य ०.२९% रहेको छ । २०३४ साल (१९७७ ईस्वी सम्बत्) मा राजपत्रमा प्रकाशित घोषणा अनुसार प्रस्तावित सबै स्थायी संरचनाहरू यही सडक सीमा भित्र निर्माण गरिनेछन् । यो सडक सीमा भित्रको सबै जग्गा सडक विभाग अन्तर्गत रहेको छ । त्यसैले यस आयोजनाका लागि स्थायी जग्गा प्राप्तिको आवश्यकता पर्दैन ।

मौसम विज्ञान र वायु गुणस्तर: अध्ययन क्षेत्रको हावापानी उपोष्ण जलवायु क्षेत्रसँग सम्बन्धित छ । यस क्षेत्रको मौसम जुन महिना देखि सेप्टेम्बर सम्म मनसुन अवधि, नोभेम्बर देखि मार्च सम्म हल्का जाडो अवधि र अप्रिल देखि सेप्टेम्बर सम्म गर्मी हुन्छ । यस क्षेत्रको वार्षिक न्यूनतम तापमान १८.२२° र

वार्षिक अधिकतम तापमान ३१ डिग्री सेल्सियस, वार्षिक वर्षा १८७१.४५ मि. मी, वार्षिक औसत हावा गति १.३१ मिटर प्रतिसेकेन्ड देखि २.५७ मिटर प्रतिसेकेन्ड सम्म हुन्छ।

आयोजना क्षेत्रको वायुको गुणस्तर निर्धारण गर्न आयोजना क्षेत्रको आधारभूत वायुको गुणस्तर सन् २०२२ अक्टोबर महिनामा परिक्षण गरिएको थियो। पाँच वायु गुणस्तर स्टेशनहरू सम्पूर्ण आयोजना क्षेत्र प्रतिनिधित्व गर्न पहिचान गरिएका थिए। यी स्टेशनहरू ढल्केबर, लालबन्दी, पौराही, निजगढ र दुधौरा थिए। परिक्षणबाट प्राप्त नतिजाले ति सबै क्षेत्रमा वायुको गुणस्तर राष्ट्रिय वायु गुणस्तर मापदण्ड वन तथा वातावरण मन्त्रालय, २०१२ ले निर्धारण गरेको परिधिभित्र रहेको देखाउँछ। आयोजना क्षेत्र भित्र वायु प्रदूषणको मुख्य स्रोत सवारी साधनको उत्सर्जन, निर्माण गतिविधि, औद्योगिक प्रदूषण, नदीको किनारबाट बालुवा लोडिङ र अनलोडिङ इत्यादी रहेका छन्।

ध्वनिको स्तर: आयोजना क्षेत्रको आधारभूत ध्वनि स्तर मापन सन् २०२२ को अक्टोबर महिनामा आयोजना क्षेत्रका केही स्थानमा गरिएको थियो। सम्पूर्ण आयोजना क्षेत्र प्रतिनिधित्व गर्न पाँच स्थानमा ध्वनि निगरानी स्टेशनहरू राखिएको थियो। यी स्टेशनहरू ढल्केबर, लालबन्दी, पौराही, निजगढ र दुधौरा थिए। सबै निगरानी स्टेशनहरूको लागि दिन र रातको ध्वनिको स्तर छुट्टाछुट्टै गणना गरिएको थियो। ढल्केबर र लालबन्दीमा रातको समयमा मात्र शहरी आवासीय क्षेत्रका लागि ध्वनी स्तर ध्वनि सम्बन्धि राष्ट्रिय मापदण्ड २०६९ ले निर्देशित गरे बराबरको रहेको र दिउँसो ध्वनिको स्तर लालबन्दीको सीमामा र ढल्केबर स्टेशनको लागि अलि बढी रहेको ध्वनि स्तर जाँचको नतिजाबाट देखिएको छ। अन्य स्टेशनहरूको लागि दिन र रातको समय ध्वनिको स्तर आवासीय क्षेत्रको लागि तोकिएको मापदण्ड भित्रै रहेको छ। आयोजना क्षेत्रमा ध्वनिको मुख्य स्रोत सवारी साधन, निर्माण गतिविधि, उद्योग, नदीको किनारबाट लोडिङ र अनलोडिङ जस्ता गतिविधिहरू आदि रहेका छन्।

जलविज्ञान र पानीको गुणस्तर: आयोजना क्षेत्रमा ७६ वटा नदी र खोलानालाहरू रहेका छन् र यी मध्ये अधिकांश नदी र खोलाहरू पानीको बहावका लागि वर्षामा निर्भर छन्। ती मध्ये तीन नदीहरू; कमला, बागमती र बकैया नदीहरू महाभारत क्षेत्रबाट उत्पन्न भएका र ठूलो जलाधार क्षेत्र भएका नदीहरू मानिन्छ। साथै, यस सडक खण्डको छेउछाउमा सात वटा पोखरीहरू रहेका छन्। आयोजना क्षेत्रमा जमिनमुनि करिब १ मिटरको गहिराइमा भूमिगत पानीको उपलब्धता रहेको छ। आयोजना क्षेत्रका सात स्थानमा जमिनमुनिको पानीको गुणस्तर अनुगमन गरिएको थियो र पानीको गुणस्तरको नतिजाबाट बागमती र पथलैया क्षेत्रमा जमिनमुनिको पानी पिउनका लागि उपयुक्त रहेको देखिए पनि अन्य स्थानमा भूमिगत पानीमा ई.कोली प्रदूषण देखिएको थियो। छ स्थानमा सतहको पानीको पनि अनुगमन गरिएको थियो र परीक्षणको नतिजाबाट बागमती नदी बाहेक सतहको पानीमा टोटल कोलिफर्मको उपस्थिति रहेको देखियो। अन्य प्यारामिटरहरू पिउने पानीको राष्ट्रिय मापदण्ड भित्र रहेका थिए।

माटो र भू-गर्भ विज्ञान: आयोजना क्षेत्रमा माटो सामान्यतया जलोढ र राम्रो देखि मध्यम बनावटको छ जुन कृषिको लागि उपयुक्त छ। आयोजना क्षेत्रका पाँच स्थानमा आधारभूत माटोको गुणस्तर अनुगमन गरिएको थियो।

कमला-ढल्केबर-पथलैया सडक ग्याङ्गेटिक जोनमा अवस्थित छ। यो क्षेत्र प्रायः कुवार्टर्नरी सेडीमेन्ट (अल्युभियम डिपोजिटहरू) बाट बनेको छ जसमा बोल्डर, बबल, ढुङ्गा, सिल्ट र माटोको साथ बलौटे बजरी छ। ठूला जलोढ फ्यान निक्षेपहरू मुख्य धाराहरूमा हुन्छन्। राष्ट्रिय भवन संहिता (एन.बि.सी.

१०५:२०२०) अनुसार, आयोजना क्षेत्र ०.३ को बराबर सेस्मिक जोनिङ कारक (जेड) भित्र पर्छ। आयोजना क्षेत्र वरपरको क्षेत्रमा भूकम्पीय जोखिम मध्यम प्रकृतिको छ।

वनस्पति: आयोजना क्षेत्रको भूमि प्रयोगमा वर्णन गरिए अनुसार कमला-ढल्केबर-पथलैया सडक खण्डको सडक सीमा क्षेत्र भित्र ५४% वन क्षेत्र रहेको छ (सडक विभागको स्वामित्वमा रहेको)। सडक सीमा रेखाले पर्सा राष्ट्रिय निकुञ्ज (राष्ट्रिय निकुञ्जको दक्षिणी सिमानामा), सागरनाथ वन विकास परियोजना वन क्षेत्र, २१ सामुदायिक वन, ९ वटा सहकारी वन र राष्ट्रिय वनको सिमाना जोडेको छ। आयोजना क्षेत्रमा पाइने रुखहरू मध्ये खयर र सिमल जातका रुखहरू प्रमुख छन्। प्रस्तावित सडक खण्डलाई फराकिलो बनाउन यस भित्र पर्ने कुल ४९१४ बिरुवा (४.०४२५ सेमी देखि १४.५६ से. मी व्यास सम्म), ८९५४ पोल (१४.५६ देखि २४.२६ सेन्टिमिटर व्यास भएको) र १९,१६६ रुखहरू (२४.२६ से. मी भन्दा बढी व्यास भएको) काट्नु पर्ने आवश्यक देखिन्छ।

यो वनस्पति मानव विचलित वातावरणमा बढ्छ, र सडक सुधार देखि वन बासस्थान मा मध्यम प्रभाव हुनेछ। साथै, रुख काट्दा १:१० अनुपातमा क्षतिपूर्ति प्रत्यारोपण हुनेछ। आईयुसियनका अनुसार रुखका केही प्रजातिहरू “खतरामा परेका प्रजाति” को श्रेणीमा छन्। तर, सतीसाल रुख “जोखिम” श्रेणीमा परेको छ। आयोजना क्षेत्रको जैविक विविधता अध्ययनका क्रममा ४१ वटा क्वाड्रेट स्याम्पलमा कुल ३० प्रजातिहरू रेकर्ड गरिएको थियो। ती मध्ये, साल प्रति हेक्टर लगभग ७२ रुखको घनत्वको साथ सबैभन्दा बढी संख्या हो। यद्यपि, साल; सतिसाल; सिसौ र खयर रुखहरू नेपाल सरकारले काट्नु, ढुवानी वा काठको निकासीमा प्रतिबन्ध लगाएको छ।

संवेदनशील वासस्थान: पर्सा राष्ट्रिय निकुञ्ज दक्षिण-मध्य नेपालको भित्री तराईको संरक्षित क्षेत्र हो। यसले पर्सा, मकवानपुर र बारा जिल्लामा ६२७.३९ वर्ग किलोमिटर क्षेत्रफल ओगटेको छ। पर्सा राष्ट्रिय निकुञ्जमा विभिन्न किसिमका लोपोन्मुख प्रजातिहरू पाइन्छन्। ३६३+१०० किलोमिटर देखि ३३४+५०० किलोमिटरको सडक खण्डमा हात्तीको आवतजावत देखिएको छ। सबै सम्भावित स्रोतहरूबाट सङ्कलन गरिएको जानकारी मुताबिक जोडेर पर्सा राष्ट्रिय निकुञ्ज र सम्बद्ध सामुदायिक आरक्षहरूमा आंशिक आप्रवासीहरू ६-७ व्यक्तिहरूको बीचमा जनसंख्या रहेको अनुमान गरिएको छ। चे. ३५७+८०० किलोमिटर देखि ३०० मि टाढा रहेको पिलुवा गाउँ नजिकै र चे ३५१+००० किलोमिटरबाट २.५ किलोमिटर दुरीमा रहेको गाउँ, टाङ्गिया बस्ती नजिकै हात्तीको आवतजावत देखियो।

पर्सा राष्ट्रिय निकुञ्जमा सन् २०१८ देखि २०२२ सम्ममा बाघको संख्या १८ बाट बढेर ४१ पुगेको पाइएको छ। आयोजनाको सडकको सन्दर्भमा हालै गरिएको बाघ गणनाअनुसार यस सडकको चे. ३२७+७०० देखि चे. ३३३+१००मा एफटी-७८ र एफटी-७९ नामक दुईवटा बाघको प्रजाती रहेको पाइएको छ। यो सडकखण्ड (चे. ३२७+७०० देखि चे. ३३३+१००) पर्सा राष्ट्रिय निकुञ्ज बाहिर छ। हालैको बाघ गणना (२०२२) अनुसार आयोजना सडक (पथलैया) नजिकै बाघको वितरणलाई चित्रण गर्ने नक्सा राखिएको छ।

वन्यजन्तु: कमला-ढल्केबर-पथलैया सडकमा ५० किलोमिटर बफरक्षेत्र भित्र आइब्याट डाटाबाट १२२९ प्रजातिका वन्यजन्तुहरूको सूची सूचीकृत गरिएको थियो। ती मध्ये, ३५ प्रजातिहरू महत्वपूर्ण मानिन्छन्। यसबाहेक, क्षेत्रीय अवलोकन र परामर्श अनुसार, आयोजना क्षेत्र भित्र प्रमुख वन्यजन्तुहरू फेला परेका छन्। चितुवा जोखिमयुक्त वर्गमा छ; यद्यपि आईयुसियन र नेपाल सरकारका अनुसार हात्ती र बाघ लोपोन्मुख श्रेणीमा छन्। आईयुसियन र नेपाल सरकारका अनुसार चितुवा र हिमालयन ग्रीफन गिद्धलाई

जोखिमको सूचीमा राखिएको छ। कमला-ढल्केबर-पथलैया सडक नजिकै एसियाली हात्ती र रोयल बेङ्गाल टाइगर को आवागमन बढी रहेको अध्ययनले देखिएको छ।

सामाजिक र साँस्कृतिक वातावरण: सडकको मुख्य भाग मुख्यतया जङ्गल र कृषि भूमि भएर जान्छ। आयोजना क्षेत्रभित्र १६ जिल्ला रहेका छन् जसमा मधेश प्रदेशका १६ नगरपालिका (१ उपमहानगरपालिका र १५ नगरपालिका सहित) रहेका छन्। सामाजिक-आर्थिक सर्वेक्षण र माध्यमिक स्रोतहरू सञ्चालन गरेर आयोजना क्षेत्रको सामाजिक-आर्थिक प्रोफाइल स्थापना गरिएको थियो। जनगणना (राष्ट्रिय तथ्याङ्क कार्यालय-२०२१) अनुसार आयोजना प्रभावित नगरपालिकाको कुल जनसंख्या ९६३८२९ छ, जसमध्ये पुरुष जनसंख्या ४७५४७४ (४९.३%) र महिला जनसंख्या ४८८३५५ (५०.७ %)। आयोजना क्षेत्रमा परिवारको औसत आकार ४.८ रहेको छ, जुन २०२१ को जनगणना अनुसार राष्ट्रिय औसत (४.३२) भन्दा बढी र प्रदेश (मधेश) स्तरको औसत (५.१५) भन्दा कम हो।

यहाँका वासिन्दाहरूको मुख्य पेशा व्यापार, व्यवसाय, कृषि, पशुपालन र घरायसी काम हो। आयोजना क्षेत्रको साक्षरता दर ९२.२ छ जुन मधेश प्रदेशको साक्षरता दर (६३.५%) भन्दा बढी हो। आयोजना क्षेत्रमा बसोबास गर्ने मानिसहरूको प्रमुख धर्म हिन्दू धर्म हो जसमा करिब ८९ प्रतिशत जनसंख्या रहेको छ भने करिब १० प्रतिशत बौद्ध धर्म र बाँकी मुस्लिम र क्रिश्चियन रहेका छन्।

आयोजना क्षेत्रमा तामाङ, मगर, नेवार, भुजेल, थारु, राई, गुरुङ, बोटे, सुनुवार, दनुवार र माझी प्रमुख आदिवासी जनजाति हुन्। यी आदिवासी जनजातिहरूमध्ये साक्षरता र शिक्षा, आय, सम्पत्ति, जग्गाको स्वामित्व र अन्य सम्पत्तिहरूको स्वामित्व को आधारमा माझी, बोटे र दनुवारलाई 'अत्यधिक सीमान्तकृत', तामाङ, गुरुङ, राई र सुनुवारलाई 'सीमान्तकृत', मगरलाई 'विपन्न' र नेवारलाई 'सम्पन्न' समूहको रूपमा वर्गीकरण गरिएको छ। आयोजना क्षेत्र भित्र कुनै पनि लोपोन्मुख आदिवासी जनसङ्ख्या देखिएन।

कमला-ढल्केबर-पथलैया सडक क्षेत्रमा तामाङ, गुरुङ, मैथिली, मगर, नेवारी, थारु र राई भाषाहरू मातृभाषाको रूपमा बोलिन्छन्। सबैभन्दा बढी बोलिने भाषा नेपाली हो। नेपाली भाषा ५७ प्रतिशतभन्दा बढीले बोल्छन् भने मैथिली भाषा ३४ प्रतिशतले बोल्छन्।

सरोकारवाला निकायहरू संग गरिएको सामुहिक छलफलको निष्कर्षहरू अनुसार, कम उमेरमा विवाह, कमजोर सामाजिक-आर्थिक स्थिति, निर्भरता र साक्षरता दरको न्यून स्तर आयोजना क्षेत्रमा देखिएका सामाजिक समस्याहरू हुन्। आयोजना क्षेत्रको लैङ्गिक अवस्था पनि घरपरिवार सर्वेक्षणबाट मूल्याङ्कन गरिएको छ। सर्वेक्षणमा परेका लगभग ७१.४४ प्रतिशत घरपरिवारले महिला र पुरुष दुवैको स्थिति बराबर रहेको र केहिले (८.५१%) यो थोरै असमान रहेको मत राखे। सर्वेक्षण गरिएका घरधुरीमध्ये ११.८९ प्रतिशत महिला घरायसी काममा संलग्न छन् भने ४.०८ प्रतिशत घरपरिवार सार्वजनिक सेवा र सामुदायिक कार्यमा संलग्न रहेको पाइएको छ।

ढल्केबर, बर्दिबास, हरिवन आदि बजार केन्द्रहरूमा मुख्यतया अवस्थित आयोजना क्षेत्रभित्र विभिन्न प्रकारका उद्योगहरू रहेको पाइएको छ। अधिकांश उद्योगहरूमा गलैँचा, ग्रिल, क्रसर, चामल मिल, तेल मिल, चाउचाउ, सवारी साधन मर्मत, फर्निचर, कपडा, बेकरी, साबुन, सिमेन्ट र इट्टाको ब्लक, दालमोठ, मसला, धूप र मैनबत्ती, ह्युम पाइप, अक्सिजन ग्यास, झोला, डेरी, कुखुरापालन, प्लाइवुड, बाँसको उत्पादन, केरा उत्पादन, टुथपिक, पानी प्रशोधन, कागज, अचार, र चक्री उद्योग आदि रहेका छन्।

यीमध्ये कतिपय उद्योगले नेपालबाटै कच्चा पदार्थ प्रयोग गर्दै आए पनि औजार र प्रविधि अन्य मुलुकबाट (विशेषगरी भारतबाट) ल्याइने गरेको छ । यसबाहेक, अक्सिजन ग्यास उद्योग जस्ता केही उद्योगहरूले अन्य देशका कच्चा पदार्थ र उपकरण दुवै प्रयोग गर्छन्। अहिले नेपाल भित्र अधिकांश भारतीय उत्पादन बिक्री भइरहेका छन् । कमला-ढल्केबर-पथलैया सडक खण्डसहित पूर्व पश्चिम (महेन्द्र) राजमार्गको स्तरोन्नति भएपछि भविष्यमा भारत, पाकिस्तान, बंगलादेश, भुटान लगायत अन्य मुलुकमा पनि व्यापार व्यवसाय विस्तार हुने विश्वास गरिएको छ ।

कमला-ढल्केबर-पथलैया सडक क्षेत्र भित्र सबै मौसममा यातायात सुविधा उपलब्ध छ। आयोजना क्षेत्रमा बस, ट्रयाक्टर, ट्रक, मोटरसाइकल, एम्बुलेन्स, अटो रिक्सा, टेम्पो, म्याजिक/भ्यान लगायतका साधनहरू उपलब्ध छन् । जिल्ला सदरमुकाम, नगरपालिका तथा वडा कार्यालय, प्रहरी चौकी, शैक्षिक संस्था, स्वास्थ्यचौकी/अस्पताल आदि पुग्नका लागि सार्वजनिक सवारी साधन उपलब्ध छन् । यद्यपि, अव्यवस्थित फुटपाथ, अपर्याप्त जंक्शन/चौबाटो डिजाइन, ट्रफिक संकेतहरूको अभाव र सडक सुरक्षाका अपुग उपायहरूका कारण मुख्यतया बालबालिका, वृद्धवृद्धा र अपाङ्गता भएका व्यक्तिहरूको पहुँचमा केही कठिनाईहरू छन्।

आयोजना क्षेत्रमा थुप्रै ऐतिहासिक तथा साँस्कृतिक महत्वका स्थानहरू रहेका छन् । ढल्केबर क्षेत्रका शिव मन्दिर, काली मन्दिर, हनुमान मन्दिर र राधाकृष्ण मन्दिर मुख्य धार्मिक स्थल हुन् । त्यस्तै टाढाको क्षेत्रबाट छठ, तीज र माघे संक्रान्तिमा धार्मिक स्नान गर्न आउने ठाउँ पनि कमलामाई हो । वागमती नदी र यसको बाँध धार्मिक महत्वका क्षेत्रको रूपमा रहेका छन् ।

प्रमुख चाडपर्वहरूमा दशैं, तिहार/दीपावली, जुरशीतल, चौरचरण, जितिया/जीवितपुत्रिका, सामा चकेवा, फागु पूर्णिमा/होली, शिवरात्रि आदि पर्दछन्। यी पर्वहरू बाहेक तीज, ल्होसार, मुस्लिम समुदायको पर्व (रमजान, ईद-उल-फित्र, ईद-उल-अदाहा, ईद-मिलाद-उन-नबी, मोहरम, शब-ए-कदर र शब-ए-बरात, आदि) पनि यस क्षेत्रमा मनाइन्छन्।

आयोजना लाभहरू

आयोजनाका फाइदाहरूमा सुधारिएको सडक पूर्वाधारहरू, अन्य सुविधाहरू जस्तै सवारीसाधन अन्डरपास (भी.यू.पी.) पैदल यात्री अन्डरपास (पी.यू.पी.) सेवा इत्यादि हुन्। आर्थिक विकास र स्थानीय जनताको जीविकोपार्जन, रोजगारी सिर्जना, बजार विस्तार, उद्योग वृद्धि, जग्गा तथा सम्पत्तिको मूल्यवृद्धि, यात्रा समय र लागतमा कमी लगायतका कार्बन उत्सर्जन बचत तथा हरितगृह ग्यास उत्सर्जनमा कमी पनि यस आयोजनाका अपेक्षित लाभहरू हुन् ।

वातावरण र सामाजिक जोखिम तथा प्रभावहरू

कमला-ढल्केबर-पथलैया सडक सुधारका लाभकारी प्रभावहरूमा सहज आर्थिक विकास, रोजगारी सिर्जना र व्यवसायका लागि अवसरहरू सिर्जना गर्ने, सेवा र बजारहरूमा पहुँच, सुधारिएको सडक पूर्वाधारले सुरक्षाका मुद्दाहरूमा योगदान पुऱ्याउने र राम्रो यातायात, आदि समावेश छन्। लाभकारी प्रभावहरू सडक पूर्वाधारको सुधार र यसको प्राविधिक दक्षता, आर्थिक विकास र स्थानीय जनताको जीविकोपार्जन सँग सम्बन्धित छन्। साथै आयोजना सम्पन्न भएपछि सडक गुणस्तर राम्रो हुने भएकोले कार्बन उत्सर्जनमा कमि हुनेछ । कार्बन उत्सर्जन तथ्यांकको एक्सट्रापोलेसनले सन् २०२२ देखि २०४६ सम्म कार्बन उत्सर्जनमा लगभग ३० प्रतिशत कमि आउने देखिन्छ ।

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

वातावरणीय र सामाजिक जोखिम तथा असरको मुल्याङ्कन र व्यवस्थापन (ई.एस.एस.-१):

कमला-ढल्केबर-पथलैया को सुधार कार्यहरू विद्यमान सडकको सिमाभित्र मात्र सीमित हुनेछन्। २०३४ साल (सन् १९७७) को नेपाल सरकारको राजपत्रमा प्रकाशित सूचना अनुसार पूर्व-पश्चिम (महेन्द्र) राजमार्ग को सम्पूर्ण खण्डको सडक सीमा दुवैतर्फ २५-२५ मिटर उल्लेख गरिएको छ जसमा केडीपी सडकलाई दुवैतर्फ २५ मिटर विस्तार गर्न सडकको सीमा सडक विभागको स्वामित्वमा रहेको छ। स्वीकृत विस्तृत डिजाइन अनुसार थप जग्गा अधिग्रहण आवश्यक छैन। त्यसैले यस आयोजनाका लागि स्थायी जग्गा प्राप्तिको आवश्यकता पर्दैन। प्रभावहरू मुख्यतया केही निजी र सार्वजनिक सम्पत्तिहरू (आवासीय/व्यापार संरचना/मन्दिर/कुवा/प्रतीक्षालय) को क्षतिसँग सम्बन्धित छन्। आयोजना प्रभावित र जोखिममा परेका घरधुरीहरू कूल ४० रहेका छन् ।

न्यूनीकरण उपायको रूपमा पुनर्वास कार्य योजनामा जीविकोपार्जन पुनर्स्थापना तालिमहरू प्रदान गरिने उल्लेख छ। यस वातावरणीय हासको साथै, श्रमिक र समुदायको स्वास्थ्य र सुरक्षामा बढेको जोखिम, बढ्दो ट्राफिक प्रवाह र ट्राफिक सम्बन्धी दुर्घटनाहरू र बढ्दो श्रमको प्रवाहसँग सम्बन्धित सामाजिक समस्याहरू जस्तै लैङ्गिक हिंसा र बाल श्रम, निर्माणको क्रममा हुने अपेक्षा गरिएको छ। रूख काट्ने र वन्यजन्तुको बासस्थानमा हुनसक्ने खलबलीलाई उच्च देखि मध्यम जोखिम प्रभावहरूका रूपमा आकलन गरिएको छ जो निर्माणसँग सम्बन्धित र छोटो अवधिका रहेका छन्। उक्त जोखिमहरू निर्माण चरणमा उच्च र संचालन चरणमा न्यून प्रकृतिका रहने समेत आकलन गरिएको छ ।

कमला-ढल्केबर-पथलैया सडकको सुधारको लागि, समष्टिगत प्रभावहरू सामाजिक पक्षमा पनि विश्लेषण गरिएको छ तर कुनै उल्लेखनीय अपेक्षित प्रत्यक्ष प्रभाव नपर्ने अध्ययन बाट आकलन गरिएको छ किनभने कमला-ढल्केबर-पथलैया सडक र अन्य आयोजनाको गतिविधि प्रायः सडकको सीमाभित्र र सार्वजनिक जग्गाहरूमा सीमित छन्। तसर्थ, त्यहाँ कुनै जग्गा अधिग्रहण छैन तर सडकको सीमाभित्रका निजी संरचनामा क्षति पुग्ने छ । तथापी रेलमार्ग, द्रुतमार्ग र निजगढ विमानस्थल आयोजना जस्ता प्रस्तावित विकास आयोजनाहरूको संख्या बढ्दा कृषियोग्य जमिनमा दबाव सिर्जना हुने र सडक छेउको अतिक्रमण, जनसङ्ख्या वृद्धि र ति क्षेत्रमा अत्यधिक भीडभाड बढ्न सक्ने सम्भावना भने रहेको छ।

यस बाहेक, व्यावसायिक भवन, होटलहरू स्थापना, आर्थिक वृद्धि वा सबै आयोजनाको निर्माण पूरा भएपछि आर्थिक हकमा स्थानान्तरणको उच्च सम्भावना हुन सक्छ। नेपालमा सडक आयोजना सम्पन्न भइसकेपछि द्रुत गतिमा बस्ती विस्तारको विकासको अभ्यास भइसकेको तथ्य अनुभव गर्न सकिन्छ। केडीपी सडकमा सडक स्तरोन्नति कार्य अगावै, भू-उपयोग परिवर्तन र भूमि रूपान्तरण जस्ता कार्य भइसकेको छ र विकेन्द्रीकरण, शहरीकरण र ग्रामीण क्षेत्रको विकास जस्ता अन्य कारकहरू कारण यो क्रम सडक स्तरोन्नति पश्चात अझ जारी रहनेछ।

श्रमिक तथा तिनीहरूको कार्यक्षेत्र (ई.एस.एस.-२):

निर्माण चरणमा तीन वर्षसम्म करिब एक हजार कामदार खटाइने बताइएको छ । यसका लागि ६०० आप्रवासी कामदारहरूलाई श्रम शिविरमा राख्नुपर्ने अनुमान गरिएको छ। एल.एम.पी. मा उल्लेख गरिएअनुसार यी शिविरमा विद्यमान नीति नियमले तोकेको न्यूनतम मापदण्ड पूरा गर्नुपर्नेछ ।

मजदुरहरूलाई भाडाको घरमा वा श्रम शिविरमा राखिन्छ। श्रम शिविर र निर्माण शिविरको सम्भावित स्थान क्रमशः चित्र १.९ र १.१० मा देखाइएको छ। कामदारहरू आवासको अनुचित प्रबन्ध, अपर्याप्त ज्याला भुक्तानी; रोजगारीमा भेदभाव, बाल श्रम, जबरजस्ती श्रम, वेश्यावृत्ति र मानव बेचबिखन जस्ता जोखिमहरूमा पर्न सक्ने देखिन्छ। जोखिमपूर्ण कामलगायत विभिन्न तहका काममा आप्रवासी, मौसमी र महिला कामदारको संलग्नता हुने सम्भावना बढी छ। व्यावसायिक जन्य स्वास्थ्य र सुरक्षाका विषयहरू मध्ये कार्यस्थलमा हुने दुर्घटना र कार्य स्थल संग सम्बन्धित रोगहरू, यौनजन्य संक्रमणहरू सहित सरुवा रोगहरू, कामदारहरूसँग सम्बन्धित गुनासोहरू र लैंगिक हिंसाहरू प्रमुख हुन्। अनुबन्धित कामदारहरू यस्ता जोखिमहरूको लागि बढी संवेदनशील हुन्छन्। पहिचान गरिएका जोखिमहरू मध्यमदेखि उच्च प्रकारका रहेका छन्। क्षेत्रीय व्यापारिक मार्ग बिस्तार आयोजनाको लागि तयार गरिएको श्रम व्यवस्थापन प्रक्रिया (एल.एम.पी) लाई श्रम र कामको अवस्थसँग सम्बन्धित केडिपी सडमा हुनसक्ने सम्भावित प्रभावहरूलाई सम्बोधन गर्न व्यावसायिक स्वास्थ्य र सुरक्षा, श्रम शिविर र आवासका लागि न्यूनतम आवश्यकताहरू, बाल श्रम निषेध जस्ता अपनाइने उपायहरूलाई उजागर गर्न अद्यावधिक गरिएको छ।

स्रोत सदुपयोग, प्रदूषण नियन्त्रण तथा व्यवस्थापन (ई.एस.एस.-३):

यस ई.एस.एस.ले साधारणतया ६ वटा जोखिम जस्तै भुगोलको अवस्थिती, सांस्कृतिक महत्वको सम्पदामा असर, वायु तथा ध्वनि प्रदूषण, संभाव्य जोखिम, फोहोरमैला व्यवस्थापन, पानीको स्रोतमा प्रदूषण बारेमा चर्चा गरेको छ। नदी र धाराहरूमा सेडीमेन्ट थुप्रिने; निर्माणको दौरान बढ्ने पानीको माग; समुदायले प्रयोग गर्ने पानीका स्रोतहरूलाई दोहन गर्न सक्ने (स्थायी पानीका स्रोतहरूको अभाव); निर्माण वाहनहरूबाट उत्सर्जन, निर्माण उपकरण तथा यन्त्रहरूको सञ्चालन; माटो खन्ने कार्यबाट निस्कने धुलो, स्ट्याक यार्ड, सामग्रीको ढुवानी, ध्वनि प्रदूषण र सडक छेउमा बसोबास गर्ने धुलो; मेसिन र उपकरणको प्रयोगबाट संरचना कम्पनमा क्षति (नदी क्षेत्रको संरचना); खतरनाक र जोखिमपूर्ण फोहोरको व्यवस्थापन, उत्खनन आदी यस आयोजनाका सम्भावित जोखिम हुन्। यी सबै प्रभावहरू निर्माण चरणमा बढी हुन्छन् तथा वायु, ध्वनि र पानीको गुणस्तरका लागि नेपाल सरकारले तोकेको राष्ट्रिय मापदण्डहरू मुताविक कार्य गर्ने र सडक निर्माण आयोजनाहरूमा लागू हुने राम्रा अभ्यासहरू मार्फत न्यूनीकरण अध्यायमा वर्णन गरिएका विशेष उपायहरू मार्फत व्यवस्थापन गर्न सकिने छ।

आयोजना क्षेत्र भित्रको वायु गुणस्तर राष्ट्रिय वायु गुणस्तर मापदण्डले तोकेको दायरा भित्र रहेको पाइएको छ। ढल्केबर र लालबन्दीमा रातको समयमा मात्र सहरी आवासीय क्षेत्रका लागि ध्वनि सम्बन्धि राष्ट्रिय मापदण्ड २०६९ ले निर्देशित गरे भन्दा केही नाघेको र लालबन्दीको दिउँसो ध्वनी स्तर सीमाभित्र र ढल्केबर स्टेशनको लागि अलिकति बढी रहेको देखियो। अन्य अनुगमन स्थानहरूको लागि दिन र रातको समयमा ध्वनिको तह आवासीय क्षेत्रको सीमा भित्र छ। आयोजना क्षेत्रमा ध्वनिको मुख्य स्रोत सवारी साधन, निर्माण गतिविधि, उद्योग, नदीको किनारबाट लोडिङ र अनलोडिङ गतिविधिहरू आदि हुन्।

आयोजना क्षेत्रमा खानेपानी प्रमुख स्रोत भूमिगत पानी हो। आयोजनाको क्षेत्रमा जमिनको पानीको गहिराइ १ मिटरदेखि १३ मिटरसम्म रहेको छ। कतिपय अवस्थामा जमिनमुनिको पानीको स्तर पनि उपलब्ध थिएन। परीक्षणका निमित्त लिईएको पानीको नमूना मध्ये वाग्मती र पथलैयाका बाहेक सबै नमूनामा ई.कोलाई प्रदूषित भएको पाइएको छ। साथै नदी र पोखरीको सतहको पानीले सबै सतहको पानीको नमूनाहरूमा ई. कोलाई प्रदूषण रहेको संकेत गर्छ। कमला र बकैया नदी र सिमसारको सतहको पानीमा टर्बिडिटी बढी देखिएको छ।

आयोजनाका कामदारहरूले प्रतिदिन करिब ३२ हजार लिटर फोहोर पानी उत्पादन गर्ने अनुमान छ। त्यसैगरी आयोजनामा कामदारले प्रतिदिन २१० किलो फोहोर उत्पादन गर्ने अनुमान गरिएको छ।

आयोजना निर्माणको क्रममा हरितगृह (ग्रीन हाउस ग्यास) उत्सर्जन हुने भए पनि सञ्चालनको क्रममा स्तरोन्नति गरिएको सडक गुणस्तरले यातायातको दक्षता बढाउने, कार्बन उत्सर्जन बचतमा परिणत हुने र अन्ततः ग्रीन हाउस ग्यासको उत्सर्जन घटाउने सन्दर्भमा सकारात्मक प्रभाव पार्नेछ।

पहिचान गरिएका जोखिमहरू न्यून देखि उच्च जोखिमको दायरा भित्र छन्। जमिनको प्रयोगमा पर्ने असरलाई न्यूनीकरण गर्न रुखबिरुवाहरूको कटानलाई फर्मेशन चौडाइमा मात्र सीमित गरिनेछ। सडकको बीच भागको मेडियन र छेउमा हरियाली कायम गरिनेछ। उर्वर माटोलाई सडक तटबन्धमा टर्फीड/बायोइन्जिनियरिङको समयमा र मध्यमा हरियाली कायम राख्ने क्रममा राम्रोसँग सङ्कलन गरी भण्डारण गरी पुनः प्रयोग गरिनेछ। उत्खनन र खाडल व्यवस्थापन योजना तयार गरि लागु गरिनेछ छ र यसको कार्यान्वयनको क्रममा निर्माण व्यवसायीले विधिपूर्वक पालन गर्न आवश्यक छ। त्यसैगरी फोहोर व्यवस्थापन योजना र माटो तथा भू-क्षय नियन्त्रण योजना प्रस्ताव गरिएको छ। वायु प्रदूषण नियन्त्रणका लागि निर्माणाधीन सडकमा दिनमा कम्तीमा दुई पटक पानी छर्किने कार्य गरिनेछ। निर्माण क्षेत्रको उचित ब्यारिकेडिङ, निर्माण कार्यको उचित समयतालिका, समयमै मेसिनरी उपकरणको सर्भिसिङ आदि गरिनेछ। विषाक्त र खतरनाक रसायनको प्रयोगका लागि, प्रदूषण फैलाउने इन्धन र हानिकारक पदार्थहरूको व्यवस्थापनको लागि सुरक्षित भण्डारण र नस्ट गर्ने प्रक्रिया प्रस्ताव गरिएको छ। फोहोर विसर्जन, निर्माण सामग्रीको भण्डारण र ढुवानी, क्रसर प्लान्ट सञ्चालन, हट मिक्स प्लान्ट र ब्याचिङ प्लान्ट आदि संचालनका लागि विशेष कार्यविधि प्रस्ताव गरिएको छ।

समुदायको स्वास्थ्य तथा सुरक्षा (ई.एस.एस.-४):

निर्माण सामग्री ढुवानी गर्दा समुदायलाई अप्ठ्यारो हुनेछ। आयोजना गतिविधिहरू जस्तै नदी संरक्षण कार्य, सडक उत्खनन, भाइब्रेसन गर्ने खालका उपकरणको प्रयोगले माटोको क्षय र धुलो प्रदूषण हुन सक्छ। निर्माण सामग्रीको भण्डारण, निर्माणका क्रममा निस्कने फोहोरले भूदृश्य र खेतीयोग्य जमिनलाई बाधा पुर्याउने र जलस्रोतलाई दूषित बनाउँछ। निर्माण गतिविधि र निर्माण सवारी साधन चलाउँदा, निर्माण सामग्रीको भण्डारणमा अवस्थित राजमार्गमा असर पर्ने सम्भावना छ।

बाहिरी श्रमिकको उपस्थितिले वातावरण र स्थानीय समुदायहरूमा नकारात्मक प्रभाव पार्न सक्छ र लैंगिक हिंसा लगायतका अवस्थाहरूलाई रोक्न उचित व्यवस्थापन गरिनुपर्छ। आयोजना क्षेत्रमा राम्रोसँग परिभाषित र समन्वित प्रतिक्रिया संयन्त्रको अभाव छ र श्रम प्रवाहसँग सम्बन्धित लैंगिक हिंसा सम्बन्धि जोखिमहरू केलाउदा उच्च स्तरको जोखिमको सम्भावनालाई सङ्केत गर्छ। साथै आवश्यक संगठनात्मक संरचना र पूर्वाधार क्षमताको अभावको कारणले पनि लैङ्गिक हिंसाको संभावित जोखिमलाई प्रभावकारी रूपमा सम्बोधन गर्न सकिएको छैन। साथसाथै फिरन्ते श्रमिकका कारण विभिन्न सरुवा रोग र यौनजन्य रोग जस्तै एचआइभी एड्स, फैलिन सक्ने संभावना पनि उत्तिकै रहेको छ। निर्माणको क्रममा ट्राफिक व्यवस्थापन र सडक सुरक्षाको लागि पहिचान गरिएको जोखिम उच्च छ भने सञ्चालनको क्रममा न्यून देखि मध्यम छ। त्यसैगरी फिरन्ते श्रमिकका आगमन र आपतकालीन तयारी र प्रकोपको प्रतिकार्यका कारण स्वास्थ्य समस्याहरूको सामुदायिक जोखिम उच्च मात्रामा हुने सम्भावना रहन्छ। मानव बेचबिखन र लैङ्गिक हिंसासँग सम्बन्धित जोखिमहरू मध्यम रूपमा अनुमान गरिएको छ। निर्माणका क्रममा दक्ष यातायातका लागि ट्राफिक व्यवस्थापन योजना प्रस्ताव गरिएको छ।

दुर्घटना हुन नदिन उपयुक्त सडक सुरक्षालाई डिजाइनमा विचार गरी सोही अनुसार सडक निर्माण गरिनेछ। यसका लागि भीडभाड हुने स्थानमा ट्राफिक संकेत, जेब्रा क्रस, गति नियन्त्रण आदि जस्ता संयन्त्र स्थापना गर्ने प्रस्ताव गरिएको छ । स्वास्थ्य तथा सुरक्षा समस्या, मानव बेचबिखन, लैंगिक तथा यौनजन्य हिंसा सम्बन्धि आदि सम्बन्धमा श्रमिक तथा स्थानीय समुदायलाई सचेत गराउन सामुदायिक सचेतना र सचेतना कार्यक्रम सञ्चालन गरिनेछ।

जग्गा अधिग्रहण, भूमि उपयोगमा बन्देज र अस्वेच्छिक पुर्नवास (ई.एस.एस.-५):

यस सडक खण्डमा हाल रहेको सडकको अधिकारक्षेत्र ५० मिटर भित्र सडक स्तरोन्नतिको कार्य गरिने भएकोले थप जग्गा प्राप्ति गर्न आवश्यक नपर्ने देखिन्छ। यस सडकको अधिकारक्षेत्र ५० (दायाँ र बायाँ सहित) मिटर रहेको तथ्य २०३४(ई.स.१९७७) मा नेपाल सरकारको राजपत्रमा प्रकाशित सूचनाले समेत प्रस्ट पारेको छ । सडक अधिकारक्षेत्र भित्र भएको बसोबास सबै अतिक्रमणहरू हुन् । तथापी सडक सीमाभित्र बसोबास गर्ने बासिन्दा, निजी, सामुदायिक तथा सार्वजनिक संरचनाहरू सडकको विस्तारका कारण क्षतिग्रस्त हुनेछन्। सडकको अधिकारक्षेत्र भित्र ६४ घरधुरीको कुल ६६ निजी संरचनाहरूलाई प्रत्यक्ष असर गर्ने देखिएको छ।

प्रभावित ६४ वटा घरधुरीमध्ये २५ वटाले आवास, ३५ वटाले व्यापारिक घरहरू र ४ वटाले आवासीय व्यवसायिक संरचनाहरू गुमाउने देखिएको छ। यसबाहेक, जस्ताको छानासहितको फलामको स्तम्भले बनेको विविध आकारका २०४ अन्य विस्तारित आवास संरचनाहरू (शेडहरू जस्तै) लाई सडकको सीमाबाट हटाउन वा सार्न आवश्यक छ। ६९ वटा प्रतिकालय, ३५ वटा साना मन्दिरहरू, ५५ वर पीपल चौतारा, ४ प्रहरी चौकी, विद्यालयको विस्तारित भाग २, विद्यालय ३ वटा, बजारको छानो बजार शेड १, सैनिक चेकपोस्ट २, धारापानी (धनुषा) मा प्रतिका कक्ष १, ट्राफिक भवन ३ वटा, सार्वजनिक शौचालय ११ वटा, बाउन्ड्री पर्खाल ५ वटा, गेट ८ वटा, इनार १ र पर्खालको संरचना सडक छेउको बगैचा र धारापानी सैनिक ब्यारेकका १६ विभिन्न संरचना कूल २१६ वटा सामुदायिक/सार्वजनिक संरचना छन्

धेरै जसो निजी र सार्वजनिक संरचना अस्थायी प्रकारका संरचनाहरू हुन् जुन ठूला आवास संरचनाहरू होइनन् र प्रभावितसँग आयोजना क्षेत्र वा गाउँ नजिकैको आवास सुविधाका अन्य विकल्पहरू छन्। आयोजना कार्यान्वयनको क्रममा पुनर्वास सम्बन्धी प्रभावहरू विश्व बैंकको वातावरणीय तथा सामाजिक रूपरेखा र सडक विभागको सामाजिक तथा वातावरणीय रूपरेखामा उल्लेख गरिएको प्रावधान अनुसार तयार गरिएको पुनर्वास योजना फ्रेमवर्क अनुरूप तयार पारिएको पुनर्वास कार्य योजना बमोजिम व्यवस्थापन गरिनेछ। पुनर्वास कार्य योजनामा उल्लेखित प्रावधान अनुसार, सबै प्रभावितले आफ्नो विस्थापन स्तर कायम राख्न आफ्नो सबै प्रकारको क्षति र जीविकोपार्जन पुनर्स्थापना तालिमको लागि नगद क्षतिपूर्ति प्राप्त गर्नेछन्।

यसबाहेक, प्रस्तावित सडक चौडाइले प्रस्तावित संरचना चौडाइ भित्र रहेका २२२१ बिजुलीका खम्बा (१४० सौर्य पोल सहित) लाई असर गर्ने छ। त्यसैगरी सडक सीमामा रहेका ३३.१६ किलोमिटर खानेपानी आपूर्तिको पाइपलाइनमा समेत असर पर्ने देखिएको छ। यी सबै बिजुलीका पोल र खानेपानी पाइपलाइनलाई लाइन विभागले स्थानान्तरण गर्ने र लागत आयोजनाले व्यहोर्ने छ।

आर्थिकरूपले बिस्थापित र सामुदायिक तथा सार्वजनिक संरचनामा पर्न सक्ने प्रभावलाई उच्च श्रेणीमा मापन गरिएको छ। प्रभावित घरपरिवारलाई क्षतिपूर्ति र प्रभावित सामुदायिक तथा सार्वजनिक संरचना तथा सार्वजनिक संरचनाको पुनर्स्थापनाका लागि छुट्टै पुनर्वास कार्य योजना तयार पारिएको छ।

जैविक विविधता संरक्षण र जीवित प्राकृतिक स्रोतको दीगो व्यवस्थापन (ई.एस.एस.-६):

केडीपीमा वन र जैविक विविधतामा पर्ने एउटा प्रमुख प्रभाव भनेको सडक सीमा भित्र (१० सेन्टिमिटर र माथिको व्यास भएको) २८१२० सङ्ख्यामा रुखहरू छन्। सडक स्तरोन्नति गर्दा यी रुख हटाउन नसकिने भएकाले एउटा रुखको सट्टा १० रुख रोपेर क्षतिपूर्ति वृक्षारोपण गरिनेछ।

आइयुसियन का अनुसार केडीपी रोड खण्डका रुखका केही प्रजातिहरू खतरामा सूचीमा अन्तर्गत रहेका छन्। सतिसाल रुख जोखिममा परेको वर्गमा पर्दछ। त्यस्तै, साल; सतिसाल; सिमल; सिसौ र खयर रुखलाई नेपाल सरकारले व्यावसायिक रूपमा कटान गर्न, ढुवानी वा काठको काठ निर्यातमा प्रतिबन्ध लगाएको छ।

केडीपी रोड खण्ड पथलैया नजिक पर्सा राष्ट्रिय निकुञ्जको दक्षिणी सीमा (१४ किमी खण्ड, चेनेज किमी ३५०+००० देखि किमी ३६६+४२०) तिर अवस्थित छ। पर्सा राष्ट्रिय निकुञ्ज वन्यजन्तु कोरिडोर र बाघ, हात्ती र अन्य प्रमुख प्रजातिहरूको बासस्थानको रूपमा रहेको छ। चे. ३६३+१०० किलोमिटर देखि ३३४+५०० किलोमिटरको क्षेत्रमा हात्तीको आवतजावतका संकेतहरू देखिएका छन्। विभिन्न अध्ययनबाट सङ्कलन तथ्य मुताविक, पर्सा राष्ट्रिय निकुञ्ज र सामुदायिक वनसंग जोडिएका क्षेत्रमा ६-७ वटा हात्तीहरूको आवतजावत रहेको अनुमान गरिएको छ। केडीपी सडकको चेनेज ३५७+८०० बाट ३०० मिटर टाढा रहेको पिलुवा गाउँ नजिक र चे. ३५१+००० बाट २.५ किलोमिटर टाढा रहेको गाउँ टाङ्गिया बस्ती नजिक हात्तीको आवतजावतका संकेतहरू देखिएको छ।

बाघ एक विस्तृत रूपमा आपसमा जडित बसोबास क्षेत्रहरूमा बसोबास गर्ने प्रमुख प्रजाति हो। बाघलाई आयुसियन को रातो सूचीमा 'लोपुन्मुख' को रूपमा सूचीबद्ध गरिएको छ। मनसुनको समयमा पर्सा राष्ट्रिय निकुञ्जको पश्चिमपट्टीको भागसँग जोडिएको चितवन राष्ट्रिय निकुञ्जबाट १२-१८ वटा बाघको समुहले मौसमी बसाइ सरेर अनुमान गरिएको छ। यस क्षेत्रमा हालसालै गरिएको बाघ गणना अनुसार दुई किसिमका बाघ, एफ टि-७९ र एफ टि-७८ रहेको पाइएको छ। चेनेज ३३३+१०० देखि ३२७+७०० बीच रहेका यी स्थानहरू पर्सा राष्ट्रिय निकुञ्ज बाहिर रहेका छन्। आइब्याट प्रतिवेदन अनुसार कुल ३८ प्रजातिहरूलाई सुचिकृत गरिएको थियो जसमा १२ सरीसृपहरू, ४४ चरा प्रजातिहरू र १० स्तनधारी प्रजातिहरू समावेश छन्। ३८ प्रजाति मध्ये २ प्रजातिहरू एशियाई हात्ती र रोयल बेङ्गाल टाइगर आयोजना क्षेत्र नजिकै रहेको पाइएको थियो।

सडक स्तरोन्नतिको कारण हात्ती तथा अन्य स्तनधारी जीवजन्तुको आवागमनमा असर गर्ने देखिन्छ। तिनीहरूमा पर्ने प्रभाव न्यूनतम र प्रत्यक्ष हुनेछ तर निर्माणचरणमा उत्पन्न हुने ध्वनि र प्रदूषणले तिनीहरूलाई अप्रत्यक्ष रूपमा असर गर्न सक्छ। स्तरोन्नतिको दौरान कामदारहरूले वनक्षेत्रमा अवैध चोरीशिकारी गर्न सक्ने सम्भावना पनि उत्तिकै रहेकोले वन्यजन्तु संरक्षणमा विशेष ध्यान पुर्याउनुपर्ने देखिएको छ।

स्थानीय मिचाहा प्रजाति वनस्पतिको फैलावटको प्रभाव न्यून रहेको पाइएको छ भने वन क्षेत्रको क्षति, जलचरको बासस्थानमा खतरा, वन्यजन्तुको चोरीशिकार र वनपैदावारको प्रयोगका कारण पर्ने सक्ने प्रभावलाई मध्यम दायराभित्र आंकलन गरिएको छ भने वनस्पति तथा वन्यजन्तुको आवागमन पनि सक्ने प्रभावलाई उच्च दायराभित्र आंकलन गरिएको छ। जैविक वातावरणसँग सम्बन्धित सबै प्रभावलाई न्यूनीकरण गर्न छुट्टै जैविक विविधता व्यवस्थापन योजना तयार गरिएको छ। सडक स्तरोन्नतिको कारण काटिने रुखलाई १:१० को अनुपातमा क्षतिपूर्ति वृक्षारोपण गरिनेछ। क्षति नगर्ने एवं पर्यावरणीय लाभको

दृष्टिकोण मुताविक: सडकको स्तरोन्नतिको दौरान काटिएको वनस्पतिको क्षतिपूर्ति स्वरूप १:१० को अनुपातमा २८१२०० रूखहरू रोप्न सिफारिस गरिएको छ। रोपिने कुल २८१२०० रूखबाट २५३०८० रूखको लाभ प्राप्त हुनेछ। क्षतिपूर्ति वृक्षारोपणको लागि कुल २९० हेक्टर क्षेत्र आवश्यक पर्दछ। क्षतिपूर्ति वृक्षारोपण पश्चात २६१ हेक्टरको वनक्षेत्रको लाभ प्राप्त गर्न सकिने छ। पर्याप्त बजेटसहित सालको प्रजातिको प्रजनन योजना समेत प्रस्ताव गरिएको छ।

हात्तीको सहज वारपार गर्नका लागि निम्न ८ वटा पुलहरूलाई वन्यजन्तु ओहोरदोहोर मैत्री बनाउन प्रस्ताव गरिएको छ: चे. ३२९+६६६ अमु-१, चे. ३३३+८४२ लमाहा, चे. ३३९+३८१ धनसार, चे. ३४७+२७२ बकैया, चे. ३५३+६१२ तेर्हीकिलो, चे. ३५७+३३७ पसाहा, चे. ३६१+००३ बालगंगा र चे. ३६३+६८७ दुधौरा। त्यस्तै बाघ तथा मध्यम आकारका वन्यजन्तुको क्रसिडको लागि दशवटा (१०) पुल तथा कल्भर्टलाई प्रस्ताव गरिएको छ: चे. २७१+५१४ (गढन्ता), २७४+९२५ (बेलगाछी/ढुङ्गे खोला), २७५+६३० (टुटेधर-१), २७७+२६६ (मराहा), २७८ ९१३ (ढोलन), २८२+७५८ (बाँके), २८५+७२१ (अमुवा), २९२+७०३ (कालिंजोर-२), ३१७+६९८ (पौराही), ३२२+५५३ (हाल कायम रहेको कजवे)। अन्य न्यूनीकरणक अभ्यासहरू जस्तै ध्वनि अवरोधहरू, प्रकाश अवरोधहरू प्रदान गर्ने, नदीको गहिराइको वार्षिक मर्मतसम्भार अन्य सुधारात्मक विषयहरू समेत प्रस्ताव गरिएको छ जस मुताविक सडक वारपार गर्ने वन्यजन्तुहरूलाई किनारमा हिँड्न र सडक पार गर्न मद्दत मिल्नेछ। वन्यजन्तुको आवागमनको अनुगमन तथा व्यवस्थापनको निमित्त निर्माण चरणमा वाइल्डलाइफ म्यानेजमेन्ट इकाइ स्थापनाको प्रस्ताव गरिएको छ।

समग्रमा, आयोजनाबाट प्रभावित वातावरण र समुदायको बीच सन्तुलन कायम गर्न सडक पूर्वाधार विकासमा अफसेट अवधारणा अपनाइएको छ। वन्यजन्तु तथा वनस्पतिमा पर्ने प्रभाव न्यूनीकरण गर्न वन्यजन्तुको लागि अन्डरपास, गार्डडीङ फेन्स, गति नियन्त्रक (स्पिड ब्रेकर), ट्रफिक संकेत र क्षतिपूर्ति वृक्षारोपण कार्यक्रम मार्फत २९० हेक्टर अतिरिक्त वन क्षेत्र विकास मार्फत लाभ प्राप्त गर्ने जस्ता उपयुक्त उपायहरूको कार्यान्वयन प्रस्ताव गरिएको छ।

आदिवासी जनजाति (ई.एस.एस.-७):

नेपाल आदिवासी जनजाति महासंघ (नेफिन, २००४) द्वारा आदिवासी जनजातिलाई लोपोन्मुख, उच्च सीमान्तकृत, सीमान्तकृत, पिछडिएको, र उन्नत गरी ५ वर्गमा वर्गीकृत गरिएको छ। नमूना घरपरिवार सर्वेक्षण अनुसार केडिपी सडक करिडोरमा लोपोन्मुख वर्गका आदिवासीहरू भेटिएको छैन। तर, आयोजना क्षेत्रमा पाइने आदिवासी जनजाति मुख्यतया सीमान्तकृत वर्गका छन्।

केडिपी आयोजनाले आदिवासी जनजातिहरूमा सकारात्मक र नकारात्मक दुवै प्रभाव पार्नेछ। आयोजनाको सकारात्मक प्रभावहरूमा परिष्कृत र सुरक्षित यातायात सुविधाहरूको प्रावधान समावेश छ। नकारात्मक प्रभाव अन्तर्गत ६४ घरपरिवारहरू मध्ये १४ आदिवासी जनजातिहरूको आवास संरचनामा क्षति समावेश गर्दछ। उक्त १४ घरधुरीहरू मध्ये १२ घरधुरी सीमान्तकृत वर्ग (भुजेल र तामाङ), २ परिवार (राई र मगर) विपन्न वर्गका छन् र ७ महिला प्रमुख घरपरिवार पनि जोखिममा रहेका छन्। प्रभावित संरचनाहरूलाई सामान्य क्षतिपूर्ति, स्थानान्तरण र जीविकोपार्जन पुनर्स्थापनाको लागि सहयोगको अतिरिक्त अन्य कुनै उपायहरू आवश्यक पर्दैन। आदिवासी जनजातीको घरधुरी स्तरमा मात्रै सडक बिस्तारको प्रभाव पर्ने देखिएको तर समुदाय स्तरमा कुनै किसिमको प्रभाव पर्ने नदेखिएकोले स्वतन्त्र अग्रिम

जानकारी सहितको मन्जुरी लिनु नपर्ने देखिन्छ । प्रभावित क्षेत्रभित्र आदिवासी जनजाती बस्तीहरूका लागि आवश्यक क्षमता अभिवृद्धि कार्ययोजना तय गरिएको छ ।

पुरातात्विक र सांस्कृतिक सम्पदा (ई.एस.एस.-८):

ई.एस.एस.-८ ले प्रत्यक्ष वा अप्रत्यक्ष सांस्कृतिक सम्पदामा पर्ने जोखिम र प्रभावको सामान्य प्रावधान विस्तार गर्दछ । केडिपी सडकखण्डमा उच्च सांस्कृतिक मूल्य, ऐतिहासिक र पुरातात्विक स्थलहरू भएका कुनै पनि प्राचीन स्मारकहरू र स्थलहरू छैनन् । स्तरोन्नति कार्य सडकको छेत्राधिकार भित्र सीमित छ जसमा नेपाल सरकारको स्वामित्व रहेको छ । केडिपी सडक खण्डको छेत्राधिकार भित्र ३५ वटा साना मठ-मन्दिरहरूलाई सडक विस्तारको क्रममा प्रभाव पर्ने देखिन्छ । मठ-मन्दिरका साथै धार्मिक महत्वका वाग्मती र कमला नदी सहित चौतारा (५५ वटा) सहितको बर-पिपलको रुख प्रभावित हुनेछन् । त्यसलाई स्थानीय सरोकारवालाहरूसँग आवश्यक परामर्श गरि पुनर्बास कार्ययोजना मार्फत व्यवस्थापन गरिनेछ । अकस्मात फेला प्रक्रिया बोलपत्र, ठेकेदार संगको सम्झौता र सि-ई.एस.एम.पि. मा पनि समावेश गरिने छ र प्रभाव व्यवस्थापनका लागि नेपाल सरकारका नीतिनियमहरू लागू गरिनेछ ।

वित्तीय मध्यस्थता (ई.एस.एस.-९):

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

सरोकारवालाहरूको सहभागिता र सार्वजनिक परामर्श तथा छलफल (ई.एस.एस.-१०):

क्षेत्रीय व्यापारिक मार्ग विस्तार आयोजना अन्तर्गत सरोकारवालाहरूको सहभागिता र सार्वजनिक परामर्श तथा छलफल योजना एनएनएम इएसआईए को तयारीको क्रममा अप्रिल २०२० गरिएको हो सरोकारवालाको संलग्नता विशेष गरी आयोजना डिजाइन, कार्यान्वयन र सञ्चालन चरण एवं आवश्यक छलफलको सुचिसहित अद्यावधिक गरिन्छ । केडिपी इएसआईए तयारी चरणमा मे २०२२ देखि अगस्ट २०२३ सम्म सरोकारवालाहरूको परामर्श गरिएको थियो । परामर्श गरिएका सरोकारवालाहरू स्थानीय सरकार, स्थानीय गैरसरकारी संस्थाहरू, नागरिक समाज, शिक्षक, राजनीतिक नेताहरू, महिला समूहहरू, स्थानीय महिला उद्यमी समूहहरू, जोखिममा परेका समुदाय तथा आदिवासी जनजाती, फरक रूपमा सक्षम व्यक्ति र सीमान्तकृत समूह, स्थानीय व्यापारी समूह र आपूर्तिकर्ता, स्थानीय उपभोक्ता समूह (जंगल, पानी, सिँचाई आदि), स्थानीय पत्रकार, सुरक्षा कर्मचारी (ट्राफिक प्रहरी र सेना), ट्राभल एजेन्सी, चालक, र सडक प्रयोगकर्ता (यात्रुहरू) रहेका छन् । छलफलको दौरान ट्रान्जेक्ट वाक, समूह केन्द्रित छलफल, मुख्य जानकारीकर्ता संग अन्तरवार्ता मार्फत गरिएको थियो र मिश्रित समूहगत छलफलहरू विभिन्न सरोकारवालाहरूसँग गरिएको थियो ।

पहिलो तहको परामर्श स्कोपिड चरणमा थियो जहाँ ४६ समूहगत छलफल र ४४ मुख्य जानकारीकर्तासंग अन्तरवार्ता (२५ अप्रिलदेखि २० जुन, २०२२) सञ्चालन गरिएको थियो । यसबाहेक, आयोजना कार्यान्वयनको दौरान निम्तिन सक्ने समस्याहरू र सरोकारवालाहरूले सुझाएका उपायहरू सम्बन्धि सार्वजनिक सूचना विभिन्न सरोकारवालाहरूलाई दिईएको थियो र यस्तै सूचना राष्ट्रिय दैनिक पत्रिका (जनकपुर एक्सप्रेस मा ३० जून, २०२२ र ०५ जुलाई २०२२ मा सौर्य राष्ट्रिय दैनिक) मा पनि प्रकाशित गरिएको थियो । आयोजनाको प्रत्यक्ष प्रभाव क्षेत्रभित्रका २० प्रतिशत घरपरिवारलाई समेट्ने घरधुरी सर्वेक्षण सन् २०२२ को अक्टोबर महिनामा आयोजना क्षेत्रमा गरिएको थियो ।

त्यसैगरी आयोजना प्रभावित घरधुरीहरूको आधारभूत अवस्था पहिचान गर्न र त्यसको आधारमा तयार गरिएको पुनर्वास योजनामा छलफल गर्न १२ समूह केन्द्रित छलफल र ६४ वटा घरधुरी सर्वेक्षण गरिएको थियो । यसबाहेक, आयोजना क्षेत्रभित्रका आदिवासी बस्तीहरूमा उनीहरूको दृष्टिकोण संकलन गर्न ३० जनवरी २०२३ देखि ३ फेब्रुअरी २०२३ सम्म छलफल कार्यक्रम आयोजना गरिएको थियो जसलाई आधार मानेर आईपीडीपी प्रतिवेदन तयार गरिएको थियो । इसआईए प्रतिवेदन तयार भएपछि २२ मे २०२३ देखि २५ मे २०२३ सम्म सडक खण्डको सात विभिन्न स्थानहरूमा सार्वजनिक सुनुवाई कार्यक्रम आयोजना गरि आयोजना बारे जानकारी प्रवाह र सुझाव संकलन गरिएको थियो ।

सरोकारवालाहरूसँग छलफल गर्दा उनीहरूले सुझाएका सुझावहरूमा स्थानीय बासिन्दाका लागि सडक वारपार गर्न सवारीसाधन अन्डरपास (भी.यू.पी.) पैदल यात्री अन्डरपास (पी.यू.पी.) सेवा, बिसौनीहरू, सडक तथा ट्राफिक सुरक्षाका चिन्हहरू तथा सुरक्षा उपायहरू, रेलिडहरू, वन्यजन्तु क्रसिङ संरचनाहरू जस्ता बिषयहरू रहेका थिए । बालबालिका तथा वृद्धवृद्धा मैत्री क्रसिङहरू, चौपायाहरूको लागि क्रसिङ, भीयूपी र पीयूपीको आवश्यकता, मन्दिर, तीर्थस्थल, प्रतिकालय, हाट बजार, बस बिसौनी, जेब्रा क्रसिङ, सडक तथा ट्राफिक बत्ती, लैङ्गिक तथा बालबालिका र भिन्न रूपमा सक्षम मैत्री सार्वजनिक शौचालय, आठ वटा कुवा (इनार)को व्यवस्थापन साइकल लेन, बिजुलीका पोल लगायतका सुविधा स्थानीय प्रशासन र स्थानीय जनताको परामर्शमा पुनर्निर्माण गरिनुपर्ने सरोकारवाला धारणा रहेको थियो ।

सरोकारवालाले उठाएका मुख्य बिषयहरू डिटेल डिजाइन प्रतिवेदनमा समावेश गरिएको छ । २६ स्थानमा पहुँच सडक, पाँच वटा भीयूपी र पीयूपी, १२७ वटा कल्भर्ट, १८ वटा चौपाया क्रसिङका साथै लालबन्दीमा हाट बजार विस्तार एवं बागमती र कमला नदीमा नुहाउने स्थलको व्यवस्थापनको पनि प्रस्ताव गरिएको छ । सरोकारवालाहरूको सहभागिता र सार्वजनिक परामर्श तथा छलफल योजनामा व्यवस्था भए बमोजिम आयोजना स्तरको गुनासो सुनुवाई संयन्त्रको स्थापना संगै दुई समानान्तर गुनासो सुनुवाई संयन्त्र (लैंगिक तथा यौन हिंसा र कामदार सम्बन्धित) को प्रावधान राखिएको छ । साथै स्थानीय सरोकारवालाहरूको चासो मुताबिक स्थानीयलाई रोजगारीमा प्राथमिकता र स्थानीय उत्पादनको प्रवर्धन गर्ने बिषय समेत समावेश गरिएको छ ।

वातावरण र सामाजिक व्यवस्थापन उपायहरू

आयोजनाको प्रभाव न्यूनीकरणका लागि प्रभाव न्यूनीकरणभन्दा प्रभावको रोकथाम वा प्रभाव नै कम गर्नेतर्फ लाग्नु नै राम्रो मानिन्छ । त्यसकारण, डिजाइन र वातावरणीय प्रभाव मुल्यांकन प्रतिवेदन तयार पार्ने टोलीहरू बीच निरन्तर अन्तरक्रिया मार्फत डिजाइन चरणको बखत वातावरणीय तथा सामाजिक सुरक्षणका सिद्धान्तहरू जस्तै प्रभावबाट जोगिने, कम गर्ने, न्यूनीकरण र क्षतिपूर्तिका उपायहरू अवलम्बन गर्नुपर्ने हुन्छ । यो प्रक्रियाले वातावरणीय तथा सामाजिक प्रभाव घटाउन मद्दत गर्दछ ।

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

आयोजनाको वातावरणीय र सामाजिक जोखिम र प्रभावहरू व्यवस्थापन गर्न न्यूनीकरणका उपायहरू लागू गर्ने तवरले वातावरणीय र सामाजिक व्यवस्थापन योजना तयार गरिएको छ । यसमा न्यूनीकरणका उपायहरू, अनुगमन योजना, क्षमता निर्माण, जिम्मेवारी र रिपोर्टिङ प्रणाली एवं आयोजनाको अनुमानित

वातावरणीय र सामाजिक लागतहरू समेत समावेश छन्। थप रूपमा, वातावरणीय र सामाजिक व्यवस्थापन योजना ले आयोजना स्तरमा लैंगिक र यौनजन्य हिंसा सम्बन्धि समस्यालाई सम्बोधन गर्न उपायहरू प्रदान गरेको छ।

यस व्यवस्थापनले आयोजनाबाट हुनसक्ने मुख्य रूपमा श्रमिकसंग सम्बन्धित समस्याहरू श्रम ऐन २०७४, श्रम नियमावली २०६५ र विश्व बैंकको वातावरणीय तथा सामाजिक मापदण्ड ईएसएस-२ मा उल्लेख भएअनुरूप श्रमिकको व्यवस्थापन प्रक्रिया तथा पेशागत स्वास्थ्य तथा सुरक्षाको संरचना समेत समावेश गरिएको छ। यसको साथै गुनासो सुनुवाइ सम्बन्धी व्यवस्थाको स्थापना गरी श्रमिकसंग सम्बन्धित गुनासोहरू समेत दर्ता तथा सुनुवाइ गर्ने व्यवस्था यस योजना अनुरूप समेटिएका छन्। त्यसैगरी श्रमिकले पालना गर्नुपर्ने अनुशासन तथा नियम वनाउनुको साथै लैंगिक हिंसा घटाउने एवं निरुत्साहित गर्न यस व्यवस्थापन योजनामा समेटिएको छ।

आयोजनाबाट पर्नसक्ने सामाजिक जोखिम तथा असरलाई सम्बोधन गर्न छुट्टै पुर्नवास कार्ययोजना तयार गरिएको छ। सबै क्षतिहरू (निजी र सार्वजनिक सम्पत्ति) लाई इन्टाइटलमेन्ट मेट्रिक्स अनुरूप प्रतिस्थापन लागत सहित क्षतिपूर्ति दिईने छ। आयोजना कार्यान्वयनको बेला हुने कुनैपनि थप प्रभावहरू हुने थप क्षतीमा लागु हुनेगरी पुनर्वास कार्ययोजना तयार गरिएको छ। ई.एस.एम.पि. ले ठेकेदार परिचालन भए पश्चात र निर्माण कार्य थालिनु गर्नु अगाडि ठेकेदारलाई ठेकेदारको ई.एस.एम.पि. (सि.-ई.एस.एम.पि.) तयार पार्न बाध्य गर्छ। सि.-ई.एस.एम.पि.मा नेपाल सरकार र आई.एफ.सि. तथा विश्व बैंकको कामदार आवाश निर्देशिका अनुरूप अरु मध्ये व्यवसाय र स्वास्थ्य सुरक्षा योजना, पानी र फोहर व्यवस्थापन योजना, बाह्य कामदारहरूको ठूलो संख्यामा आगमनको व्यवस्थापन योजना, श्रम शिविर व्यवस्थापन योजना, ट्राफिक र सडक सुरक्षा व्यवस्थापन योजना, क्वेरि व्यवस्थापन योजना र साईट पुनर्स्थापना योजना समावेश हुनुपर्ने छ। सरोकारवालाहरूको सहभागिता र सार्वजनिक परामर्श तथा छलफल योजनाले महिला र युवा केटीहरूलाई जोड दिँदै, स्वास्थ्य खोज्ने व्यवहारलाई बढावा दिँदै सामुदायिक चेतना र संवेदनशीलताको लागि वकालत सामग्री उपलब्ध गराउनेछ। जोखिममा परेका र आईपी घरधुरीको समस्यालाई सम्बोधन गर्न पुनर्वास कार्ययोजना र आईपीडिपी तयार गरिएको छ। पीडितलाई क्षतिपूर्ति दिन नन् टाईटल होल्डर को लागि क्षतिपूर्ति योजना पुनर्वास कार्ययोजनामा समावेश गरिएको छ।

सामान्य जोखिम र प्रभाव निवारण उपायहरूमा बायोइनिजिनियरिङ्ग र सुदृढीकरण संरचनाहरू सहितको भू-क्षय नियन्त्रण योजना, प्रभावित ल्याडस्केपको जिर्णोद्धार, स्टकपाइलिंग रउत्खनन व्यवस्थापन योजनाको विकास, क्षतिपूर्ति रोपण, दक्ष मेसिन र कार्बन अफसेट का लागि सिफारिस, अर्थपूण परामर्शका साथ समुदायलाई विश्वासमा लिएर सबै प्रभावित उपयोगहरूको उचित स्थान परिवर्तन र पुनर्स्थापन, सबै शिकार दुरुत्साहित गर्ने नियमहरूको कार्यान्वयन र नियन्त्रण, उपयुक्त स्थानमा गति सीमा संकेत स्थापना, चालकहरूलाई जागरुकता प्रदान गर्ने, उजुरीका लागि गुनासो निवारण संयन्त्र (जि.आर.एम.) स्थापना, परियोजना स्थलसम्म र परियोजना स्थलबाट श्रमिकलाई यातायात सुविधा, कामदारहरूको सुरक्षा उपायहरू अपनाउने जस्तै चम्किने ज्याकेट (एप्रोन), जुता, पन्जा र हेलमेटहरू, श्रम कानूनको पालना, कामदार शिविर संचालन निर्देशिकाको स्थापना, खतरनाक सामग्री प्रयोग, भण्डारण, यातायात र व्यवस्थापन गर्न खतरनाक सामग्री व्यवस्थापन योजना विकास, जल गुणस्तर व्यवस्थापन योजनाको विकास, महिला र जवान बालिकाहरूलाई जोड दिएर समुदाय जागरुकता र संवेदनशीलता, निर्माण भन्दा पहिला खतरनाक रासायनिक फोहरसहितको रासायनिक व्यवस्थापन योजना पर्दछन्। कुनैपनि प्रत्यक्ष वा अप्रत्यक्ष

पुरातात्विक महत्वको सम्पदामा असर पर्ने छैन। आकस्मिक प्राप्त विषयहरूमा ई.एस.एम.एफ.मा उल्लेखित आकस्मिक प्राप्त कार्यविधि अनुसरण गरिने छ ।

स्थान विशेषका असर न्यूनीकरणका उपायहरूमा जथाभावी जमिनको कटान तथा उत्खननमा रोक लगाउँदै स्लोपको बेन्चिङ्ग कार्य गरिनेछ एवं ठाडो र भिरालो जमिनमा विस्तारै र न्युन कटान गरिनेछ । यसका साथै हाल रहेका प्राकृतिक जल निकास व्यवस्थापन, तथा स्लोप नियन्त्रण कार्य, एक रुख काटेबापत १० रुख रोप्नुपर्ने प्रावधान, रोप्दा स्थानीय प्रजातीको छनौट, नर्सरीको स्थापना, विद्युतका पोलको स्थानान्तरण, सडक सुरक्षा चिन्ह तथा बोर्डको स्थापना, ध्वनिका अवरोध क्षेत्रको स्थापना, निर्माणजन्य सामग्री भण्डारण स्थललाई त्रिपालले ढाक्ने, भण्डारण गरिएको निर्माणजन्य सामग्री धुलोले उडाउनबाट रोक्न पानी छर्कने, उक्त क्षेत्र सुरक्षाको लागि बारबेरा तथा सुरक्षा गार्डको प्रबन्ध र स्थानीय वासिन्दाको लागि फुटपाथ तथा आकाशे पुलको निर्माण लगायतका उपाय अवलम्बन गरिनेछ । यी उल्लेखित न्यूनीकरणका उपायहरू अवलम्बन गर्न लाग्ने वातावरणीय व्यवस्थापनको अनुमानित खर्च रु. ४६४,१२३,७५६ रहेको छ । लागतमा मुख्यतया बिओक्युमा समावेश नगरिएका विषयहरूको न्यूनीकरण गर्न जैविक विविधता व्यवस्थापन योजना, पुनर्बास कार्ययोजना र आईपीडिपी प्रतिवेदनमा तालिम र अनुगमन जस्ता शीर्षक अन्तर्गत समावेश गरिएका छन्। सामुदायिक र सार्वजनिक संरचनाहरू र खानेपानी आपूर्ति पाइपलाइनहरू र बिजुलीका पोलहरू लगायत सार्वजनिक महत्वको बस्तु स्थानान्तरणको लागि लागत ठेकेदारको जिम्मेवारी अन्तर्गत बिओक्युमा समावेश गरिएको छ ।

संस्थागत व्यवस्था

भौतिक पूर्वाधार तथा यातायात मन्त्रालय अन्तर्गत सडक विभाग नेपाल सरकार र दातृ निकाय अन्तर्गतका रणनीतिक सडक आयोजनाहरूको विकास र कार्यान्वयन गर्ने प्रमुख निकाय हो । सडक विभागमा विकास आयोजना कार्यान्वयन गर्ने पाँच महाशाखाहरू छन्। विकास सहायता कार्यान्वयन महाशाखाले सबै दाताहरूको लगानी रहेका आयोजनाहरू सञ्चालन गर्दछ। विकास सहायता कार्यान्वयन महाशाखा अन्तर्गत आयोजना समन्वय इकाइहरूले प्रारम्भिक वातावरणीय परीक्षण, वातावरणीय तथा सामाजिक प्रभाव मुल्यांकन, पुनर्बास कार्ययोजना र आईपीडिपी तयार गर्दछन् र अन्य वातावरणीय तथा सामाजिक जोखिम व्यवस्थापन गर्दछन्। यो आयोजना व्यवस्थापन गर्न छुट्टै समन्वय इकाइ बनाइएको छ।

सडक विभाग अन्तर्गतको भू-वातावरण तथा सामाजिक शाखा मा वातावरणीय जोखिम व्यवस्थापन र अनुगमन गर्ने निकाय हो। भू-वातावरण तथा सामाजिक शाखाले नेपाल सरकार र दातृ निकाय अन्तर्गतका आयोजनाहरूको वातावरणीय तथा सामाजिक प्रभाव मुल्यांकन, पुनर्बास कार्ययोजना र आईपीडिपी प्रतिवेदन समीक्षा र अनुगमन गर्छ। भौतिक पूर्वाधार तथा यातायात मन्त्रालय विशेषतः वातावरण संरक्षण ऐन तथा नियमावलीको दायरा रही यातायात क्षेत्रका आयोजनाहरूको समीक्षा र अनुमोदन गर्नको लागि जिम्मेवारी दिइएको एक सरकारी निकाय हो। यसले वन तथा वातावरण मन्त्रालयद्वारा प्रतिवेदन समीक्षा र स्वीकृत गर्नुपूर्व वातावरणीय तथा सामाजिक प्रभाव मुल्यांकन प्रतिवेदनहरूको समीक्षा गर्दछ। वन तथा वातावरण मन्त्रालय अन्तर्गत वातावरणीय प्रभाव मुल्यांकन शाखाले वातावरणीय प्रभाव मुल्यांकन प्रतिवेदन समीक्षा र स्वीकृत गर्दछ।

वन तथा भू-संरक्षण विभाग, राष्ट्रिय निकुञ्ज तथा वन्यजन्तु संरक्षण विभाग श्रम तथा व्यवसायजन्य सुरक्षा विभाग र आयोजना प्रभावित नगरपालिका लगायतका निकायहरूले पनि आयोजना कार्यान्वयनका लागि सहयोगी भूमिका खेलेका छन्।

ठेकेदारहरूले बोलपत्र, सम्झौता र सडक विभागको ई.एस.सि.पि.मा उल्लेखित ई.एस.एम.पि. र सम्बन्धित योजनाहरू पालना गर्नुपर्ने छ ।

संस्थागत सुदृढीकरण कम्पोनेन्ट अन्तर्गत आयोजनाले वातावरणीय र सामाजिक जोखिम तथा प्रभावहरू व्यवस्थापन गर्न आयोजना कार्यान्वयनमा संलग्न विभाग र निकायहरूको तालिम र क्षमता अभिवृद्धिलाई सहयोग गर्नेछ । पहिचान गरिएका र सुझाव मुताविक संस्थागत सुधार, क्षमता सुदृढ गर्ने विषय अन्तर्गत कार्यालय स्थापना तथा व्यवस्थापन, आवश्यक जनशक्ति परिचालन र क्षमता अभिवृद्धि तालिम र साथै क्षमता अभिवृद्धिका गतिविधिहरूमा सुरुवा रोगहरू (एचआईभी/एडस् सहित) बारे कार्यस्थलका श्रमिकहरूलाई सचेतना कार्यक्रम प्रदान गरिने कुरा प्रस्ताव गरिएको छ । निर्माण सामग्रीको व्यवस्थापन गर्न कामदारहरूलाई सचेतना, फोहोर व्यवस्थापन, सडक र ट्राफिक तथा व्यवसाजन्य स्वास्थ्य र सुरक्षामा स्थानीय समुदायको भूमिका, स्थानीय समुदाय र श्रमिकहरूलाई सचेतना, मानव बेचबिखन सम्बन्धी स्थानीय समुदायलाई सचेतना, तथा सो सम्बन्धि कार्य गर्ने संघसंगठनसँग समन्वय गर्ने, कामदारहरूलाई सचेतना तथा क्षमता अभिवृद्धि र लैंगिक तथा यौनजन्य हिंसाका विषयमा सामुदायिक सचेतना र अभिमुखीकरण गर्ने विषयहरू उल्लेख गरिएको छ ।

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ABBREVIATIONS

AADT	Annual Average Daily Traffic
ACCESS	Accelerating Transport and Trade Connectivity in Eastern South Asia
AD	Anno Domini
ADB	Asian Development Bank
AH2	Asian Highway 2
AH42	Asian Highway 42
AHDS	Asian Highway Design Standard
AsETWG	Asian Elephant Transport Working Group
BMP	Biodiversity Management Plan
BS	Bikram Sambat
BZ	Buffer Zone
CBD	Convention on Biological Diversity
CBS	Central Bureau of Statistics
CCSG	Connectivity Conservation Specialist Group
CEG	Consulting Engineers Group Ltd.
CFC	Compensation Fixation Committee
CH	Critical Habitat
CHA	Critical habitat assessment
CIAS	Civil Informatics and Solutions Pvt. Ltd.
CITES	Convention on International Trade in Endangered Species
CoC	Code of Conduct
CoI	Corridor of Impact
CR	Critically Endangered
CRN	Core Road Network
CSEA/SH	Child Sexual Exploitation, Abuse and Sexual Harassment
CNP	Chitwan National Park
DCID	Development Corporation Implementation Division
DFO	Division Forest Office
DG	Diesel Generator
DHM	Department of Hydrology and Meteorology
DIA	Direct Impact Area
DLP	Defect Liability Period
DNPWC	Department of National Parks and Wildlife Conservation
DOR	Department of Roads
EAAA	Ecologically appropriate area(s) of analysis
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EN	Endangered
EPA	Environment Protection Act
EPR	Environment Protection Rule
ESA	Environment and Social Assessment
ESIA	Environment and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Standards
EWB	East-West Highway
FGD	Focus Group Discussion

FW	Formation width
GESI	Gender Equality and Social Inclusion
GON	Government of Nepal
GPS	Global Positioning System
GRID	Green, Resilient, and Inclusive Development
IBA	Important Bird and Biodiversity Area
IBAT	Integrated Biodiversity Assessment tools
IDA	International Development Association
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IIA	Indirect Impact Area
IPDP	Indigenous People's Development Plan
IPF	Investment Project Financing
IPPF	Indigenous Peoples Planning Framework
IUCN	International Union for Conservation of Nature
JV	Joint venture
KDP	Kamala-Dhalkebar-Pathlaiya
KII	Key Informant Interview
KM	kilometer
LMP	Labour Management Procedures
M	Meter
MoALD	Ministry of Agriculture and Livestock Development
MoFE	Ministry of Forests and Environment
MoICS	Ministry of the Industry Commerce and Supply
MOPIT	Ministry of Physical Infrastructure and Transport
NAAQS	National Ambient Air Quality Standard
NBC	National Building Code
NDWQS	National Drinking Water Quality Standards
NGO	non-governmental organization.
NNL	No Net Loss
NNM	Nagdhunga Naubise Mugling
NPWC	National Parks and Wildlife Conservation Act, 2029
NRS	Nepal Road Standards
NTFP	Non-Timber Forest Products
PAs	Protected Areas
PCU	Passenger Car Unit
PIA	Project Influence Area
PNP	Parsa National Park
PS	Performance Standard
PWR	Parsa Wildlife Reserve
RCC	Reinforced Cement Concrete
ROW	Right of Way
RP	Resettlement Plan
RPF	Resettlement Policy Framework
SAFTA	South Asian Free Trade Area
SCDP	Safe Corridor Demonstration Program
SEP	Stakeholder Engagement Plan
SRCTIP	Strategic Road Connectivity and Trade Improvement Project
TCU	Tiger Conservation Unit
TOR	Terms of References

TSP	Total Suspended Particulate
VECs	Valued Environmental Components
VTR	Valmiki Tiger Reserve
VU	Vulnerable
WB	World Bank
WWF	World Wildlife Fund

CHAPTER-I: PROJECT DESCRIPTION

1.1 Project Background

The proposed road project under the Strategic Road Connectivity and Trade Improvement Project (SRCTIP) is funded by the World Bank (WB under IDA credit no 6673-NP & 6674-NP). The project is aimed at upgrading the Kamala-Dhalkebar-Pathlaiya (KDP) section of the Mahendra Highway². This section is a vital component in the national road network of Nepal, linking major tourist and industrial cities such as Pokhara, Sauraha (Chitwan), Lumbini and Biratnagar. It is also an integral part of the Asian Highway 2 (AH2). The KDP road section spanning 130 km, begins at the Kamala River and ends at the Pathlaiya junction of Bara district. More specifically, the KDP road crosses the Dhanusha, Mahottari, Sarlahi, Rautahat and Bara districts, is a major access route to Birgunj in the south-west, Kathmandu in the north and the various other parts of the west via this Mahendra Highway.

East-West (Mahendra) Highway (Dhalkebar-Pathlaiya section, 109 Kms) was constructed in 1974 AD, however Kamala Dhalkebar section of same highway was constructed in 1970's. Both sections were upgraded to double lane standard in late 1990's. The bridges at Kamala Dhalkebar section are of double lane standard while the bridges at Dhalkebar-Pathlaiya section are of Intermediate Lane standard. The bridges of Dhalkebar-Pathlaiya section are now bottlenecks to the traffic. The passenger and freight traffic have been increasing because of trade enhancement. The recent regional trade agreements for further enhancement of trade among the member countries, necessitates the standard of road needs to be upgraded to match with the Asian Highway Standards (Class I). In order to enhance road capacity and efficiency in the road transport, GON, DoR intends to upgrade the KDP section (130 Kms) of the East West (Mahendra) Highway under the proposed project from 2-lane to 4-lane road under SRCTIP Project.

1.2 Project Location

KDP road section is a part of East West (Mahendra) Highway (Chainage 236+698 to 366+667). The proposed road section starts from Kamala 26°52'40.73"N and 86° 8'24.20"E and ends at Pathlaiya 27°11'57.66"N and 84°58'50.76"E. Settlements within project area have mixed communities. There are 11 ethnic groups within project area. The road stretch lies within Madhesh Province and covers 6 Districts, 16 Municipalities (including 1 sub-metropolitan city) and 78 wards as shown in **Table 1.1** below.

Table 1.1: Districts, Municipalities and Wards covered by the Road Alignment

Districts	Municipalities	Wards	Major Settlements
Siraha	Karjanha	2, 3	
Dhanusha	Ganeshman Charnath Municipality	1, 2, 4, 6, 7, 8,	Godar, Birendrabazar
	Dhanusadham Municipality	6, 8, 9	Bhiman, Dharapani, Kanchibazar
	Mithila Municipality	3, 4, 5, 6, 7, 8, 9, 10	Puspalpur, Bishrampur, Dhalkebar, Ranatol,

²The KDP road is being upgraded under the Development Corporation Implementation Division (DCID) of the Department of Roads (DOR).

Districts	Municipalities	Wards	Major Settlements
			Badahari, Lalgah
Mahottari	Bardibas Municipality	1, 4, 5, 8, 10, 11, 14,	Bardibas
	Gaushala Municipality	1, 8, 10, 11, 12	
Sarlahi	Ishworpur Municipality	4, 5, 12, 13,	
	Lalbandi Municipality	1, 6, 7, 9, 10, 17	Raniganj, Lalbandi, Nawalpur
	Hariwan Municipality	4, 8, 9, 10, 11	Harion, Nayaroad
	Bagmati Municipality	1, 2, 4, 11, 12	Karmaiya, Bagmati East
Rautahat	Brindaban Municipality	1	
	Chandrapur Municipality	1, 2, 3, 4, 5, 6	Bagmati West, Chandrapur,
	Gujara Municipality	2, 3	
Bara	Nijgadh Municipality	2, 3, 4, 7, 8, 9	Nijgadh
	Kolhabi Municipality	2, 3, 5, 6, 8	
	Jeetpursimara Sub-Metropolitan City	1, 2, 4, 14, 15, 16, 17	Pathlaiya

The Project location along with proposed road alignment is shown in **Figure 1.1** and proposed road alignment in google earth is shown in **Figure 1.2**. Detail map of the project area is given in **Annexure 1.1**. Start point of the road section, Kamala is 209 km far from Kathmandu via Kathmandu-Banepa-Dhulikhel-Bardibas (BP-Highway) road and end point of the road section, Pathlaiya, is 110 km far from Kathmandu via Kathmandu-Kulekhani-Hetauda Road. Nearest airport from the road section is at Simara, which is around 6 km far from Pathlaiya. Similarly, Janakpur airport is around 24 km far from Dhalkebar (Ch 257+200).

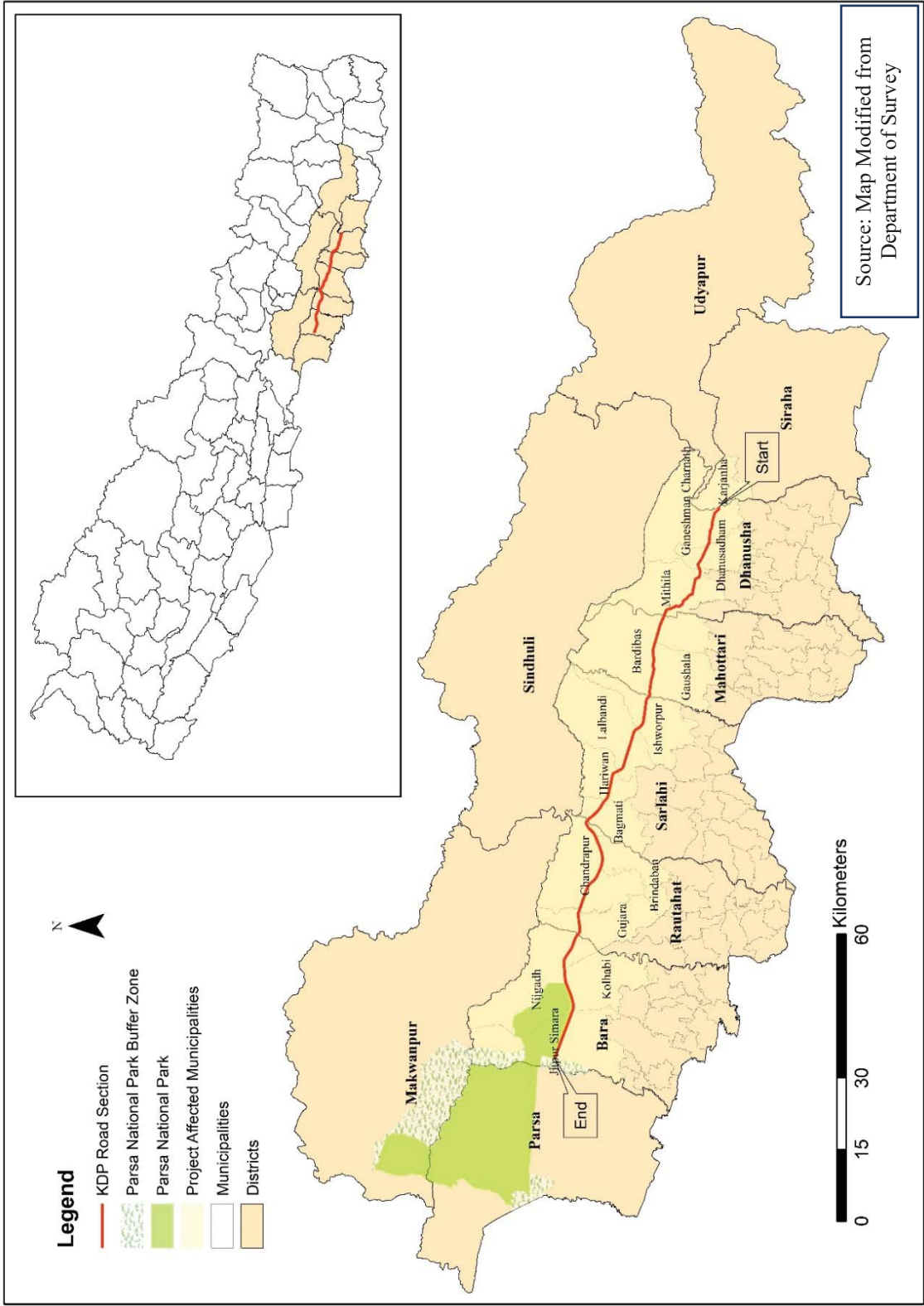


Figure 1.1: Proposed Road Alignment in Map of Nepal

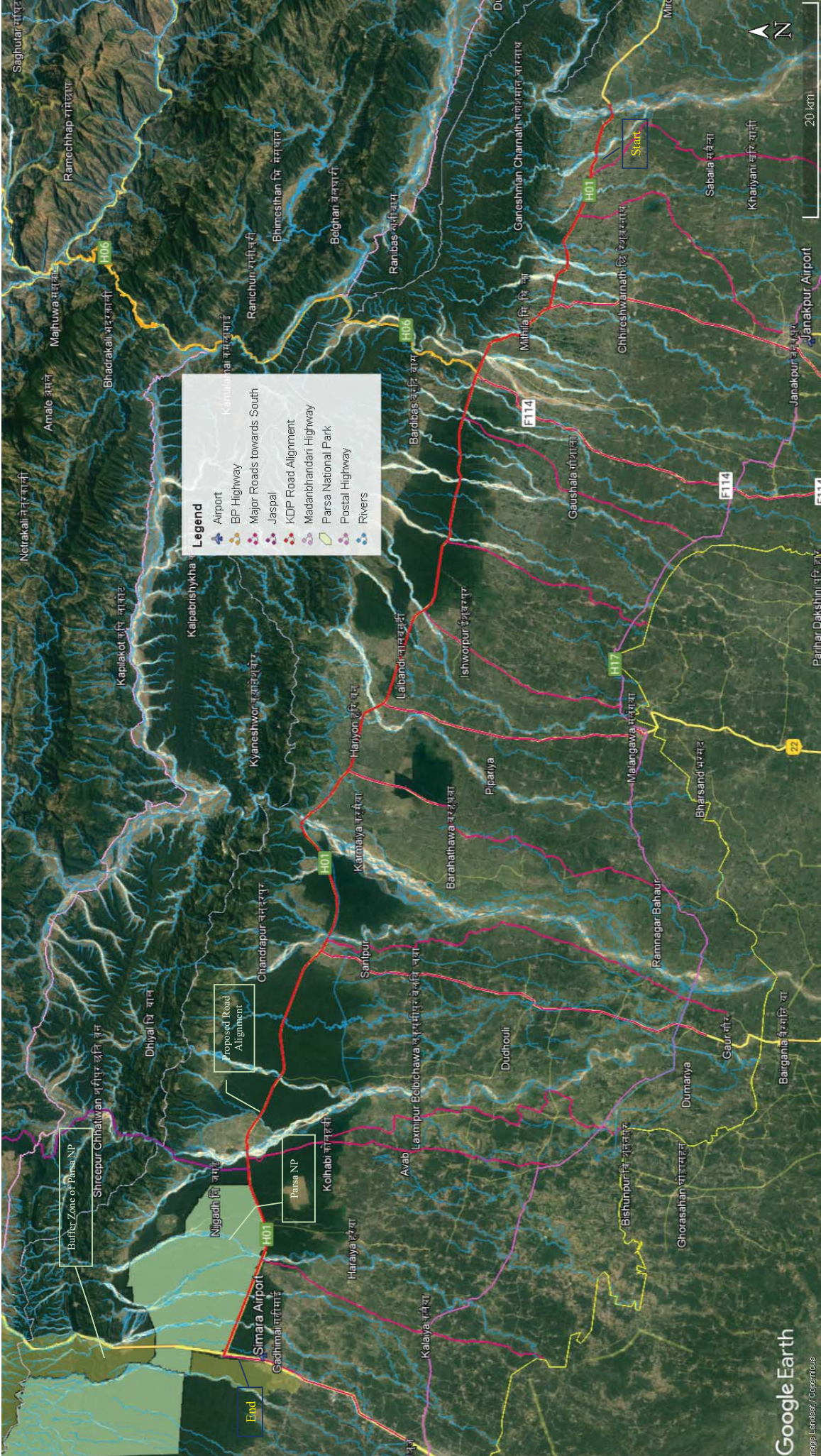


Figure 1.2: Proposed Road Alignment in Google Earth (retrieved on October 10, 2023)

1.3 Salient Features

The existing 2-lane KDP road has been proposed to be improved into the 4-lane Asian Highway Standard (Class I). The road will be widened to 18 m width (7 m on either side with 4 m center median). Service roads of width 6.5 m each will also be constructed in either side in urban areas along with footpath and cycle lane. Along with road widening, the project also encompasses significant road improvement works. Regarding bridges 61 additional bridges out of 76 existing bridges will be constructed; where 15 small bridges will be converted into the Box Culverts Besides, this, 27 major junctions' improvement, 49 Bus Bays and 5 Truck Lay Bays, 18 Tractor/Cart Crossings and 10 PUP + 5 VUP in five locations (at Birendra Bazar, Lalbandi, Nawalpur, Hariwon and Naya Road), 8 elephant passes and 10 medium size animals crossings has also been proposed in the design of KDP road improvement project. Given that the proposed project route passes through the Parsa National Wildlife Reserve, specific measures are being taken to ensure wildlife safety in this area. In addition, riverbank protection works for rivers on which bridge improvement/construction has been proposed under this project. Salient features of the proposed road project are given in **Table 1.2** and typical cross-sections of the proposed road upgradation are shown in **Annexure 1.2**.

Table 1.2: Salient Features of the Project

Name of the Project		Upgrading of Kamala-Dhalkebar-Pathlaiya Road section of East West (Mahendra) Highway	
Location			
Province		Madhesh	
Start Point		Kamala Bridge (Ch: 236+698) 26°52'40.73"N latitude and 86° 8'24.20"E longitude	
End Point		Pathlaiya Junction (Ch: 366+887)27°11'57.66"N latitude and 84°58'50.76"E longitude	
Name of District and Municipalities		Siraha District: a) Karjanha Dhanush District: a) Ganeshman Charnath Municipality, b) Dhanusadham Municipality, d) Mithila Municipality Mahotari District: a) Bardibas Municipality, b) Gaushala Municipality SarlahiDistrict: a) Ishworpur municipality, b) Lalbandi municipality, c) Hariwan Municipality, d) Bagmati Municipality Rautahat District: a) Brindaban Municipality, b) Chandrapur Municipality, c) Gujara municipality Bara District: a) Nijgadh Municipality, b) Kolhabi Municipality and c) Jitpur Simara sub–Metropolitan City.	
Major Settlement adjoining to KDP road alignment		Godar Bazar, Birendra Bazar, Dharapani, Puspapur, Dhakebar, Badahari, Lalgadh, Bardibas, Phuljor, Raniganj, Lalbandi, Nawalpur, Harion, Bagmati, Chandpur, Nijgadh and Pathlaiya.	
Geographical Feature			
Terrain		Plain	
Geology		Alluvial deposit with deep to very deep, poorly drained, high-water table, and silt to silt loam textures	
Altitude (maximum and minimum)		Maximum 227 at Ch 266+300, Bardibas and minimum 105 at start (Kamala river)	
Climate		Tropical/Subtropical	
		Existing	Proposed
Road Classification			
Classification		Class II as per NRS 2070	Class II as per NRS 2070 and Class I as per AHDS
Length of Road		130 km	130 km

Name of the Project		Upgrading of Kamala-Dhalkebar-Pathlaiya Road section of East West (Mahendra) Highway
Road Pavement		
Sub-base Material	15 cm	20 cm
Base Material	10 cm	25 cm
Dense Bituminous Macadam	0 cm	9 cm for 40 and 60 MSA and 10 for 75 MSA
Wearing Course	DBST (5-10 cm)	Asphalt Concrete (4 cm for 40 MSA and 5 cm for 60 MSA and 75 MSA)
Cross-section		
Right of Way	50 m	50 m
Carriageway Width	7.0m (Average)	18 m (7.0 m on either side with 4 m center median), further 6.5 m service road width in either side of roads in urban areas.
Formation Width	(10 – 12) m	24 m
Shoulder Width	1.2 m	2.5 m
Side Drain (Width)	Side Drains are available at Dense settlement area	Open drain in rural areas and trench type with cover for footpath in urban areas
Design Standard		
Standard		NRS-2070
Design Speed		100 kmph
Gradient (Maximum and Minimum)		5 %
Minimum Radius of the Horizontal Curve		Maximum as per design and minimum should be at least 870 m as per NRS-2070.
Camber		2.5 %
Super Elevation		7 %
Crossings		
Bridges (Locations)	76	60 (15 bridges into culverts and 1 bridge under construction)
Culverts (Locations)	122	157
Causeway (Locations)	23	All causeway to be replaced by Box culverts
Truck laybys		5
Bus shelters		49
Service Road		19 nos. in total length of 34,704 m
Tractor and Cattle Crossings		18 nos. (existing bridges)
Elephant Underpasses		Total 8 nos. (existing bridges), 2 of them to be dismantle and rebuild
Medium size animal crossings		Ten (10) bridges/culverts. (one bridge to be dismantled and rebuild)
VUP/PUP		5 VUP /10 PUP
Cut and Fill		
Cut		221,591 cubic meters
Fill		5,018,645 cubic meters
Traffic Data (January 2022, Base Year Traffic)		

Name of the Project	Upgrading of Kamala-Dhalkebar-Pathlaiya Road section of East West (Mahendra) Highway
AADT, Vehicle/day	13249 at Kamala-Dhalkebar section and 8306 at Nijgadh-Pathlaiya section
AADT, PCU/day	15,386 at Kamala-Dhalkebar section and 12067 at Nijgadh-Pathlaiya section
Total Project Cost	NPR 36.924 Billion

Source: Detailed Design Report, 2023

In addition to road widening, the riverbank protection work will be done for rivers coming across the KDP section. The borrow sites will be operated for soil and aggregates, which will be used for embankment and construction purpose. The list of borrow area is given in **Table 1.6**. The aggregates will be procured by the contractor from government approved quarry site. Upgradation works will also be carried out for bridges constructed on Rivers and Canals. The name of Rivers or Canals/Bridges which are considered for upgradation is given in **Table 1.3**.

Table 1.3: List of Bridges Associated with KDP

S N	River or Canal/Bridge Name	Chainage (Center of Bridge)	Existing Bridge		Proposed				Type of River	Nature (Siltation)
			Span Length (m)	Total Length (m)	Span Length (m)	Total Length (m)	LBL (m)	HFL (m)		
1	Kamala	237.022	24*26.65	639.6	114+206+206+114	640	100.81	106.12	Perennial	Aggrading
2	Kamala Canal	237.812	5*14.2	71	45	45	104.057	106.057		
3	Charnath	241.185	15*21.4	321	15*21.4	321	122.05	123.79	Ephemeral	Aggrading
4	Baluwa	244.825	7*16	112	32+32+32+16	112	134.04	136.53	Ephemeral	Aggrading
5	Jagadav Branch	250.492	26.6	26.6	20	20	161.66	162.44	Ephemeral	Aggrading
6	Jagadav	250.817	2*21.5 + 2*26.5	96	2*20.6	53.2	159.11	159.92	Ephemeral	Aggrading
7	Jalad	252.472	10*26.6	266	10*20.6	266	153.68	155.44	Ephemeral	Aggrading
8	Aurahi	254.605	12*26.6	319.2	12*26.6	319.2	163.9	165.38	Ephemeral	Aggrading
9	Basai	256.142	2*26.5 + 2*21.5	96	21.4+2*26.6+21.4	96	164.18	165.65	Ephemeral	Aggrading
10	Sukhajor	258.631	2*22	44	2*22	44	171.82	174.34	Ephemeral	Aggrading
11	Badahari	260.957	2*23.5+28	75	23.5+28+23.5	75	183.18	185.12	Ephemeral	Aggrading
12	Ratu	265.312	2*38.5+4*33+5*2.95	223.75	41+4*36+41	226	216.41	219.06	Ephemeral	Aggrading
13	Ratu Chahara	266.108	2*9.4	18.8	2*6	12	224.16	225.32	Ephemeral	Aggrading
14	Bhapsi	268.134	4*12.5	50	3*25	75	206.37	209.54	Ephemeral	Aggrading
15	Atabbe	269.363	3*9.5	28.5	28.5	28.5	205.65	207.15	Ephemeral	Aggrading
16	Janga Pul-1	270.717	6*12.5	75	5*25	125	207.56	210.01	Perennial	Stable
17	Janga Pul-2	270.993	3*12.55	37.65	3*6	18	206.32	207.82	Ephemeral	Aggrading
18	Gadhanta	271.36	5*12.5	62.5	3*25	75	209.65	211.53	Ephemeral	Aggrading
19	Belgachhi (Dhungre Khola)	274.798	4*9.5	38	2*20	40	195.21	197.32	Ephemeral	Aggrading
20	Tuteshwar- 1	275.494	2*9.5	19	20	20	188.67	190.9	Ephemeral	Degrading
21	Tuteshwar- 2	276.903	2*9.5	19	20	20	187.03	188.23	Ephemeral	Aggrading
22	Maraha	277.004	15+2*18+2*15+2*18+15	132	5*33	165	188.21	190.651	Ephemeral	Aggrading
23	Maraha Pul	278.219	2*9.45	18.9	3*6	18	187.79	189.36	Ephemeral	Aggrading
24	Dholan	278.783	4*9.5	38	38	38	187.35	189.4	Ephemeral	Aggrading
25	Jarlahi (Kholi Pul)	280.453	2*9.5	19	20	20	184.98	186.71	Ephemeral	Aggrading
26	Batuwa	281.883	3*9.5	28.5	28.5	28.5	177.3	179.77	Ephemeral	Aggrading
27	Bankhe	282.73	15+4*18+15	102	33+36+33	102	177.92	180.14	Ephemeral	Aggrading
28	Amuwa	285.648	2*9.2	18.4	25	25	164.06	167.09	Ephemeral	Aggrading

S N	River or Canal/Bridge Name	Chainage (Center of Bridge)	Existing Bridge		Proposed				Type of River	Nature (Siltation)
			Span Length (m)	Total Length (m)	Span Length (m)	Total Length (m)	LBL (m)	HFL (m)		
29	Phuljor	290.223	7*12.5	87.5	5*25	125	156.76	159.56	Ephemeral	Aggrading
30	Kalinjor – 1	291.893	3*9.5	28.5	28.5	28.5	155.19	156.52	Ephemeral	Aggrading
31	Kalinjor – 2	292.761	3*21.1	63.3	3*22	66	150.97	154.23	Perennial	Stable
32	Betini	294.155	2*6	12	2*6	12	146.97	148.25	Ephemeral	Degrading
33	Dumdume	295.388	2*9.45	18.9	25	25	139.71	142.32	Perennial	Stable
34	Bastipur	296.328	2*9.5	19	3*6	18	140.22	141.19	Ephemeral	Aggrading
35	Lakhandei	300.671	15+4*18+2*15+4*18+15	204	33+36+2*33+36+33	204	136.39	138.81	Ephemeral	Aggrading
36	Chapani	301.712	3*22	66	3*22	66	136.62	139.94	Perennial	Aggrading
37	Bastol	302.553	2*10.35	20.7	6	6	141.92	142.76		
38	Sukhapokhari	305.624	2*9.5	19	3*6	18	136.88	137.51	Ephemeral	Aggrading
39	Rai Bridge	307.663	4*9.5	38	38	38	130.87	135.12	Perennial	Degrading
40	Dumajor	309.914	4*9.45	37.8	2*20	40	127.7	130.99	Ephemeral	Aggrading
41	Godari	311.444	2*9.45	18.9	20	20	128.45	130.79	Ephemeral	Aggrading
42	Bagmati East	312.07	11.3	11.3	25	25	126.12	128.12		
43	Bagmati	312.941	11*33.045	363.495	99+165+99	363	122.88	131.26	Perennial	Aggrading
44	Bagmati West	313.615	11.57	11.57	25	25	125.546	127.546		
45	Gairi	313.99	3*11.4	34.2	35	35	126.92	129.36	Ephemeral	Aggrading
46	Gairi Khola	314.83	11.5	11.5	3	3	137.15	137.87	Ephemeral	Partial Aggrading
47	Paurahi	317.792	3*22.17	66.51	3*22	66	121.25	124.11	Ephemeral	Stable
48	Lachkan	319.13	2*11.25	22.5	20	20	125.87	127.45	Ephemeral	Aggrading
49	Katha Ko Pul	323.567	4*11.4	45.6	25	25	121.91	123.42	Ephemeral	Aggrading
50	Chandi	325.262	5*32.95	164.75	5*33	165	119.81	122.61	Perennial	Aggrading
51	Dhou	327.332	2*11.25	2*11.25	3	3	132.56	132.96	Ephemeral	Aggrading
52	Jungle Tole	328.136	3*11.39	34.17	20	20	134.89	135.7	Ephemeral	Stable
53	Amu – 1	329.666	3*11.34	34.02	25	25	139.97	140.79	Ephemeral	Stable
54	Amu – 2	330.895	2*11.35	22.7	3*6	18	142.88	144.22	Ephemeral	Stable
55	Kathi	332.717	5*11.35	56.75	30	30	144.15	145.08	Ephemeral	Aggrading
56	Lamaha	333.842	2*33	66	2*33	66	134.21	137.82	Perennial	Stable
57	Kali Khola	334.396	3*11.3	33.9	33	33	133.81	136.3	Perennial	Degrading
58	Dhansar	339.381	8*20.5	164	4*41	164	145.3	147.35	Ephemeral	Aggrading
59	Lamopul	342.172	4*11.3	45.2	25	25	148.02	148.95	Ephemeral	Stable
60	Bhamara	343.395	32.89	32.89	33	33	145.97	151.63	Ephemeral	Aggrading

S N	River or Canal/Bridge Name	Chainage (Center of Bridge)	Existing Bridge		Proposed				Type of River	Nature (Siltation)
			Span Length (m)	Total Length (m)	Span Length (m)	Total Length (m)	LBL (m)	HFL (m)		
61	Rampul	343.99	2*11.3	22.6	20	20	149.85	151.78	Ephemeral	Aggrading
62	Bakeya	347.272	16*22.2	355.2	82.5+165+82.5	330	148.84	153.22	Perennial	Aggrading
63	Unasi	348.934	8*11.2	89.6	35	35	149.58	152.62	Ephemeral	Aggrading Degrading
64	Terhakilo	353.612	4*11.4	45.6	41	41	146.48	149.12	Ephemeral	Aggrading
65	Barahakilo	354.656	3*11.25	33.75	35	35	139.17	141.56	Ephemeral	Stable
66	Pasaha	357.337	5*33	165	5*33	165	139.2	141.63	Perennial	Aggrading
67	Pasaha Branch	357.46	2*11.1	22.2	3*6	18	142.53	143.64	Ephemeral	Stable
68	Bangandi	358.581	10*11.36	113.6	35	35	142.87	144.22	Ephemeral	Aggrading
69	Balganga	361.003	3*22.36	67.08	3*22	66	147.55	149.53	Ephemeral	Aggrading
70	Bajura	362.952	4*11.52	46.08	2*23	46	152.75	154.61	Ephemeral	Aggrading
71	Dudhaura	363.687	2*45.2465	90.493	2*45.25	90.5			Ephemeral	Aggrading
72	Dhungre - 1	364.553	11.2+11.6	22.8	3*6	18	159.58	160.59	Ephemeral	Aggrading
73	Dhungre - 2	364.776	11.2+11.4	22.6	3*6	18	157.09	159.01	Ephemeral	Stable
74	Tin Number	365.866	11.6+11.6+10.4	33.6	35	35	159.65	161.45	Ephemeral	Stable
75	Dui Number	366.391	2*11.6	23.2	3*6	18	160.96	161.92	Ephemeral	Stable
76	Ek Number	366.61	11.45	11.45	2*6	12	162.88	163.62	Ephemeral	Aggrading

Source: Detail Design Report 2023

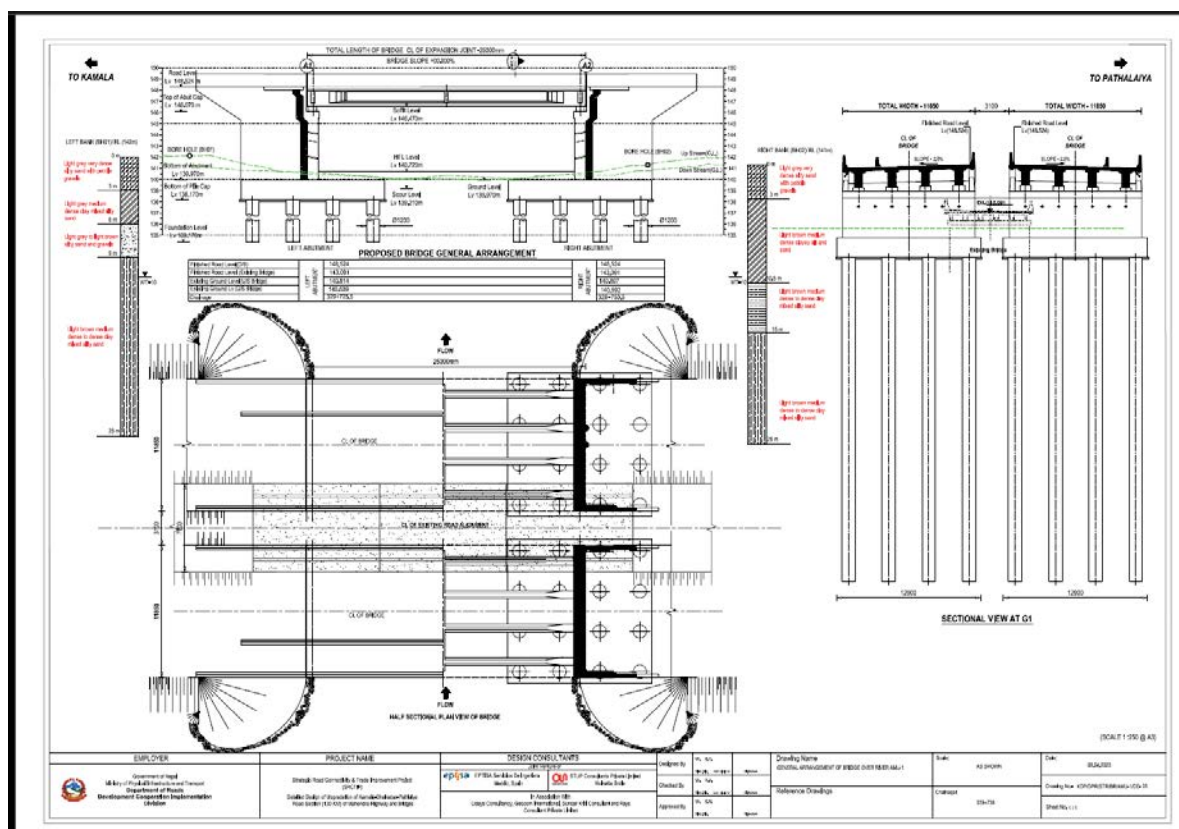


Figure 1.4: Sample Design of the Proposed Bridge (Amu 1)



Figure 1.5: Project Site and Landscape with Application of the Mitigation Hierarchy

1.4 Existing and Projected Traffic

The traffic survey was carried out for the project in January 2022 by the design consultant. The entire project road was divided into six homogeneous sections for traffic survey. These homogeneous sections are Kamala-Dhalkebar, Dhalkebar-Bardibas, Bardibas-Nawalpur, Chapur-Nijgadh, and Nijgadh-Pathlaiya. The traffic data was collected continuously from these homogeneous road sections. The vehicles consist of motorised and non-motorised vehicles. The motorized vehicles consist of trucks, buses, cars, utilities vehicles, two wheelers, three wheelers and

tractors. However non-motorised vehicles consist of rickshaws, bicycles, and bullock carts. The non-motorised vehicles particularly bullock cart was mainly present in rural areas. The slow-moving vehicles that are rickshaws, bicycles, and bullock carts may face safety issue after improvement of the KDP road as traffic on four lane road will be fast moving traffic.

Total traffic was distributed into 12 categories for survey purposes that is Multi-axle Truck, Heavy Truck, Mini truck, Large-bus, Mini bus, Micro-bus, Car, Motorcycle, Utility vehicle, Four-wheeler, and Tractor.

The existing average daily traffic (ADT) was maximum at Chapur-Nijgadh section that is 14828. The existing average daily traffic (ADT) was minimum at Nijgadh-Pathlaiya Section that is 8470.

The projected traffic for the year 2046 AD was maximum at Chapur-Nijgadh section that is 70591. The projected average daily traffic for the year 2046 AD was minimum at Nijgadh-Pathlaiya Section that is 36970.

The major settlements in project area are Dhalkebar, Bardibas, Nijgadh and Pathlaiya. However, second largest traffic was observed in Nawalpur- Chapur section and third highest were observed in Dhalkebar Bardibas section.

The detail baseline traffic and projected traffic is given in **Annexure 1.3**.

It is noticed that 43% of road accidents from FY 2015-16 to 2020-21 occurred in Mithila, Chandrapur and Charnath (Mithila-17%, Chandrapur-15% and Charnath-11%). Lalbandi and Hariwon in Sarlahi region experienced 9% and 8% of total accidents on the stretch. Bridge locations had around 9% of total accidents. It is also noted that vulnerable road users (VRUs) are being the most affected in accidents with proportion of 55% (most of them are motorcycles) involved in accidents while 35% vehicular traffic involved in accidents (Detailed Design Report 2023). Mithila, Chandrapur and Charnath locality seems to be accident hot-spots and special attention has been given in the proposed design of these locations in providing facilities in order to minimize accidents.

1.5 Construction Approach and Methods

The construction activities mainly consist of mobilization and setup of workers camp, construction camps, protection or relocation of existing utilities, excavation of existing pavement, earth works (cut and fill), Vehicles movement for material transportation, equipment movement for construction, activities, prepare the formation layer, laying of subbase layer, laying of road base layer, compaction, spray bituminous prim coat, laying of asphalt base course, laying of asphalt wearing course, roads marking, Signage (foundations), Signage installation and road marking. However, RoW and work place will be cleared from trees and other encumbrances present within in RoW and work place. Crusher plants and borrow pits will be established in several proposed locations to obtain sand, soil and aggregates. The general method of highway construction will be mechanical, however; it will be environmentally 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. Construction activities will be carried out in piecemeal approach for the improvement of existing KDP. 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.

1.6 Construction Materials

For construction of the road and other road component, construction material (Sand, Gravel, Stone, Cement, Aggregates, Concrete, Bitumen, lumber, steel etc.) are required. Tentative quantities of major construction materials required for the project are given in **Table 1.5** below.

Table 1.5: Construction Materials Required

Material	Unit	Quantity Required	Sources
Soil	Cum	5,185,510.983	Borrow sites as mentioned in Table 1.6 .
Steel	MT	17,499.868	Procurement from Market/Industry
Aggregate	Cum	3,016,627.724	Procurement from approved quarry or as mentioned in Table 1.6 with necessary environment Permit.
Bitumen	Ton	29,952.594	Procurement from Market/Industry.
Cement	Ton	220,347.940	Procurement from Market/Industry.
Sand	Cum	187,896.742	Approved river bed extraction sites within project affected municipalities, suitable sites mentioned in Table 1.6
Water	Liters	1,923,859	Ground Water and river water where available

Source: Detailed Design Report 2023

Most of the rivers along the proposed road alignment like Kamala, Baluwa, Jaladh, Basai, Lakhandei, Bagmati and Bakaiya have plenty of construction materials (sand, aggregates and stones) that can be used for the project with consent from concerned municipality. Most of the municipalities have even conducted and approved Initial Environmental Examination (IEE) for extraction of river bed materials in sustainable way. Detailed Design Report of this project has suggested 6 different locations for base and sub base materials – Ratu Khola (26°59'54.43"N, 85°54'50.19"E), Banke Khola (27°1'10.89"N, 85°44'34.49"E), Maraha Khola (27°0'40.26"N, 85°47'38.00"E), Bagmati River (27° 7'20.95"N, 85°28'37.48"E), Bakaiya River (27°12'31.87"N, 85°10'14.01"E) and Rapti River (27°25'57.48"N, 84°59'11.23"E). Similarly, 4 different locations are suggested for embankment filling materials – Lakhandei Khola (27° 4'16.87"N, 85°34'34.27"E), Lamaha Khola (27°9'3.43"N 85°17'49.57"E), Dhansar Khola (27° 9'23.52"N, 85°14'43.78"E) and Chandi Khola (27° 7'1.07"N, 85°22'26.05"E). The location of quarry and borrow pits proposed for the project are shown in **Figure 1.8** and detailed of these quarries and borrow pit sites are given in **Table 1.6**. The probable locations for borrow have been identified and these are suitable locations for earth borrowing as there are no major environmental & social risk associated with these sites. However, guidelines for borrow and quarry area operation and closure are as follow:

- Topsoil will be excavated and preserved and re-applied for vegetation growth.
- The identified sites are probable sites; however, contractor may identify another suitable site once he will be mobilized at site. The contractor shall prepare re-development (as per the contract with land owner) plan for the borrow/quarry site and get it approved by the CSC, before the commencement of any quarry activity.
- The contractor shall restore all haul roads to their original state.
- Contractor will be responsible for enforcing all safety measures/guidelines.

- In borrow pits, the depth shall be so regulated that the sides of the excavation will have a slope not steeper than 1 vertical to 2 horizontals, from the edge of the final section of the bank. This will reduce the soil erosion impacts.
- The sites will be handed over to owner as per the contract between landowner and contractor. If landowners want these locations to be used as ponds, they may ask the contractor during agreement.

These materials will be extracted as per standards related with extraction sale and management of sand, 2077 and Forest Rule 2079 for quarries and borrow pits within forest area. Extraction of sand from seasonal rivers is unavoidable for this project. However, will be controlled to the extent possible due to the impact on complex flood hydrology, which can result in much more serious storm floods. The extraction will be spread over the longest length possible so that no section of riverbed is excessively disturbed. If the sand, gravel, aggregates are purchased/ sourced from a supplier, vendors should comply environmental statutory condition from local/provincial/federal government of Nepal



Figure 1.6: Existing Crusher Plant near Bharat Tal, Bagmati



Figure 1.7: Mound of Soil at Lakhandei River that can be used for the Project

Table 1.6: Information of Borrow Places

Name of Source		Location	Available Materials	Estimated Quantities	Remarks
Dhanusa District (Section between Kamala River to Ratu Khola)					
1	Kamala River (Chisapani)	7km U/S from Chainage 0+000 Starting point (Kamala) and 35.5Km away from Chainage 28+500 ending point (Ratu)	Sand & Natural Aggregates, Cobble	1260000 m ³	3 km Blacktop and 4km Earthen Road from Chainage 0+000 Starting point (Kamala)
2	Ratu Khola	28 km away from Chainage 0+000 Starting point (Kamala River)	Boulders, Cobbles, Sand, Sub-base, base & Embankment filling	560000 m ³	28km Blacktop and 200m Earthen Road from Chainage 0+000 Starting point (Kamala) & 101.5km Blacktop and 200m Earthen Road from Chainage 130+000 ending point (Pathlaiya)
Mahottari District (Section Between Ratu Khola to Banke Khola)					
2	Ratu Khola	200m away from Chainage 28+500 (Ratu Khola)	Boulders, Cobbles, Sand, Sub-base, base & Embankment filling	560000m ³	200m Earthen Road away from Chainage 28+500 (Ratu Khola)
3	Maraha Khola	11+400 km away from Chainage 28+500 (Ratu Khola)	Cobbles, Pebbles, Sand & Embankment filling	320000m ³	11.4km Blacktop and 500m Earthen Road away from Chainage 28+500 (Ratu Khola)
4	Banke Khola	17.48km away from Chainage 28+500 (Ratu Khola)	Boulders, Cobbles, Sand, Sub-base, base & Embankment filling	500000m ³	17.48km Blacktop and 500m Earthen Road away from Chainage 28+500 (Ratu Khola) & 84.02km Blacktop and 500m Earthen Road from Chainage 130+000 ending point (Pathlaiya)
Sarlahi District (Section Between Banke Khola to Bagmati River)					
4	Banke Khola	500m away from Chainage 45+980 (Banke Khola)	Boulders, Cobbles, Sand, Sub-base, base & Embankment filling	500000m ³	500m Earthen Road away from Chainage 45+980 (Banke Khola) & 45.98Km Blacktopped and 500m Earthen Road away from Chainage 0+000 from starting point (Kamala)
5	Lakhandei Khola	17.89Km away from Chainage 45+980 (Banke Khola)	Sand & Embankment filling	250000m ³	17.89Km Blacktop and 300m Earthen Road from Chainage 45+980 (Banke Khola)
6	Bagmati River	30.23km away from Chainage 45+980 (Banke Khola)	Boulders, Cobbles, Sand, Sub-base, base & Embankment filling	550000m ³	30.3Km Blacktop and 500m Earthen Road from Chainage 45+980 (Banke Khola) & 53.5Km Blacktop and 500m Earthen Road from Ending point (Pathlaiya)
Rautahat District (Section Between Bagmati River to Dhansar River)					
6	Bagmati River	500m away from Chainage 75+500	Boulders, Cobbles, Sand,	550000m ³	500m Earthen Road from Chainage 75+500

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Name of Source		Location	Available Materials	Estimated Quantities	Remarks
		(Bagmati River)	Sub-base, base & Embankment filling		(Bagmati River)
7	Chandi Khola	12.27Km away from Chainage 75+500 (Bagmati River)	Sand & Embankment filling	250000m ³	12.27Km Blacktop and 500m Earthen Road away from Chainage 75+500 (Bagmati River)
8	Lamaha Khola	20.90Km away from Chainage 75+500 (Bagmati River)	Sand & Embankment filling	350000m ³	20.90Km Blacktop and 500m Earthen Road away from Chainage 75+500 (Bagmati River)
9	Dhansar Khola	26.39 Km away from Chainage 75+500 (Bagmati River)	Sand & Embankment filling	300000m ³	26.39 Km Blacktop and 500m Earthen Road away from Chainage 75+500 (Bagmati River) & 26.7Km Blacktop and 300m Earthen Road from Ending point (Pathlaiya)
Bara District (Section Between Dhansar River to Pathlaiya)					
9	Dhansar Khola	300m away from Chainage 102+600 (Dhansar Khola)	Sand & Embankment filling	300000m ³	300m Earthen Road from Chainage 102+600 (Dhansar Khola)
10	Bakaiya Khola	7.79Km away from Chainage 102+600 (Dhansar Khola)	Boulders, Cobbles, Sand, Sub-base, base & Embankment filling	120000m ³	7.79Km Blacktop Road and 300m Earthen Road from Chainage 102+600 (Dhansar Khola) & 19.5 Km Blacktop and 300m Earthen Road from Ending point (Pathlaiya)
11	Rapti	33km away from Chainage 130+000 Ending point (Pathlaiya)	Boulders, Cobbles, Sand & Embankment filling	850000m ³	32.5 Km Black top and 500m Earthen Road from Ending point (Pathlaiya)

Source: Detailed Design Report 2023

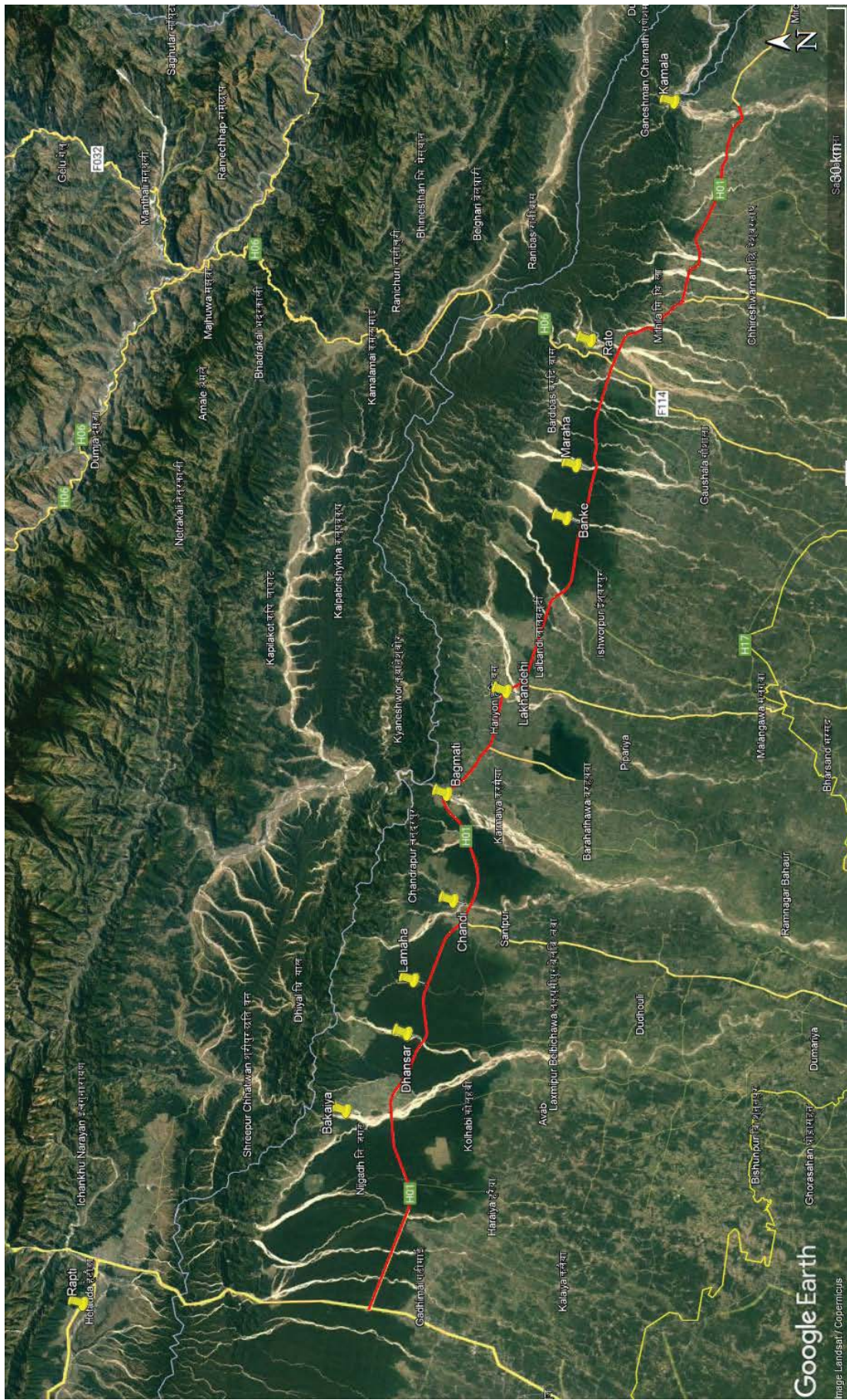


Figure 1.8: Proposed Quarry and Borrow Pits in Google Earth

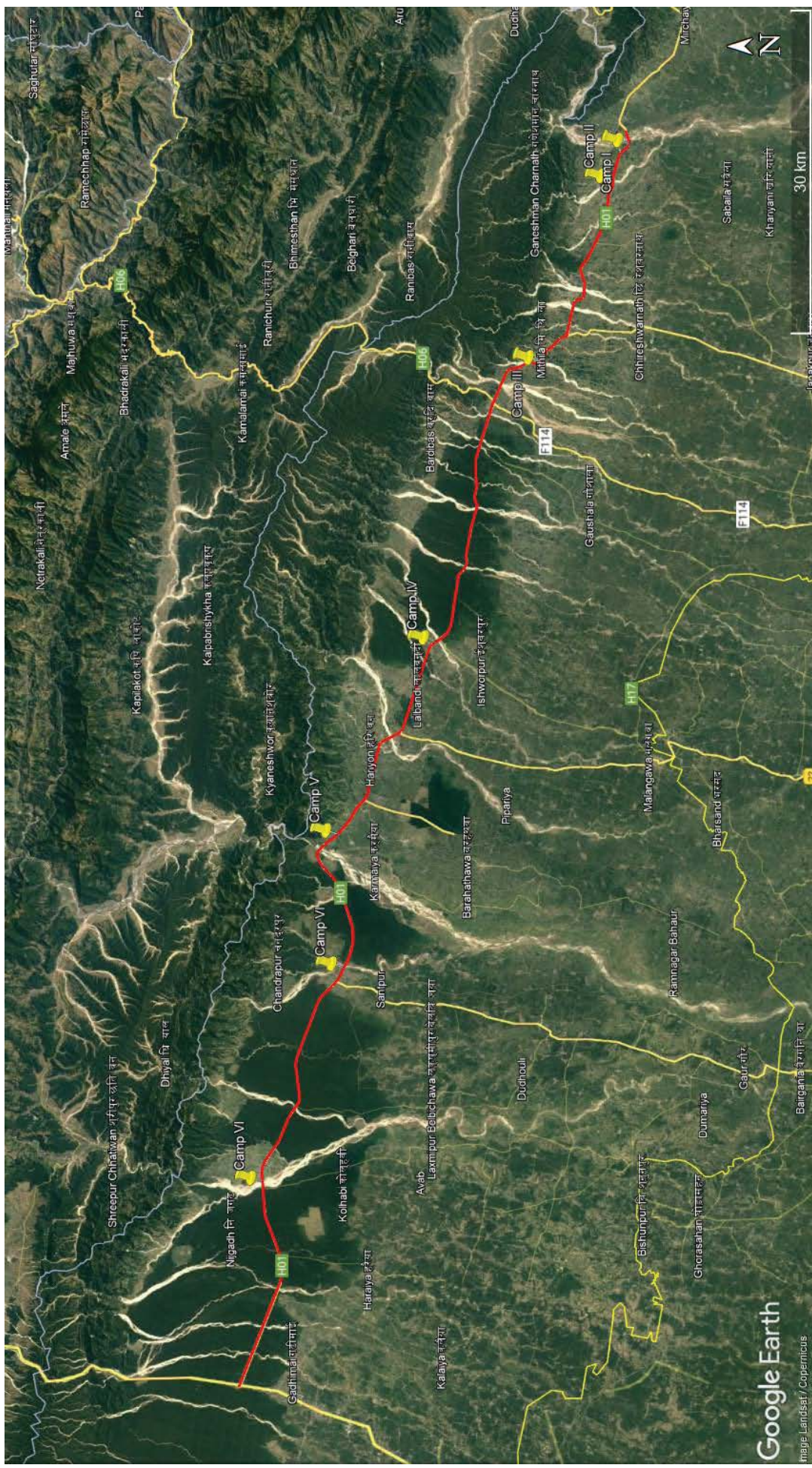


Figure 1.9: Proposed Labour Camp Locations in Google Earth

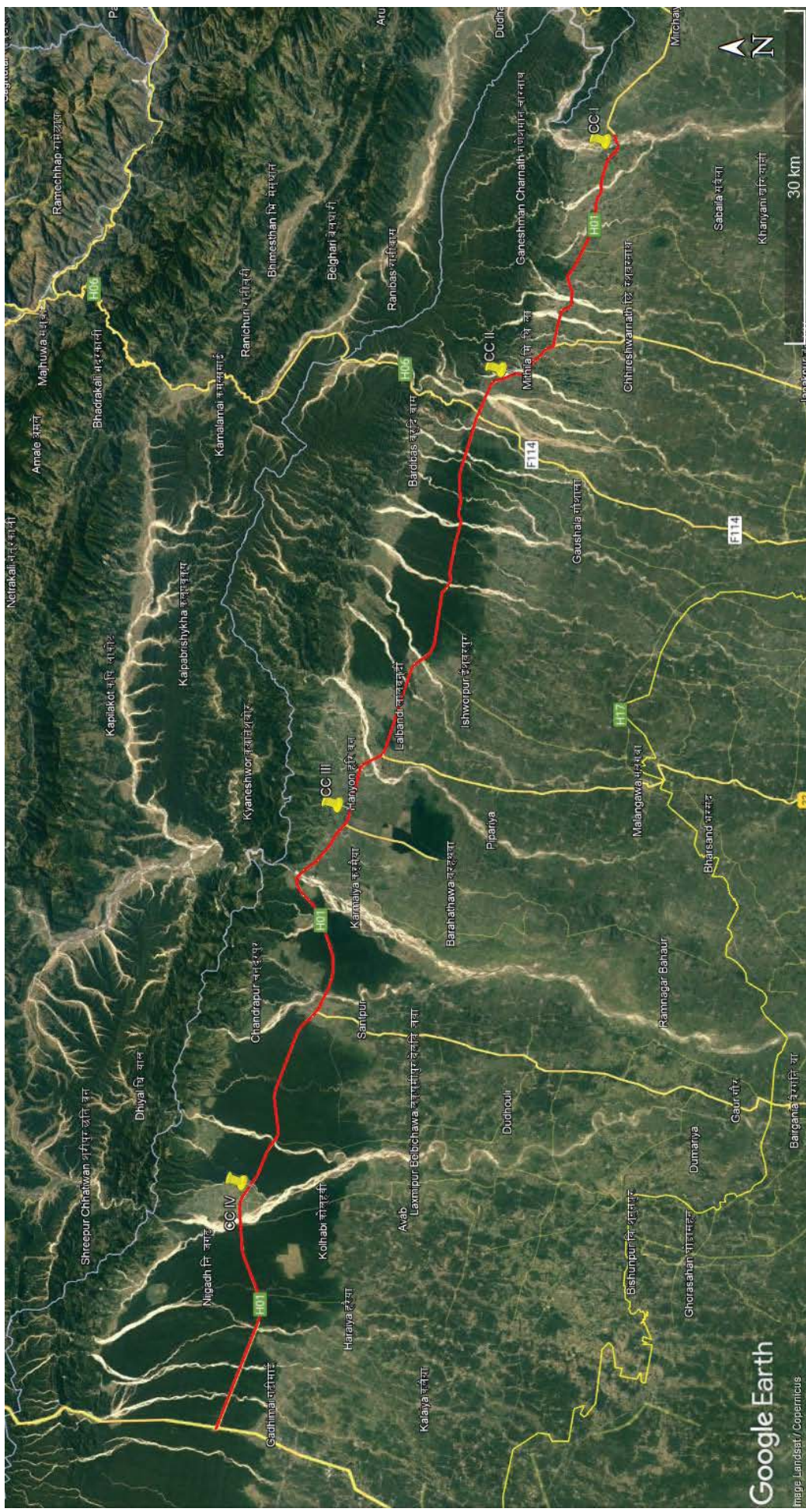


Figure 1.10: Proposed Construction Camp Locations in Google Earth

1.7 Associated/Ancillary Facilities

For the proposed project, different associated/ancillary facilities are required like labour camps, construction camps (including construction equipment storage yards, workshops, stockpiling yards, crusher plant sites, hot mix plants, batching plants etc.) and quarry and burrow pit area. For labour camps, construction equipment storage yards, workshops and stockpiling yards, agricultural lands adjoining the road alignment will be leased (possible chainages at 237+700 (26°52'34.67"N, 86° 8'2.29"E), 241+430 (26°53'26.93"N, 86° 6'2.02"E), 260+800 (26°57'4.60"N, 85°55'51.88"E), 290+500 (27° 2'17.62"N, 85°40'21.64"E), 311+000 (27° 7'6.87"N, 85°29'39.29"E), 325+100 (27° 6'50.21"N, 85°22'14.70"E) and 346+900 (27°10'48.36"N, 85°10'19.33"E)). However, the contractor should search and use barren land wherever possible. For labour camps, existing house along the road alignment can also be rented. Even for crusher plant sites, hot mix plants, batching plants, agricultural lands away from dense settlements will be leased (possible chainages at 237+400 (26°52'35.18"N, 86° 8'11.59"E), 262+000 (26°57'41.53"N, 85°55'47.90"E), 305+500 (27° 5'33.74"N, 85°32'23.89"E) and 343+600 (27°10'8.30"N, 85°12'0.66"E)). It is estimated that around 7 ha of land is required temporarily for these associated/ancillary facilities. Locations proposed for labour camps and construction camps are shown in **Figure 1.9** and **Figure 1.10** respectively. These locations have been identified as per study team's observation, distance from sensitive receptors, settlement, forest etc.

1.8 Source of Construction Water

Ground water is the main source of water that can be used for construction purpose. As per detailed design report 2023, it is noticed that the ground water depth along project alignment ranges from minimum of 1 m to 13 m. In some cases, ground water level was not available within studied bore hole depth. Ground water will be used with necessary statutory permissions from the GoN competent authorities at local level. Beside ground water, surface water can also be used by contractors if available in the vicinity of the project area but only after obtaining necessary statutory approvals.

1.9 Use of Energy and Energy Saving Measures During Project Implementation

The power requirement for construction will be approximately 2000 KVA will be made available through national grid supply and for power backups Diesel Sets will be used. 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.

1.10 Labour and Working Conditions

The proposed project will involve a large number of skilled and unskilled labours during the construction in various phases. It is estimated that around 1000 labours per day will be engaged in this road project among which there will be about 600 migrant workers from other different districts of Nepal. It is difficult to quantify the number of workers (mainly skilled ones like engineers, supervisors, lab technicians, mechanics, drivers of different machineries and equipment to be used in the project, mason, welders, etc.) at one place itself.

Occupational Health and Safety (OHS) risk is likely to be high in road construction projects. The expected risks relate to potential for injury, traffic-related accidents, fall from height, poor working and living conditions of workers, use of hazardous chemicals, handling of heavy load, long working hour, risk of radiant heat and cold, exposed to mechanical risk, electric risks, and lack of PPEs.

Also, apart from OHS risks there are social risks e.g., child labour engagement, forced labour, discrimination in employment opportunities and wage rate to the vulnerable groups or ethnic minority. However, Labour Management Procedure (LMP) is prepared for the project as a separate standalone document along with this ESIA to manage these social risks.

Specific requirements to manage or mitigate risks associated with labour influx, related to the interaction between project workers and local communities, such as communicable diseases and gender-based violence, most specifically sexual exploitation, abuse and sexual harassment, will be managed through contractual requirements, code of conduct and training set out in this document. These procedures are guided by Labour Act, 2017 and ESS2.

Detail about occupational health and safety, labour welfare and labour working condition as per GON and guidelines of WB, ESS2 are given in Labour Management Procedure (LMP) which is standalone document and also a part of ESIA in KDP project.

1.11 Construction Schedule

It is estimated that the construction of proposed road section will be completed within three years. Construction Schedule of the proposed road upgradation works is given in **Annexure 1.4**. The construction of proposed road project will be implemented through the contractors.

CHAPTER –II: LEGAL AND INSTITUTIONAL FRAMEWORK

This chapter provides an overview of the national legislation and the World Bank Environmental and Social Management Framework that are relevant to the environmental and social assessment of the subproject and actions that are taken (or to be taken) up by DOR to meet these requirements.

2.1 Legal Framework under GON

The constitution heads the legal framework and in case of Nepal, the Constitution of Nepal has covered sufficient environmental issues by providing the right of everybody to live in a clean and healthy environment. The constitution also mentions about pursuing policies to develop balanced, environment friendly, quality and sustainable physical infrastructures, while according priority to the regions lagging behind from development perspective.

National Environmental Policy 2076 targets to ensure citizens' right to live in a clean and healthy environment by pollution control, waste management and green promotion. As per this policy, the project has proposed appropriate measures for controlling pollution, waste management and compensatory as well as avenue plantation for green promotion. Similarly, design of the proposed project (mainly bridges and drainage facilities) are aligned to cope climate change risks as per National Climate Change Policy 2076.

In case of environment protection, the Environment Protection Act (EPA) 2019 is the umbrella act and ensures protection of environment of the nation. Environment Protection Rule (EPR) 2020 formed under EPA 2019 further elaborates procedures to be adopted for environment protection and punishments/fines in case of not meeting the criteria. As per schedule 3 pertaining to rule 3 of EPR 2020, EIA is required for upgradation of National Highways or Feeder Roads of more than 50 Km and this applies to the case of KDP as this section is 130 km long. This EPR also guides in conducting EIA with all the steps required to follow, data to be included, alternatives to be assessed, methods of impact assessment, process of public consultations, and approval processes.

As the project passes through forest sections and there are trees to be cut down, the project has to follow provisions as included in Forest Act and Forest Rules. Counting of affected trees due to project has been done as per this rule. Further, as per this rule, compensatory plantation in the ratio 1:10 has been proposed and cost required for plantation and care for five years will be deposited to Forest Development Fund.

Solid wastes generated due to all the project activities are to be managed as per Solid Waste Management act and its Rule. Beside this, the project also has to follow Soil and Watershed Conservation Act and its Rule, Water Resource Act etc. During excavation process, there may be chance find of ancient monuments and for this the project has to follow Ancient Monument Preservation Act.

For protection and rights of labours involved in the project, there are different acts, rules and guidelines like Labour Act and its Rule, The National Civil (Code) Act, The Sexual Harassment at Workplace (Prevention) Act etc. that the project should be aware of. Similarly, for protection of child and their miss use in the project, there are The Act Relating to Children and Child Labour (Prohibition and Regulation) Act and its Rule.

Land Acquisition Act, 1977(2034 BS) provides right to Government of Nepal to acquire land for public works by providing compensation as per the provision of clause 3 by land owners. However, no further land needs to be acquired for this project. The National Foundation for Development of Indigenous Nationalities (NFDIN) Act (2002) is a key policy initiative for the welfare and

advancement of IPs (Adivasi/ Janajati). The Act aims to conserve and develop social, economic and cultural aspects of indigenous peoples, and to enhance their equal participation in the mainstream of national development.

As the project is associated with road construction, Public Road Act is of major concern. The design and construction of the road should follow Nepal Road Standards. Beside this, for facilitating movement of wildlife across the road, mainly in forest sections, the design should adopt Wildlife Friendly Infrastructure Construction Guidelines 2078. Beside this, Green Infrastructure Design for Transport Projects, A Road Map to Protecting Asia's Wildlife Biodiversity has also been considered for identifying and designing wildlife friendly road structures.

For addressing environmental and social issues, DOR, GESU has prepared Environmental and Social Management Framework (ESMF) based on which impacts and mitigation measures associated with the proposed project are assessed. SRCTIP itself have prepared different framework and procedures like Environmental and Social Management Framework, Indigenous Peoples Planning Framework, Labour Management Procedures, Resettlement Policy Framework, Stakeholder Engagement Plan etc. for addressing environmental and social issues due to project.

Beside these, there are many general and sectoral policy, plan, acts, rules, guidelines, standards and conventions/agreements that has to be followed during planning, designing, constructing and implementing the proposed road project. Nepal is a signatory to many international treaties on biodiversity such as Rio de Janeiro Convention on Biological Diversity (CBD, 1992 A.D.), Convention on International Trade in Endangered Species of wild Fauna and Flora (CITES 1973 A.D.), The Ramsar Convention 1971. Brief review of relevant national environmental legislations including constitution, policies and plans, acts and regulations, manuals/guidelines, international conventions and treaties, and standards is provided in **Annexure 2.1**.

2.2 Environmental and Social Consideration for World Bank Funded Projects

In August 2016, the World Bank adopted a new set of environmental and social policies called the Environmental and Social Framework (ESF). The ESF consists of the World Bank's Vision for Sustainable Development; the Bank's Environmental and Social Policy for Investment Project Financing (IPF); ten Environmental and Social Standards (ESSs), which set out the requirements that apply to borrowers; the Environmental and Social Directive for IPF (which sets out requirements for Bank staff to implement the E&S Policy); and a Directive on Addressing Risks and Impacts on Disadvantaged or Vulnerable Individuals or Groups.

The purpose of the ESIA is to assess and predict potential adverse social and environmental impacts and to develop suitable mitigation measures, which are documented in an Environmental and Social Management Plan (ESMP).

The scope and depth of the ESIA depends on the nature, complexity and significance of the identified issues, as established by the ESMS screening. For a full ESIA the scope is defined by a scoping study which involves relevant stakeholders to confirm the risks identified by the ESMS screening, to set priorities for the ESIA and to determine the types of assessments required for the ESIA.

The World Bank is providing a series of Good Practice Notes (GPN) to accompany the ESF to support its implementation. This note focuses on addressing road safety on World Bank financed operations. GPNs are developed in partnership with specialists from inside and outside the Bank and are designed to be reviewed and updated periodically, when appropriate. This note should be read in conjunction with the ESF, including the Policy, the Environmental and Social Standards (ESS1-10) and the accompanying Guidance Notes for Borrowers.

The World Bank Environment and Social Framework: The World Bank Environmental and Social Framework sets out the World Bank's commitment to sustainable development, through a Bank Policy and a set of Environmental and Social Standards that are designed to support borrowers' projects, with the aim of ending extreme poverty and promoting shared prosperity.

Environment and Social Standards (ESS): Projects supported by the Bank through Investment Project Financing are required to meet the following Environmental and Social Standards:

- Environmental and Social Standard 1: Assessment and Management of Environmental and Social Risks and Impacts (applicable for assessment and management of environmental and social risks and impacts due to project including risk evaluation, identification of VECs, CIA)
- Environmental and Social Standard 2: Labour and Working Conditions (applicable for safeguarding rights of labour, assessment of risk from project activities and key labour risks such as hazardous work, child labour and forced labour, migrant or seasonal workers, discrimination against women, Gender Based Violence, assess potential for discrimination against vulnerable groups in terms of access to jobs and project-related opportunities, etc., labour influx, occupational health and safety, possible accidents and incidents on site, emergencies, among others)
- Environmental and Social Standard 3: Resource Efficiency and Pollution Prevention and Management (applicable for assessment of use of resource efficient technologies and techniques during construction and operation, calculation of greenhouse gas emissions due to project activities, assessment of construction material extraction and potential construction material sources and associated risks and impacts)
- Environmental and Social Standard 4: Community Health and Safety (applicable for assessment of potential risks and impacts of the project in relation to traffic and road safety, community exposure to STIs/AIDs, exposure to hazards that may be extended by excavations, pits, and trenches, health and safety issues etc.)
- Environmental and Social Standard 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement (applicable for assessment of risks and impacts related to physical and economic displacement due to widening of road)
- Environmental and Social Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (applicable for assessment of critical habitats, natural habitats and modified habitats, wildlife movement, loss of vegetation, forest area encroachment, forest fires etc.)
- Environmental and Social Standard 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities (applicable for assessment of indigenous people within the project area and impact on them due to project activities)
- Environmental and Social Standard 8: Cultural Heritage (applicable for assessment of cultural heritage sites and tangible and intangible cultural aspects within the project area and impact on them due to project activities)
- Environmental and Social Standard 9: Financial Intermediaries (Not applicable for this ESIA); and
- Environmental and Social Standard 10: Stakeholder Engagement and Information Disclosure (applicable for identifying different stakeholders associated with the project and engaging/involving them in different stages of the project).

The Environmental and Social Standards are designed to help borrowers to manage the risks and impacts of a project, and improve their environmental and social performance, through a risk and outcomes-based approach. The desired outcomes for the project are described in the objectives of each ESS, followed by specific requirements to help borrowers achieve these objectives through

means that are appropriate to the nature and scale of the project and proportionate to the level of environmental and social risks and impacts. In addition, World Bank Group General EHS Guidelines for Toll Roads and Construction Materials Extraction are applicable to the project.

2.3 Policy Gap Analysis between GON and WB ESS

It is noticed that the World Bank has been safeguarding environmental and social components through its Environmental and Social Standards (ESS). These ESS as discussed above are well defined and fully guide in formulating and complying mitigation measures through mitigation hierarchy. Further Cumulative Impact Assessment assists in analyzing not only the impacts due to project intervention but also interaction of project intervention with other projects in the vicinity.

In case of Government of Nepal, there are many sectoral policies dealt through different ministries and departments/institutions for safeguarding the environmental and social components. Though individually these policies well defined and are functioning properly for particular objective, due to lack of integration with each other, they are not been able to give output at most.

Table 2.1: WB ESSs and Comparison with relevant National Laws

World Bank ESS requirements		Nepal's policy framework and requirements	Gaps between ESSs and GoN & legal and policy requirements	Gap-Bridging Measures
ESS	Requirements			
ESS 1: Assessment and management of Environmental and Social Risks and Impacts	ESS 1 requires the Borrower will assess, manage and monitor the environmental and social risks and impacts of the project throughout the project life cycle so as to meet the requirements of the ESSs in a manner and within a timeframe acceptable to the Bank. The Borrower will: (a) Conduct an environmental and social assessment of the proposed project, including stakeholder engagement; (b) Undertake stakeholder engagement and disclose appropriate information in accordance with ESS10; (c) Develop an ESCP, and implement all measures and Actions set out in the legal agreement including the ESCP; and (d) Conduct monitoring and reporting on the environmental and social performance.	Environment Protection Act (EPA), 2019; Environment Protection Regulation (EPR), 2020; and National Environmental Impact Assessment Guidelines, 1993 are legal instruments for the requirements of Environmental and Social Assessment of any development projects.	The Schedules are based on activity type, threshold/size, as well as location. The potential risks associated with the project are omitted in GoN policy. No provision for associate projects/activities; large projects can be split into smaller projects to avoid full ESIA study. The EA requirement in Nepal is primarily based on project's size, location and financial threshold; irrespective of the level of potential risks. It gives total freedom to proponent to design and implement EA on their own (for example all documents including Scoping, ToR, EIA reports are prepared by proponent and approved by concerned government offices. Experiences have shown that not all projects need for EA is justified based on size, location, thresholds. 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	- ESSA is prepared in compliance, for government clearance, separate IEE or EIA will be prepared as per the standard - The ESMP to be prepared shall be made an integral part of the bidding document so that the Contractor (as for the provision of services) shall adhere to the provisions prescribed in the ESMP during the execution of the project.
ESS 2: Labour and Working Conditions	There are numbers of requirements of ESS2 under the following heading: - Working conditions and management of worker relationships; - Protecting the work force; - Grievance mechanism;	Labour Act (2017) and Labour Rules 2018; and Child Labour Act (2001) are legal instruments.	Current OHS legislation is not adequate (No separate legislation on OHS). Current OHS mandate is provided only in Chapter 12 of the Labour Act)	- Labour Management Procedures (LMPs) will be implemented in the project implementation - Sub-project specific OHS plans will be developed by the contractors

Environmental and Social Impact Assessment (ESIA) of Mahendra Highway (Kamala-Dhalkebar-Pathlaiya Section)

World Bank ESS requirements		Nepal's policy framework and requirements	Gaps between ESSs and GoN & legal and policy requirements	Gap-Bridging Measures
ESS	Requirements			
	- Occupational Health and Safety - Contracted workers; - Community workers; and; - Primary supply workers		Lack of industry-specific standards (DoLOS has so far issued only one directive: OHS Directive for Brick Workers)	
ESS 3: Resource Efficiency and Pollution Prevention and Management	The Borrower shall consider ambient conditions and apply technically and financially feasible resource efficiency and pollution prevention.	EPA (2019), EPR (2020), National Ambient Air Quality Standards (2003), Nepal Vehicle Mass Emission Standard (2012), National Ambient Sound Quality Standard (2012), Standard on Emission of Smoke in Air by New and Existing Diesel Generator (2012), National Water Quality Standard (2008), Tolerance Limits for Industrial Effluents to be discharged into Inland Surface Waters (2003), The Solid Waste Management Act (2011), Solid Waste Management Rule (2013), Water Resources Act (1992), Water Resources Rules (1993), Drinking Water Regulation (1998), Drinking Water Quality Standards	Lack of suitable enforcement mechanisms for legislation on resource use efficiency in projects	Resource efficiency and pollution prevention in any project activity will be captured in ESIA/ESMP preparation.
ESS 4: Community Health and Safety	There are numbers of requirements of ESS4 under the following headings: - Community health and safety and - Security personnel	- The EPA identifies the direct and indirect human health impact as one of the components in assessing the effect of development projects. - EPA Section 7: 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	- There is limited coverage as scope of ESIA's do not necessarily include community safety issues. - Public health legislation does not specifically impose requirements for development and infrastructure projects.	ESIA/ESMPs developed under the project will address all community health and safety issues that arise during the execution and operation of the project.

Environmental and Social Impact Assessment (ESIA) of Mahendra Highway (Kamala-Dhalkebar-Pathlaiya Section)

World Bank ESS requirements		Nepal's policy framework and requirements	Gaps between ESSs and GoN & legal and policy requirements	Gap-Bridging Measures
ESS	Requirements			
ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	There are number of requirements of ESS 5 under following headings: - General (Eligibility classification; Project design; Compensation and benefits for affected persons; Community engagement; Grievance mechanism; Planning and implementation); - Displacement (Physical displacement; Economic displacement); - Collaboration with other responsible agencies or subnational jurisdictions; and; - Technical and financial assistance.	health. Land Acquisition Act (1977) Guthi Corporation Act (1976) Land Acquisition Guidelines (1989) Land Reform Act (1964) Clause 3 of the Land Acquisition Act states that any asset that is required for public purposes shall be acquired by providing compensation. Compensation Fixation Committee shall establish the Compensation rates. Guthi Corporation Act, 2033 (1976). Section 42 of this Act states that Guthi land (religious trust land) acquired for the purpose of the development shall be replaced with other land, then compensated in cash Compensation shall be provided for loss of crop damaged and income source.	- Does not require preparation of RAP - Does not allow for PAP consultation in the compensation options - Does not allow non-cash compensation options such as land-for-land and replacement homes, only "arrangements for rehabilitation" and "priority in employment". - Valuation of lost assets considers depreciation and hence not at replacement cost - Does not make mention of compensating non-titleholders (tenants, long-term land users, encroachers and squatters).	- The project shall be required to prepare vulnerability assessment and mitigation plan for the affected people that have impacts on their livelihood after losing the land. - A Resettlement Framework is being prepared to provide guidance for any resettlement activities. - The project shall assist those who have impacts on their livelihoods due to land acquisition by the project, including tenants. - The lost assets need to be fully replaced and affected livelihoods restored. - Pragmatic livelihood assistance program shall be designed by the project. - The project shall develop alternative forms of compensation or assistance for adversely affected non-title holders, encroachers and squatters.
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	There are number of requirements of ESS 6 under the following headings: - General (Assessment of risks and impacts following a precautionary approach); - Conservation of biodiversity and habitats; - Habitats are classified as the Modified habitat; Natural habitat; and Critical habitat; - No Net Loss is achieved to mitigate the loss of natural habitats, where critical habitats are impacted, Net Gain	Aquatic Animal Protection Act (1961), National Park and Wildlife Conservation Act (1973), National Park and Wildlife Conservation Regulations (1974), Soil and Watershed Conservation Act (1982), Himalayan National Park Regulation (1979), National Trust for Nature Conservation Act (1983), Forest Act (2019), Conservation Area Management Rules (1996), Buffer Zone Management Rules (1996), Plant	- Natural habitats are not specifically required to be assessed in the EIA - Does not specifically require Biodiversity Management Plan even where biodiversity impact is found significant in the EIA	- All the provisions of relevant laws will be complied with by the project. - A separate Biodiversity Management Plan needs to be developed for project activities that have potential impacts on biodiversity and critical/natural habitats.

World Bank ESS requirements		Nepal's policy framework and requirements	Gaps between ESSs and GoN & legal and policy requirements	Gap-Bridging Measures
ESS	Requirements			
	will be demonstrated for the biodiversity values for which critical habitat is designated. - Legally protected and internationally recognized areas of high biodiversity value; - Invasive alien species; - Sustainable management of living natural resources and primary suppliers.	Protection Act (2007)		
ESS 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	There are numbers of requirements of ESS 7 under the following headings: - General (Projects designed solely to benefit indigenous peoples/Sub-Saharan African historically underserved traditional local communities; Projects where indigenous peoples/Sub-Saharan African historically underserved traditional local communities are not the sole beneficiaries; Avoidance of adverse impacts; Mitigation and development benefits; Meaningful consultation tailored to indigenous peoples/Sub-Saharan African historically underserved traditional local communities; - Circumstances requiring free, prior and informed consent, FPIC (Impacts on lands and natural resources subject to traditional ownership or under customary use or occupation; Relocation of indigenous peoples/Sub-Saharan African historically underserved traditional local communities from lands and natural	National Foundation for the Development of Indigenous Nationalities Act (2002), Local Self-Governance Act (1999), ILO Convention 169 (2007) The GoN encourages to include and consider IPLC's concerns in each development and infrastructure programs and formulate a plan or mechanism to incorporate income generation program targeted to IPLC.	- The GoN encourages development programs to incorporate income generation schemes for IPs. - The provision of FPIC and broad community support in relation to IPs is absent. Nonetheless, the GoN has ratified ILO 169 and the United Nations Declaration of Rights of Indigenous People (UNDRIP). - The GoN is in the process of preparing National Action Plan to implement these international commitments.	- An Indigenous People Development Framework (IPDF) is being prepared to provide guidance to mitigate any impacts on IPs. - The project shall seek to maximize the ability of Adivasi/ Janajati to benefit from the project by: - creating an environment for social inclusion; - enabling their participation in policy discussions and decision making; - promoting their culture, language and knowledge through different project activities.

Environmental and Social Impact Assessment (ESIA) of Mahendra Highway (Kamala-Dhalkebar-Pathlaiya Section)

World Bank ESS requirements		Nepal's policy framework and requirements	Gaps between ESSs and GoN & legal and policy requirements	Gap-Bridging Measures
ESS	Requirements			
	resources subject to traditional ownership or under customary use or occupation; Cultural heritage); Grievance mechanism; and; Indigenous peoples/Sub-Saharan African historically underserved traditional local communities and broader development planning.			
ESS 8: Cultural Heritage	There are numbers of requirements of ESS 8 under the following headings: • General • Stakeholder consultation and identification of cultural heritage (Confidentiality; Stakeholders' access); • Legally protected cultural heritage areas; • Provisions for specific types of cultural heritage (Archaeological sites and material; Built heritage; Natural features with cultural significance; Movable cultural heritage); and • Commercial use of cultural heritage	• The EPA (2019) and EPR (2020) provision that physical and cultural resources shall not be disturbed or damaged without the prior approval of concerned authority. • Ancient Monument Act (1956) have provisions on cultural heritage	• Does not include intangible cultural heritage • Does not provide for the development of Cultural Heritage Plan • 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	• The ESMF has incorporated "Chance" Finds" provisions and requirements • ESMPs to be developed under the project will aim to address any issues of cultural heritage that may be affected by the execution and operation of the project. • During the drafting stage of this ESMF, not all cultural heritage is identified and documented. However, through a Collaborative approach community will be consulted in identifying cultural heritage sites with local significance/importance and documented and follow CHP-CFP.
ESS 10: Stakeholder Engagement and Information Disclosure	There are numbers of requirements of ESS 10 under the following headings: • Engagement during project preparation (Stakeholder identification and analysis; Stakeholder Engagement Plan; Information disclosure; Meaningful consultation); • Engagement during project implementation and external reporting; \Grievance mechanism; and; • Organizational capacity and commitment	• Prevailing national policies including EPA 2019 and EPR 2020 has envisaged the stakeholder engagement at different stage of the project design and implementation. Stakeholder consultation, disclosure and grievance hearing system are provisioned.	• Does not require stakeholder analysis and preparation of stakeholder engagement plan • Does not provide for continuous stakeholder engagement/consultations beyond EIA process during construction and operation phase	• The project has prepared a Stakeholder Engagement Plan (SEP) to ensure that stakeholder engagement activities are effective and meaningful consultation is carried out including guideline for establishing a comprehensive GRM with clear, safe and accessible procedures to identify and respond to grievances, including SEA/SH, cases.

2.4 Environmental Approvals, Permits and Clearances

The environmental approval, permit and clearance are important part of the project. The **Table 2.2** below summarizes the responsible agency for environmental approval, permit and clearances to obtain for construction and implementation of the project.

Table 2.2: Responsible Agency for Environmental Approval, Permits and Clearances

E & S Reports/ Activities	Competent Authority for Approval	Time frame
ESIA	WB	Before signing of loan agreement
SD/TOR and EIA	GoN/MoFE	Prior to construction (before bidding process)
RAP	DCID-DOR/WB	Prior to construction
IPDP	DCID-DOR/WB	Prior to construction
SEP	DCID-DOR/WB	Prior to construction
LMP	DCID-DOR/WB	Prior to construction
BMP	DCID-DOR/WB	Prior to construction
Quarry/borrow operations in the river, establishing crusher plants, batching plants, labour camps, and muck disposal sites	Local Governments: Municipalities/ Rural Municipalities	Prior to construction and establishment of quarry or crushing facilities
Tree cutting	DoFSC/ DFO DNPWC/ PNP	Prior to construction

CHAPTER-III: ESIA APPROACH AND METHODOLOGY

The overall ESIA including collection of environmental and social baseline, risk and impact assessment, formulation of mitigation measures, stakeholder consultations and preparation of related plans (Environmental and Social Management Plan, Stakeholder Engagement Plan, Environmental and Social Commitment Plan etc.) are done as per the World Bank Environmental and Social Framework. The approach and methodology adopted for the assessment is described below.

3.1 Approach of the Study

The ESIA study approach is based on a clear understanding of the Terms of Reference and understanding the scope of work for Environmental and Social components of the study. The study has been carried out with close coordination with various stakeholders that is DoR, WB, KDP Design Consultant, Parsa National Park, Forest User Groups Local Representatives etc. The relevant studies carried out so far, WB guidelines and good practices, Environmental legislations and guidelines of GON, design reports prepared by design consultant has been reviewed. The data gaps were identified, and these data gaps were fulfilled by field survey, stakeholders' consultations, and primary data collection. Also, the Valued Environmental Component (VEC) and key environmental issues were identified during the study. The impacts on VEC were examined in view of proposed proposal for development. The environmental and social impacts are quantified and evaluated by using models & tools, experience in similar projects, stakeholder consultation and judgement of experts. The impacts are proposed to be avoid, minimize, mitigate and compensate with appropriate mitigation measures and management plan. Where it is not possible to avoid, minimize or mitigate the impacts, the impacts will be compensated. The mitigation hierarchy was applied for adverse environmental and social impacts and seek opportunities to enhance the positive impacts of the project. The environmental and social assessment also included stakeholder engagement as an integral part of the assessment, in accordance with ESS10. Finally, Environmental & Social management Plan has been prepared to implement the plan during construction and operation stage.

Approaches of the socio-economic and IPs study has been adopted as nature of universe population across the project impact zones. Based on stakeholder identification, a stakeholder mapping was done to determine the level of influence and interest of the stakeholders, participatory approach-Directly Involvement of Local Stakeholders, Focus Group Discussion (FGD) and Household surveys were applied as determined the scope of works. Project Affected Families (PAFs) who are known as informal settlers living within the RoW were assessed for the RAP preparation. Likewise, based on the ESA and paragraph 8 of ESS7, the ESIA has identified the presence of indigenous people (IPs) within the Direct Impact Area (DIA) of the project area and baseline information of such population were collected to analysis risk and impacts needed with specific reference as a mitigation measure to the Indigenous People Development Plan.

3.2 Delineation of Project Area

The delineation of the project area is important for identifying the potential environmental and social risks associated with the project, and for developing strategies to mitigate those risks. The process of delineating the project area typically involves consultations with stakeholders, including local communities and civil society organizations, to ensure that their concerns and perspectives are taken into account in the assessment and decision-making process.

The project affected municipalities are considered to be within the Project Influence Area or Zone of Influence (ZOI). For KDP road project, it is noticed that sixteen municipalities (including one sub-metropolitan city) from six districts viz. Karjanha Municipality from Siraha District, Ganeshman Charnath, Dhanushadham and Mithila Municipality from Dhanusa District, Bardibas and Gaushala

Municipality from Mahottari District, Lalbandi, Ishwarpur, Harion and Bagmati Municipality from Sarlahi District, Brindaban, Chandrapur and Gujara Municipality from Rautahat District and Nijgadh Municipality, Kolhabi Municipality and Jitpur Simara sub-metropolitan city from Bara District lie within ZoI. The impact area has been further categorized into following as per ToR.

3.2.1 Right of Way (ROW)

Twenty-five meters both sides from center line of the existing road proposed for widening/upgradation have been considered within ROW. As per the declaration published in Gazette in 2034 BS (1977 AD), all the land within 50 m (i.e. 25 m either side from central line of the road) is considered to be within the boundary of the road (**Annexure 3.1**).

Census survey of all the affected structures have been done within this zone. Similarly, all the trees within this zone have been counted along with species, diameter and height. Within forest of this area, consultations with respective divisional forest offices and community forestry user groups were carried out and observation of wildlife movement and their habitat has been done through direct and indirect method.

3.2.2 Direct Impact Area (DIA)

The areas within the 150 m on either side from the center of the road (300m corridor) have been considered for a larger analysis of land use and other environmental features as per TOR. This area also includes ancillary facilities required for the Project including worker camps and stockpiling yards. Air quality, noise level, water quality and soil quality have been monitored within this zone as representative locations as these areas may be contaminated due to project activities like dust, noise, spillage of chemicals, fuel, overflow of cement slurry etc. Similarly, within forest of this area, quadrat sampling and observation of wildlife movement and their habitat through direct and indirect methods have been done. For socio-economic analysis, 20% household survey through questionnaire has been done within settlements along the alignment.

3.2.3 Indirect Impact Area (IIA)

The adjacent area within 1 kilometer either side of the road alignment (2 km corridor) are considered as the Indirect Impact Area (IIA) as per TOR. In this area, physical, biological and social environment will experience induced impacts during the time of construction like impact on agricultural land, disturbance in traffic movement, disturbance to wildlife, livelihood of people depending on forest, downstream contamination of river water due to contamination of river water due to bridge construction etc. The IIA is evaluated as area of avoidance of the road by wildlife, which varies from 1,000 m for deer to 5,000 m for some larger and medium sized mammals, such as Elephants and Tigers.

Besides, indirect impacts, there will be cumulative impacts in the region due to overlapping of impacts of other projects too like disturbance in wildlife movement, more loss of forest area, impacts to adjoining community etc.

Public consultations within settlements, Focused Group Discussions (FGDs), etc. have been done in the project area for establishing the socio-economic and cultural baseline. Within forest area, general observation of vegetation and observation of wildlife movement and their habitat through direct (Directing Sightings of animals, their pugmarks, excreta etc.) and indirect methods (crossed check with consultations with different stakeholders including local residing villages, livestock grazers, forest product collectors, forest field level working personals, livestock market areas etc.) has been done.

3.3 Methodology for Collection of Physical Environment Baseline

3.3.1 Climate Data

Climate Data was collected from Department of Hydrology Meteorology (DHM). For this, precipitation (rainfall), temperature, humidity and average wind speed data from year 1985 to 2022 from DHM stations at Simara Airport (index no. 909) and Karmaiya (index no. 1121) were collected and analysed. Further, rainfall analysis, flood data, and catchment characteristics of major drainage outlets within project area have been taken from Design Report of KDP 2022. Water induced risk areas/ water logging areas, river bank cutting, ponds etc. within DIA were visually observed and recorded and consulted with local people.

3.3.2 Geology

For geological analysis of the project area, reference from geological map of Nepal (modified from Dahal 2006) and ICIMOD (rds.icimod.org) was obtained. Further, geotechnical analysis from Design Report of KDP 2022 has been referred and verified by ESIA study team during field study.

3.3.3 Seismic Hazards

For seismic data, reference from seismic zoning factor as per National Building Code (NBC 105:2020) has been collected.

3.3.4 Air Quality

For collection of baseline data of air quality, the representative location along the alignment were identified. Sampling location at Dhalkebar represents highly commercial area (including industries), Lalbandi represents commercial area, Paurahi and Dudhaura represents forest areas and Nijgadh represents mix residential area. The high-volume air sampler was used for air quality monitoring of the project area. The air sample for 24 hours collected for Particulate Matter (PM₁₀), Particulate Matter (PM_{2.5}), Total Suspended Particulate Matter (TSP), Sulphur Dioxide (SO₂) and Nitrogen Dioxide (NO₂). The samples were analysed for above said air quality parameters. These samples were collected from five locations, the sampling locations, Chainage, location coordinates and date of sampling is presented in **Table 3.1**.

Table 3.1: Sampling Locations and Date for Air and Noise Quality Monitoring

Sampling Location	Chainage	Coordinate	Sampling Date and Time
Mithila M.-06, Dhalkebar, Dhanusha	257+500	26°55'47.1" N, 85°57'25.0" E	2022/10/18-2022/10/19, 24 hrs.
Lalbandi M.-06, Lalbandi, Sarlahi	294+600	27°03'06.7" N, 85°38'14.8" E	2022/10/18-2022/10/19, 24 hrs.
Paurahi, Sarlahi	317+700	27°07'06.4" N, 85°26'39.9" E	2022/10/19-2022/10/20, 24 hrs.
Thado Lane, Nijgad, Bara	344+000	27°10'19.5" N, 85°12'06.6" E	2022/10/19-2022/10/20, 24 hrs.
Near Dudhaura River Bridge, Bara	364+000	27°11'19.1" N, 85°00'39.9" E	2022/10/20-2022/10/21, 24 hrs.



Figure 3.1: Installing High Volume Air Sampler at Dhalkebar

3.3.5 Noise Level

For collection of baseline data on noise level, Noise Level Meter (REED R8080) was used. Recording interval was set to 2 seconds. Sampling locations, dates and time were same as that of air quality monitoring. The noise data was for Leq. The Leq for 24 hours has been calculated as per following equation.

$$L_{eq} = 10 \log \sum_{i=1}^{i=n} (10)^{\frac{L_i}{10}} \times t_i$$



Figure 3.2: Noise Level Monitoring at Lalbandi

Where, Leq is the equivalent noise level for measured time (i.e. 24 hours), n is the total number of samples taken, L_i is the noise level in dBA of the i^{th} sample and t_i is fraction of total sample time.

3.3.6 Water Quality



Figure 3.3: River Water Sampling

Bakaiya River (left) and Wetland Water Samplings (right)

For water quality, samples of river water from 4 locations, drinking water from 7 locations, pond water from 1 location and wetland water from 1 location were collected and analysed in lab. Rivers and wetland are selected as per water availability and importance. Sample location for drinking

water are selected as representative locations within market centers along road alignment to identify the existing baseline scenario.

Temperature and dissolved oxygen (DO) were measured at site itself where as other parameters were analysed in lab. The analysis was done as per American Public Health Association (APHA) 23rd edition. Location, source of water and sampling date are given in **Table 3.2**.

Table 3.2: Sampling Locations and Date for Water Quality Monitoring

S.N.	Sampling Location	Coordinates	Source of Water	Sampling Date
1	Kamala River	26°52'34.62"N, 86° 8'20.55"E	Surface Water	2022/10/19
2	Dhalkebar	26°55'45.17"N, 85°57'23.62"E	Drinking Water	2022/10/19
3	Bardibas	26°59'24.17"N, 85°53'34.84"E	Drinking Water	2022/10/19
4	Ratu Khola	26°58'58.40"N, 85°54'34.21"E	Surface Water	2022/10/19
5	Lalbandi	27° 3'11.64"N, 85°38'1.27"E	Drinking Water	2022/10/19
6	Chandranighapur	27° 7'13.41"N, 85°21'22.39"E	Drinking Water	2022/10/20
7	Bagmati River	27° 7'49.29"N, 85°28'44.30"E	Surface Water	2022/10/20
8	Bagmati	27° 7'50.53"N, 85°28'59.09"E	Drinking Water	2022/10/20
9	Nijgad	27°10'49.36"N, 85°11'1.41"E	Drinking Water	2022/10/20
10	Wetland near Chandranighapur	27° 6'47.29"N, 85°22'21.65"E	Surface Water	2022/10/20
11	Pond near Chandranighapur	27° 8'5.17"N, 85°20'27.25"E	Surface Water	2022/10/20
12	Bakaiya River	27°10'37.46"N, 85°10'19.51"E	Surface Water	2022/10/20
13	Pathlaiya	27°11'56.94"N, 84°58'55.85"E	Drinking Water	2022/10/21

Beside these, discharge data/flows in rivers/ stream/ floods, quantity of waters, water bodies/ wetlands, surface water flows, drainages, etc. were collected from design report, field level observation and consultations with local people. Similarly, water induced disaster risk areas mainly areas prone to flooding, riverbank cuttings and waterlogging were identified through visual observation and consultation with local people.

3.3.7 Soil Quality

For soil quality, soil samples from 5 different locations (agricultural lands) were collected and analysed in lab (parameters like pH, moisture content, Soil organic matter, Nitrogen, Phosphorous, Potassium, Sodium and oil and grease) to establish baseline scenario for agricultural land so that whether construction activities have contaminated these agricultural lands can be compared.

Sampling locations, chainages and sampling dates are given in **Table 3.3**. These locations are selected as representative locations to represent agricultural land quality throughout the road alignment.



Figure 3.4: Soil Sampling from agricultural land near Kamala River

Table 3.3: Sampling Locations and Date for Soil Quality Monitoring

S.N.	Location	Chainage	Sampling Date
1	Near Kamala River	241+000	2022/10/19
2	Bardibas	266+000	2022/10/19
3	Raniganj	291+000	2022/10/19

S.N.	Location	Chainage	Sampling Date
4	Bagmati	311+000	2022/10/19
5	Nijgadh	344+000	2022/10/20

3.3.8 Existing Road Condition

Existing road condition, road embankment, drainage and cross drainage structures, river protection structures, etc. were observed and their adequacy was discussed with local people. Further, issues regarding water logging and flood at different places, need of extra river protection works, aggregating and degrading rivers including sedimentation load, requirement for animal crossings etc. were discussed with design team.

3.3.9 Green House Gas Emissions Calculations

The GHG emission calculation from construction phase has been done considering the material quantities required for the proposed KDP road. The major materials required for construction are Soil, Aggregate, Bitumen, Cement and Steel etc. was estimated based on detailed design report. Further fuel required during construction was also estimated that can contribute to GHG emission. The emission factors as per “Guidelines for estimating greenhouse gas emissions of Asian Development Bank projects: Additional guidance for transport projects” was used for calculating GHG emission. Beside this, decrease in CO₂ absorption due to loss of trees for upgradation of proposed road alignment is calculated as per the “Arbor Day Foundation” (Source: USDA)³.

The GHG Emission estimation for operation phase has been conducted using different variables i.e. Traffic data forecasting, vehicle type, fuel used & efficiency, vehicle speeds, Road condition etc. The Emission factor is considered from “IPCC Guidelines for National Greenhouse Gas Inventories”. The emission factors assume that 100 percent of the carbon present in fuel is oxidized during or immediately following the combustion process (for all fuel types in all vehicles) irrespective of whether the CO₂ has been emitted as CO₂, CH₄, CO or Non-Methane Volatile Organic Compounds (NMVOC) or as particulate matter.

3.4 Methodology for Collection of Biological Environment Baseline

A team of international, national biodiversity experts, field level surveyors and assistants were involved in the bio-diversity study and covered various seasons for collection of baseline data on wildlife. Following are the survey dates:

1. January 25-27, 2022
2. February 07-14, 2023
3. May 31- June 05, 2023
4. January 3-4, 2024

Methodology adopted for collection of baseline information is formulated based on ESS6 Biodiversity Conservation and Sustainable Management of Living Natural Resources and studies conducted by World bank were also referred.

³ Source: U.S. Department of Agriculture (USDA) referred from website
<https://www.usda.gov/media/blog/2015/03/17/power-one-tree-very-air-we-breathe>

3.4.1 Desktop Review

The project site location and immediate surroundings were studied as per the IUCN listed threatened species (Critically Endangered-CR, Endangered-EN and Vulnerable-VU) (CR, EN, and VU Species). Databases such as iBAT (Integrated Biodiversity Assessment tools), and range distribution maps were reviewed from IUCN Red list, crowd sourcing platforms such as eBIRD⁴ (online database of bird observations providing real-time data and analysis of bird distribution and abundance), and Important Bird IBA⁵ to understand the presence and absence of the potential Critical Habitat (CH) trigger species and their habitat values.

Literature were reviewed such as existing environmental studies, scientific literature published by research and academic institutes or other types of biodiversity assessments available for the project area and/or adjacent areas, national or regional plans (e.g., Strategic Environmental Assessments, National Biodiversity Strategies and Action Plans, management plans, Wildlife Management Plans if any, for the protected area and the Key Biodiversity Area within the area of influence & existing conservation programs or initiatives by Forest/Wildlife Department.

Identification of an Area of Analysis (AoA) for the determination of critical habitat: The AoA includes the project's area of influence as well as the surrounding ecological boundary that considers the extent of biodiversity values and where such values may be negatively impacted by project activities within the broader landscape.

Review outcomes of stakeholder engagement conducted to date and identify additional stakeholders associated with the area of interest and potential biodiversity values.

Develop a list of candidate critical habitat values. In tabular form, present for each candidate biodiversity value details on:

- Key information sources (e.g. IUCN Red List, expert sources);
- Rationale on potential to trigger critical habitat criteria, where rationale exists for inclusion in further assessment;
- Key information needs for biodiversity values where rationale and potential to trigger critical habitat criteria exists but existing data is inadequate to confirm status.
- Protected and internationally recognized areas
- International conventions like World Network of Biosphere Reserves, the Ramsar List of Wetlands of International Importance, and the United Nations Educational, Scientific, and Cultural Organization's world natural heritage sites.

⁴<https://ebird.org/home>

⁵<https://www.birdlife.org/projects/ibas-mapping-most-important-places/>

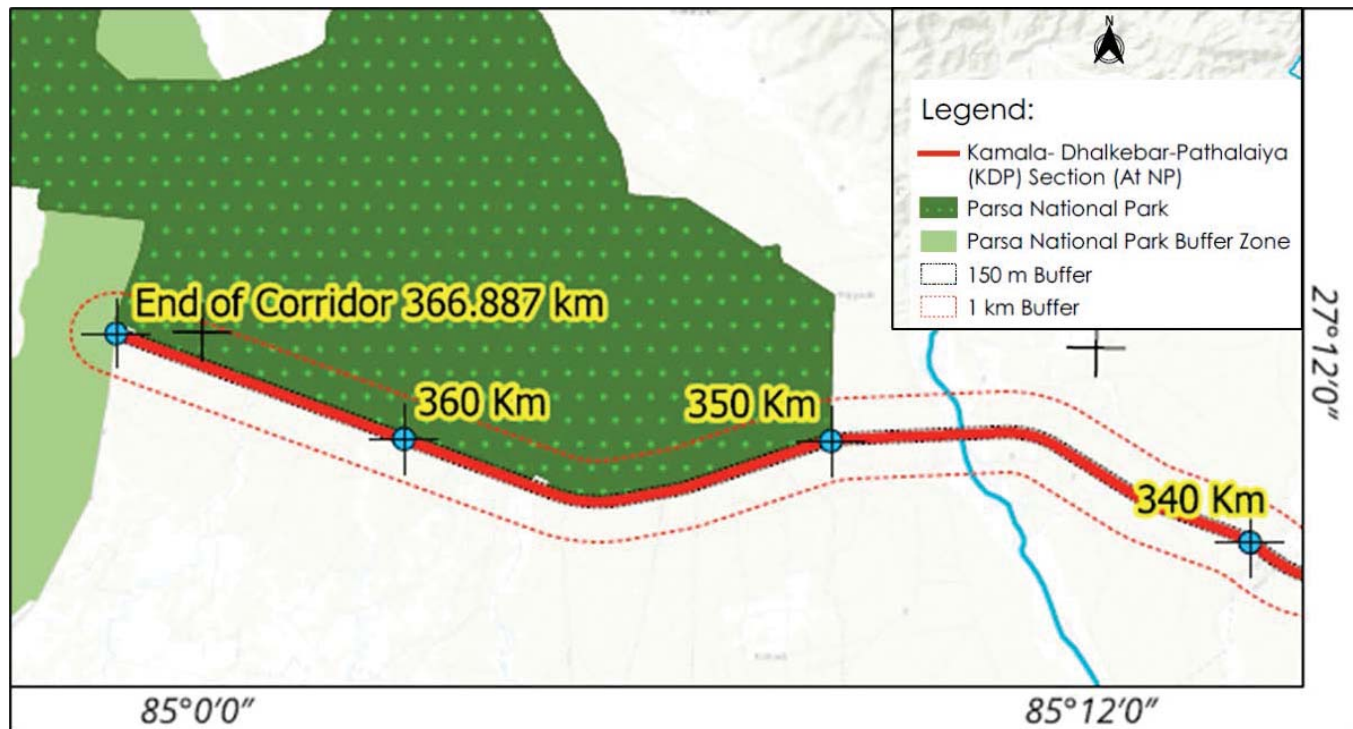


Figure 3.5: AoA of the Project Area

3.4.2 Stakeholder Consultation

Consultation with stakeholders such as Local/Tribal dwellers; NGO organization working on Wildlife, Environment & Social aspects; District Forest Officer (DFO); Chief Wildlife Warden were carried out and consultation details are given in Chapter 4.



Figure 3.6: Consultation with Forest Authorities 1) With Warden of Parsa National Park 2) With DFO Rautahat

3.4.3 Walk Through Observation

The biological team of the consultant walked through the road alignment and forest area within ROW, DIA and IIA observing vegetation and wildlife and recorded site observation. Surveys were conducted between 25 to 27th January 2022, 31st May to 5th June & February 7th to 14th 2023. Field level assistants and surveyor were mobilized for field work and survey during the month of May and June.



Figure 3.7: Walkthrough Observation on the Project Road Near Parsa National Park Ch 361

3.4.4 Transect Survey

To assess the faunal presence in the project area, standard line transect method was adapted. In this method, the transect lines were chosen randomly perpendicular with the road axis. The length of the transect lines dependent on the habitat and the terrain. Randomly selected alternate transects has been made on both sides of the road.

3.4.5 Primary Evidence for Elephant, Tiger Presence

Collected presence absence signs of elephants viz. footprint, conflict sign, dung signs and another feeding signs to know the habitat use. We had collected information on individual numbers, pattern of movement and prominent locations of active movement, crucial road crossings along the project road. Stake holder consultations were conducted with forest department starting from higher official to ground level working staff, consultations were made in the conflict villages & local forest dwellers. Photographs were collected from Forest and local people which was documented during the active road crossing period.

3.4.6 Bridges and Culvert Survey

Bridges and culverts, especially near the Parsa National Park and community and collaborative forest area were identify whether these are used by wild animals to cross the existing KDP road. These Bridges and culverts are normally located to mainly serve the hydrological functions and were never intended for utilization by the animals, however large and small animals (mammals, reptiles & amphibians) were using this bridges and culverts for road crossings. Foot Impression were collected all across the river crossings and culverts selected based on the site visit to cross check and confirm that whether the existing culverts are being used by wild life. Following photographs are at bridge across the Dhansar river and Pasaha river.



Figure 3.8: Bridge and Culvert Survey along the Project Road: a) 337+700 b)Ch 353+300

3.4.7 Nocturnal Survey

On alternate days, nocturnal surveys were conducted along the road (328+ 000 to 343+550 and 347+000 to 366+000) to identify the presence of nocturnal species in the study area in general, as well as to study the movements of various faunal species at night. In the study section, the entire study stretch was monitored at different times between 7 PM in the evening and 5 AM in the morning. Alternate days were used for the study. All encounters in the study area were also recorded in a general checklist.



Figure 3.9: Nocturnal Survey along the Project Road near Ch 364+100

3.4.8 Road Kill/Man-Animal Conflict Surveys

No major road-kills were recorded during day and night surveys. As per the literature, in January 2021 a Tiger was killed on Pathlaiya-Hetauda section of East-West Highway which is 20 km from the KDP road section. In addition to these observations, the views of local people, police, traffic police, local ward officials and forest department regarding man-animal conflicts in the project influence area has been recorded through consultation. Survey was conducted between 25 to 27th January 2022, 31st May to 5th June & February 7th to 14th 2023.

Road kills near the Parsa national park are contributed by two highways namely Tribhuvan Highway and East-West Highway. The Pathlaiya-Amlekhgunj road section (Tribhuvan Highway) has the highest number of accidents and following are the road kill data reported near Parsa National Park.

- Year 2018-19 42 Road kills
- Year 2017-18 36 Road kills
- Year 2016-17 24 Road kills

Road kills of wild animals include Spotted deer, blue bull, wild boar and jackal, among other wild animals, are killed in accidents every year, as per the record of the park.

<https://kathmandupost.com/climate-environment/2019/08/09/wildlife-deaths-by-road-accidents-on-the-rise-in-parisa-national-park>

3.4.9 Tree Census

All the trees within ROW were counted and recorded along with coordinates, height and girth. Coordinates were measured through hand Global Positioning System (GPS) device whereas tree height were measured through clinometer and girth through measuring tape (at breast height).



Figure 3.10: Tree Census along the Project Road

3.4.10 Quadrat Survey

For vegetation analysis, all together 41 quadrats of size 10x10 were laid down adjacent to the road corridor. For quadrat sample locations, wildlife sensitive locations as per Biodiversity Assessment of East-West Highway and Bridges, Nepal (Kakarbhitta- Pathlaiya Section), 2017, SRDP, WWF, The World Bank and Environmental and Social Assessment (ESA) Report, 2020, Kakarbhitta – Pathlaiya Road Corridor, including Kamala -Dhalkebar – Pathlaiya Road Segment, of East West (Mahendra) Highway (MRM), SRCTIP, DCID, DoR, MoPIT were considered. The quadrate survey locations are shown below.



Figure 3.11: Quadrate and Transect Survey Locations along the Project Road



Figure 3.12: Quadrats Survey along the Project Road

3.4.11 Mammal Survey

Collected presence absence signs of elephants viz. footprint, conflict sign, dung signs and another feeding signs to know the habitat use. We had collected information on individual numbers, pattern of movement and prominent locations of active movement, crucial road crossings along the project road. Stakeholder consultations were conducted with forest department starting from higher official to ground level working staffs, consultations were made in the conflict villages & local forest dwellers. Photographs were collected from Forest and local people which was documented during the active road crossing period.

Visual observation of mammals both by eye and using 10x binoculars; registration of field signs of wild mammals, including animal tracks, faeces, digging, burrows, dead animals, etc. and photographing the animals, their tracks and traces of their vital activity, typical habitats facilitated by geotagged photographs with GPS enabled camera SONY DSC-HX300 were done.

3.4.12 Reptile and Amphibian Survey

Attempts were made to assess the status of reptiles and amphibians in the study area (specification of the species, territorial distribution, including places of concentration, the state of habitats). The field survey conducted a mix of stationary point surveys and transect surveys which were focused on representative habitats across the proposed Project area.

3.4.13 Approach to Critical Habitat Assessment

ESS6 provides the following five criteria for recognizing critical habitat:

- (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;
- (b) Habitat of significant importance to endemic or restricted range species;
- (c) Habitat supporting globally or nationally significant concentrations of migratory or congregatory species;
- (d) Highly threatened or unique ecosystems;
- (e) Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).

For critical habitat screening and assessment of the above criteria, Parsa National Park, Tiger movement zones were identified as per Nepal Tiger Census 2022 and as well as primary evidence

during the survey. Elephant corridors were identified based on the scientific publications, evidence during the survey and consultations with forest department, NGOs and local people.

3.4.14 Delineation of Area of Analysis (AoA)

To assess critical habitat, an area of analysis is required. These boundaries may include catchments, large rivers, or geological features. Area of analysis to assess the applicability of the critical habitat criteria and thresholds to determine critical habitat for the species and/or ecosystems concerned. In all cases, the critical habitat assessment considers the distribution and connectivity of such features in the landscape and the ecological processes that support them.

Accordingly, considered the project area, Protected areas and its surroundings which are known to be habitat of IUCN listed Threatened (critically endangered CR, endangered EN and Vulnerable VU) species as AoA. Following VECs were considered for AoA.

Table 3.4: Valued Environmental Components (VECs) to be Mapped

S. No.	Valued Environmental Components	Description
1.	Terrestrial & Tree Cover	Vegetation cover, no of tree falling in proposed sub project area
2.	Wetland and Aquatic ecosystems	Typology of water body (pond/lake etc.) in immediate influence area sub project sites. Study of Flood level on/ nearby to sub project region. Width of river/stream etc. intercepting the project site.
3.	Environmentally Sensitive Areas	National park and other biodiversity areas passing along, offset or within the proposed sub project, Wildlife crossings and other associated development interventions.

This assessment of critical habitat follows an approach developed by the World Bank in 2022 for interpretation of ESS6 critical habitat criteria to determine if the habitat has significant importance for species or the ecosystem. The assessment is conducted in four steps:

Step 1 involves compiling lists of Critically Endangered (CR), Endangered (EN) and Restricted Range (RR) species based on global and national data.

Step 2 involves screening these species based on their likelihood of occurrence.

Step 3 determines if the reduced list of species qualify as critical habitat features with occurrence of unique ecosystems and ecological functions also assessed. The following six guidelines are provided to facilitate the interpretation of the ESS6 critical habitat criteria:

- (i) Recognized areas of high biodiversity value (such as legally protected areas, Key Biodiversity Areas, Important Bird Areas, Alliance for Zero Extinction (AZE) sites, Ramsar Wetlands of International Importance and World Heritage Natural Sites) and importantly the reasons for which they are designated can provide useful indicators of potential critical habitat. A review of protected areas data should therefore be included into an assessment of critical habitat.
- (ii) ESS6 Criterion (a) requires an assessment against both global (IUCN) and national red list ratings. ESS6 footnote 13 states that where the threatened status of a species is listed differently on the (global) IUCN Red List and national/regional lists, assessment of the impact of net reduction should be based on the national/regional population. This is interpreted as a requirement to follow a precautionary approach and to prioritize assessment of species reduction (project impact) to the lesser population of a species (i.e. the national assessment) over the global assessment.

- (iii) By definition, Critically Endangered (CR) species face an extremely high risk of extinction and their continued survival in the wild is in a critical state. Therefore, if a surviving population of a CR species is present in the critical habitat AoA, the habitat should be considered to have significant importance for the species under ESS6 Criterion (a).
- (iv) Where a significant proportion of the national, regional or global population of a species has a likely presence within the AoA, the habitat is considered to have significant importance for the species under ESS6 Criterion (a), (b) or (c). Presence (or likely presence) of $\pm 1\%$ of the global or national population within the AoA is considered significant for this CHA.
- (v) ESS6 Criterion (b) can additionally be achieved for range-restricted species where the full extent of the critical habitat AoA overlaps a significant proportion ($\pm 1\%$) of a species' distribution range.
- (vi) ESS6 Criteria (d) and (e) are to be assessed on a case-by-case basis using specialist input and reliable data sources with consideration given to the presence of conservation initiatives, legally protected areas and internationally or regionally recognized areas of high biodiversity value and the reasons for which they are designated.

Step 4 investigates requirements for net gain⁶, and if such outcomes are feasible.

Where critical habitats are adversely impacted by a project ESS6 requires net gain to be demonstrated for the biodiversity features for which the critical habitat is designated.

3.4.15 Prominent Wildlife Crossings

Direct and indirect count method have been used to estimate wildlife road crossings for elephant, tiger and ungulates. Elephants along the project road have been counted integrating both direct and indirect evidence. Indirect evidence was crossed check with consultations with different stakeholders including local residing villages, livestock grazers, forest product collectors, forest field level working personals, livestock market areas etc. Photographs and videos of each individual evidence were captured. Further, photographs were collected from National Park, Forest Divisions and local grazers where elephant movement was close to the project road. Presence absence signs of elephants viz. footprint, tree breach, conflict sign, dung signs and another fee ding sign were collected to know the habitat use along the river crossings, causeway bridges and important road crossing section near the settlements. QGIS was used to prepare distribution map based on direct evidence to prepare habitat suitability and habitat use map of Asian elephant, tiger & ungulates in the study area.

Further, ADB Guidelines on Design of Roads in Biodiversity Rich Area of Asia 2019 and other GIIP and Nepal Guideline for construction of wildlife friendly linear infrastructure have also been considered for assessing wildlife crossings.

3.4.16 Analysis of Modified and Natural Habitats

Classification, Mapping and characterization of Modified and Natural Habitats: Undertake secondary & desktop analysis of available data to understand the habitat types in the entire project influence area (PIA) which is 50 m & the Corridor of Impact (COI) which is 300 m and Indirect impact of 2 km. In order to differentiate between the two habitats, ESS6 guidance note and technical manual was referred.

⁶Where critical habitats are adversely impacted by a project ESS6 requires net gain to be demonstrated for the biodiversity features for which the critical habitat is designated.

Prepared a map by demarcate the modified and natural habitats within the PIA in general & COI in particular in the map and included in BMP report.

3.4.17 Addressing NNL and Net Gain Issues

NNL or preferably Net Gain needs to be demonstrated where project activities result in residual impacts to natural habitats. The ESIA undertaken the following approaches to identify NNL.

- Quantify the loss of natural habitat due to the project interventions
- Mitigation hierarchy shall be applied to first avoid, minimize and mitigate
- Compensation of trees that are to be felled for the project, in a ratio that is in synchronization as per Environment Protection Rule (EPR), 2020, Government of Nepal were proposed.
- Native, non-invasive tree species as per suggestions of the forest and wildlife authorities will be selected for restoration of natural habitats.
- Based on the quantified loss, species-specific actions may also be suggested after due consultations with the stakeholders
- Indicators have been listed in the ESMP / BMP for measuring the NNL/Net Gain along with monitoring programs, & awareness programs IBAT Screening

Further for wildlife analysis within project area, list of species found within 50 km buffer from the proposed road alignment was generated through IBAT and screened as per secondary literatures, consultations and field verification.

The project's mitigation strategy needs to be designed to achieve net gains of those biodiversity values for which the critical habitat is assessed.

3.5 Methodology for Collection of Socio-economic and Cultural Environment Baseline

Methodology applied for data collection on socio-economic and cultural environment for existing baseline condition are document review, sampled household survey, focused group discussion (FGD) and key informant interview (KII) as described here under.

3.5.1 Reports/Documents Reviewed

The study team has reviewed following reports/documents for designing baseline survey formats, checklists and survey tools:

- Appraisal Environmental and Social Review Summary, Appraisal Stage, (ESRS Appraisal Stage), SRCTIP 2020, The World Bank.
- Environment and Social Impact Assessment (ESIA), 2020, Improvement of Nagdhunga-Naubise-Mugling (NNM) Road, SRCTIP, DCID, DoR, MoPIT
- Environmental and Social Assessment (ESA) Report, 2020, Kakarbhitta – Pathlaiya Road Corridor, including Kamala -Dhalkebar – Pathlaiya Road Segment, of East West (Mahendra) Highway, SRCTIP, DCID, DoR, MoPIT
- Environmental and Social Impact Assessment, 2022, Upgrading of Butwal-Gorusinghe Road Section of East-West Highway, Accelerating Transport and Trade Connectivity in Eastern South Asia (ACCESS) – Nepal Multi-Phase Programmatic Approach (MPA) Project Phase 1, DoR
- Good Practice Handbook, Assessment and Management: Guidance for the Private Sector in Emerging Markets, IFC
- IFC Policy on Environmental and Social Sustainability, IFC 2012
- Labour Management Procedures (LMP), 2020, SRCTIP, DCID, DOR, MoPIT

- Labour Management Procedures (LMP), 2020, SRCTIP, Trade Facilitation Component, MoICS and MoALD
- Stakeholder Engagement Plan (SEP), 2020, SRCTIP, DCID, DoR, MoPIT
- The World Bank Environmental and Social Framework, 2017, The World Bank
- Feasibility Study Report of Kamala-Dhalkebar-Pathlaiya Section (130 km) of East West (Mahendra) Highway and Bridges/ DoR, Jan 2020
- Websites of the project affected municipalities.

3.5.2 Household Survey

To assess the socio-economic status of households within the project area, sampled household survey was carried out within the direct impact zone (DIA) of the project area. For this, households within DIA were divided into seventy-one clusters as per the settlement pattern. All the households within these clusters were considered as universe.

As per Krejcie & Morgan⁷, following formula can be used for determining sampling size for household survey.

$$S = \frac{X^2 NP (1 - P)}{d^2 (N - 1) + X^2 P (1 - P)}$$

Where,

S= required sample size

N= the given population size = 4290

P= prevalence = 50%

d= the degree of accuracy = 0.05

x²= 3.841 for the 0.95 confidence level

Applying the above formula for population size of 4290 households, the sampling size will be just 353 (8.22%). However, as per the TOR, 20% sample size, i.e. 858 is considered for this study.

All major settlements/clusters within DIA were identified and HHs within these settlements were listed as universe. All together there were 4,290 households within the universe or DIA. Thus, the proposed 20 percent it is noticed that 10 percent sampling size is sufficient for representative household survey. To meet 20 percent sample size, one HH among five HHs was selected. For this, first sample unit (HH) was selected by using lottery method in each settlement after which other sample unit/households were chosen in a regular interval of 5 from the list. Altogether, 858 HHs were selected as sampled HHs for survey as shown in **Table 3.5**.

Table 3.5: Detail Information about the Universe and Sample Households

SN	District	Municipality	Universe for sample survey (No of HHs in the sample area)	Sample taken for survey (20% HHs of Universe)
1	Dhanusha	GaneshmanCharnath	465	93
2		Dhanushadham	320	64
3		Mithila	985	197
4	Mahottari	Bardibas	405	81
5	Sarlahi	Lalbandi	765	153
6		Ishworpur	70	14

⁷ Krejcie, R.V. & Morgan, D.W. (1970). Determining sample size for research activities. Educational & Psychological Measurement. 30, 607-610.

SN	District	Municipality	Universe for sample survey (No of HHs in the sample area)	Sample taken for survey (20% HHs of Universe)
7		Harion	330	66
8		Bagmati	155	31
9	Rautahat	Chandrapur	350	70
10	Bara	Nijgadh	325	65
11		Jeetpursimara	120	24
	Total		4,290	858

Source: Field survey 2022

The selected household was interviewed using structured questionnaire to collect socio-economic data/information at household level. Both qualitative and quantitative data/information was collected for baseline condition and likely impact assessment.

Within these sampled/selected 858 households, the household heads or available member were interviewed using structured questionnaire (**Annexure 3.2**). The collected data were compiled and analysed using data analysis application software called Ms-Access and STATA. All the hard copies of filled questionnaires were coded and converted into digital data through the data entry application developed in Ms-Access software. After completion of data entry, data cleaning work was performed in Ms-Access by using SQL queries tools. Outlier data were removed/cleaned. After data cleaning, data were converted into STATA format for data analysis, where all the variables were decoded and levelled as per STATA. The outcomes or result were then tabulated in excel format with frequencies and percent for reporting. In addition to household survey, FGD and KII were conducted to supplement and triangulate the findings.

3.5.3 Focused Group Discussions

Forty-six numbers of Focused Group Discussions (FGD) were conducted with various mixed groups of stakeholders within DIA and IIA. The FGD participants were identified and involved in the discussions to collect the required information to prepare the baseline report as per approved ToR of ESIA. Prior to FGD events, facilitators coordinated with the project affected Ward Offices for planning, selection and invitation of the FGD participants. The FGD participants were selected from the concern stakeholders representing local government/ward, local leaders, teachers, businessman, health workers, farmers, media person, local NGOs/CBOs, women groups, forest user groups, social workers, senior citizen and general peoples. After selection of FGD participants, the date, time and venue were decided. Then the participants were informed and invited through telephone calls. The facilitators managed sitting arrangements and refreshment before the FGD event starts. The facilitators started the event by introducing and briefing about the KDP and objectives of FGD event. The informed consent for voluntary participation was taken from the participants prior to conducting the actual discussion on issues specified in the FGD checklist (**Annexure 3.3**). Attendance of the participants was recorded. All the participants were encouraged to share their view actively in the discussion. The outcomes of the discussions were noted by the facilitators. The FGD guidelines were developed to capture the local issues, likely impacts, mitigation measures and aspiration about the KDP Project. The outcome of the FGD were listed in matrix form for content analysis, which is attached in **Annexure 3.4**. The outcome of the FGD are triangulated in respective chapters.



Figure 3.13: Conducting FGD at Nijgadh

3.5.4 Key Informant Interview

Key Informant Interviews (KII) were conducted to collect the first-hand knowledge and information which can provide in-depth insight on the socio-economic situation of KDP alignment by meeting them personally using standard checklist developed by the experts. Concern key persons/ informants within the project area (e.g., mayor, ward chair, local leaders, government officers, school teachers, CBO/NGO representatives etc.) were selected, consulted in coordination with the project affected Wards. The field surveyors contacted and visited the key informants on scheduled time and venue for interview. Interview was conducted on the basis of KII Checklist attached in **Annexure 3.5**. Altogether, 44 KIIs were conducted within the DIA and IIA of the KDP road alignment. The project specific concern, issues and suggestions were collected from the KII participants, and the findings have been incorporated in appropriate chapters of the report. The detail information of KII participants and outcome is presented in **Annexure 3.6**.

3.5.5 Public Hearing/Consultation

Public hearing/consultation at 11 different locations (7 public hearing for EIA, 3 consultations for ESIA, and 1 consultation for biodiversity assessment) were conducted within the project area to collect comments and suggestions/feedback from the stakeholders including local people, users' groups, local representatives, NGOs, Shopkeepers, police/traffic police, women representatives, forest/wildlife representatives, school teachers, officials from water & electricity department, Irrigation department, and revenue department etc. The notice stating date, time and venue for public hearing was pasted in ward offices, municipal offices and other public places and same was published in National Daily Newspaper. Letters were sent to concern stakeholders requesting their presence in public hearing/consultation and further follow-up through phone conversation to ensure their presence during consultation. For other consultations (ESIA and BMP consultations) also, letters were sent to concern stakeholders and further follow-up was done through personally and phone conversation.

3.5.6 Census survey of Affected HHs

A chainage-wise inventory of loss (IoL) assessment of the affected assets was carried out to establish an inventory of assets to determine the project affected households who will be eligible for compensation. A census HH survey was conducted with the identified affected households within the RoW. Altogether 66 affected structures of 64 HHs were identified for census household survey. Moreover, 216 public and community structures which were distributed within the RoW were also assessed and cost calculation for the relocation and rehabilitation was determined. The compensation will be decided or calculated based on entitlement framework provided in chapter 6 of the RAP report.

3.5.7 Risk and Impact Assessment and Mitigation Measures

Based on field visit observation, consultation meeting with local, analysis of baseline data, cases from similar projects and expert judgement, risks and impacts that may trigger due to project intervention were identified and categorized into high, substantial, moderate and low based on WB ESF. The risk and impact were assessed based on matrix method by setting values and multiplying probability of impact with severity of impact. Severity of impact were categorized as per whether impacts could be controlled or would commonly result in less minor injury or damage; whether impact causes severe injury or major damage or whether impact causes fatal incident or major system loss. Probability of impact were categorized as per less likely to occur, occasional (likely to occur sometime) or probable (likely to occur often). From the exercise both types of beneficial and adverse impacts were identified for assessment. The impacts further assessed as per WB ESS as mentioned in WB ESF. After identification and categorization of project related risks and impacts,

mitigation measures were designed so as to overcome those impacts. While assessing and managing environmental and social risks and impacts, mitigation hierarchy (first priority for avoiding risks and impacts followed by minimizing or reducing risks and impacts to acceptable levels, then mitigating risks and impacts and finally where significant residual impacts remain, compensate for or offset them where technically and financially feasible) as defined in the Guidance Note of WB ESF has been adopted.

For analyzing the combined impact of project intervention with other projects within the project vicinity, cumulative impact assessment (CIA) has also been done. Process of risk and impact assessment has given in Chapter 6 and detailed in Annexure 6.1.

CHAPTER-IV: BASELINE ENVIRONMENTAL AND SOCIAL CONDITIONS

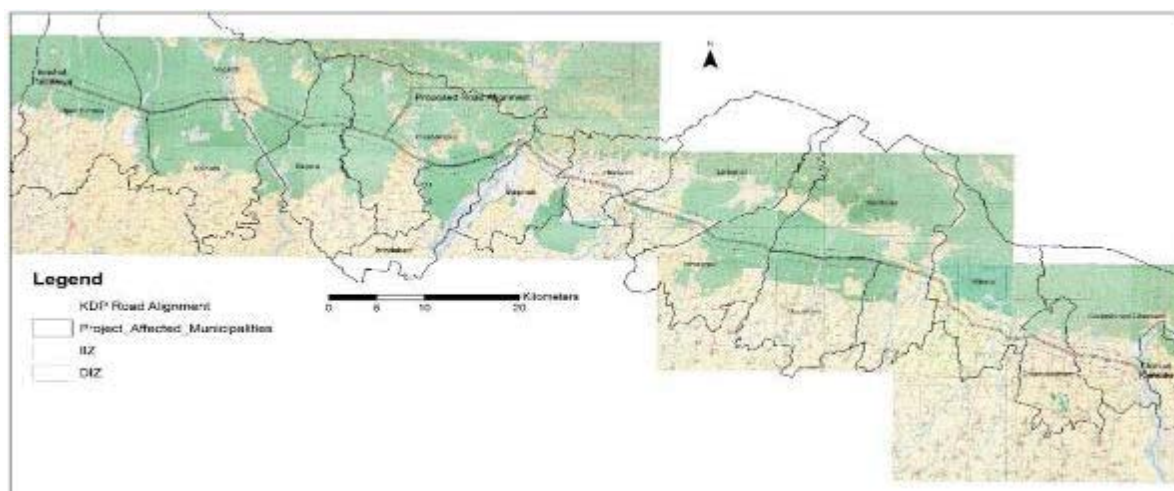
The baseline conditions are the standard against which projected future conditions are compared with project alternatives. In this chapter we are describing the baseline environmental and social conditions of KDP project area which is passing through six districts.

4.1 Physical Environment

The physical environment of project area consists of topography, climate & hydrology, geology, seismology, land use & landscape, and Environmental quality of the project area. These physical features of project area are described in following sections.

4.1.1 Topography and Land use

The proposed alignment passes through flat topography of Terai region. The road alignment starts from Kamala River at an elevation of 105 msl, gently rises to elevation 227 msl at 266+300 (Bardibas), again gradually decreases to elevation 122 msl at 322+800 (forest area) and gradually increases to elevation of 166 msl at end (Pathlaiya). Proposed road alignment in topographic map is shown in **Figure 4.1**.



Source: Department of Survey

Figure 4.1: Proposed Road Alignment in Topographic Map

Also, alignment is shown in Google map in **Figure 1.2**.

The land use along the road alignment is predominantly forest land followed by agricultural. The land use for various category of land use was analysed for land within RoW (i.e. 50 meters), land within Direct Impact Area (i.e. 300-meter corridor of the road) and Indirect Impact Area (i.e. 2 km corridor of the road). The land use map along the road alignment is given in **Figure 4.2** and further illustrated in **Annexure 1.1**. Land use category of the project area is given in **Table 4.1**.

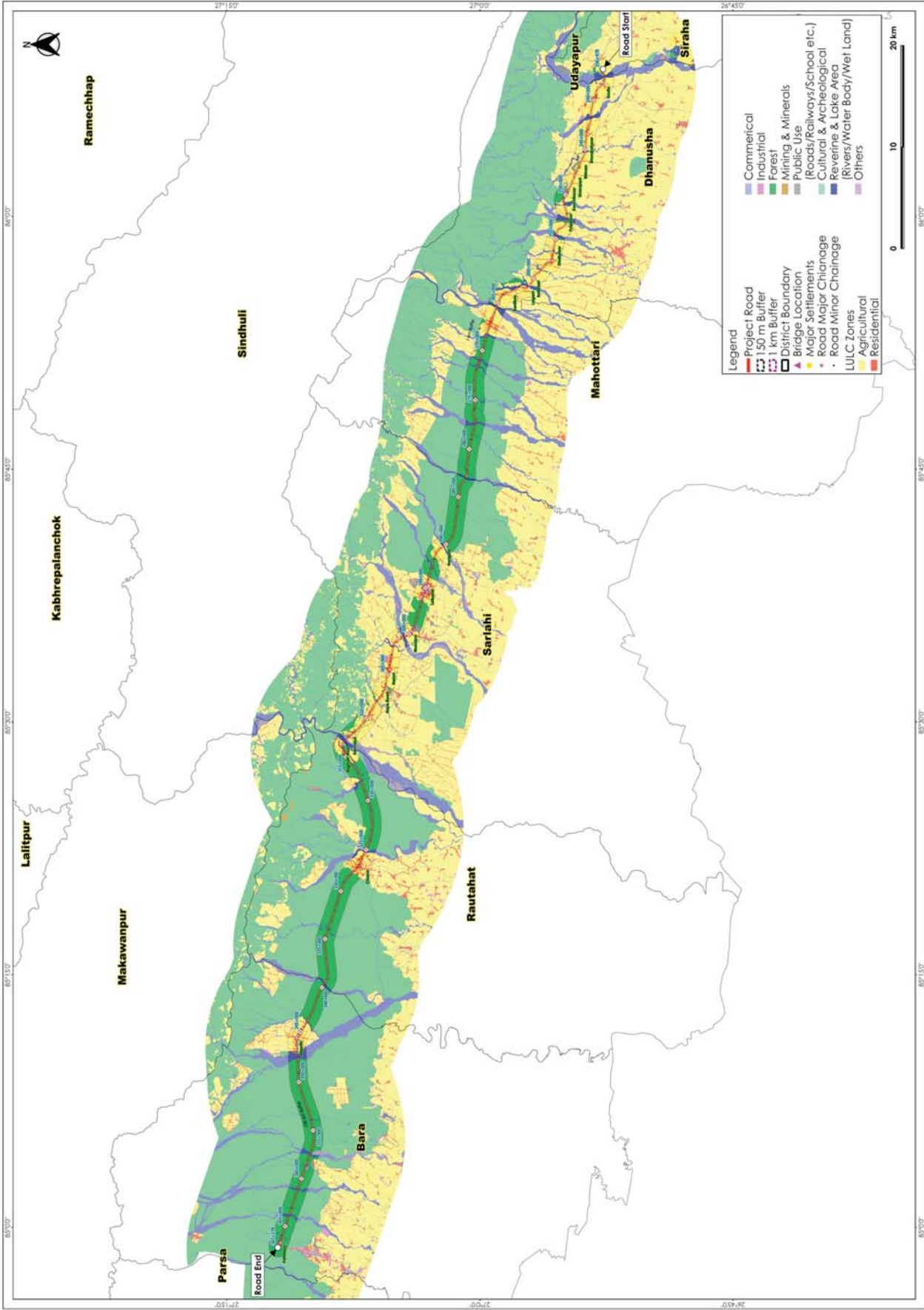


Figure 4.2: Land Use Map along the Road Alignment

Table 4.1: Land Use Category of Project Area

Land Use Category	Impact Zone					
	ROW (50 m)		DIA (300 m)		IIA (2 km)	
	Ha	%	Ha	%	Ha	%
Agricultural	97.14	14.92	949.76	24.28	8218.24	31.23
Residential	56.93	8.75	311.09	7.95	1109.79	4.22
Commercial	29.89	4.59	141.52	3.62	199.78	0.76
Industrial	1.6	0.25	12.42	0.32	112.47	0.43
Forest	317.09	48.71	1989.01	50.85	13890.8	52.78
Mining & Minerals	0.67	0.10	2.94	0.08	3.35	0.01
Public Use (Roads/Railways/School etc.)	124.51	19.13	296.19	7.57	771.47	2.93
Cultural & Archaeological	1.35	0.21	5.96	0.15	8.04	0.03
Riverine & Lake Area (Rivers/Water Body/Wet Land)	19.83	3.05	184.34	4.71	1802.02	6.85
Others	1.9	0.29	18.03	0.46	203.11	0.77
Total (ha/%)	650.91	100.00	3911.26	100.00	26319.07	100.00

Source: Field Survey 2022, Google Earth and Arc GIS

4.1.2 Climate, Meteorology and Air Quality

The climate of the study area belongs to the tropical climatic zone. The climate is characterized by a distinct monsoon period from June to September, a mild winter period from November to March and a hot summer from April to September. The region has a hot and humid climate during summer and has foggy climate during winter.

i) Temperature

The 37 years data of temperature was collected from Simara Airport (index no. 909) which is in Bara district and Karmaiya (index no. 1121) which is in Sarlahi district of project area. The average annual temperature was recorded from 1985 to 2021. **Table 1 of Annexure 4.1** shows the average annual temperature of project area during last 37 years and it shows that temperature is almost stable with some fluctuations only. The road construction project doesn't have significant impact on temperature, however tree cutting may have some micro level temperature impacts in project area.

As per the data recorded, the annual average temperature of the project area is 25.03°C with annual average minimum temperature of 19.1°C and annual average maximum temperature of 31.01°C.

ii) Rainfall

The 37 years data of rainfall was collected from Simara Airport (index No.909) which is in Bara district and Karmaiya (index no.1121) which is in Sarlahi district of project area. The average annual rainfall was recorded from 1985 to 2021. The annual average precipitation within project area -the annual average rainfall in Bara district is 1875.45 mm and in Sarlahi District it is 1803 mm. **Annexure 4.1, Table 2** shows the average annual rainfall of project area during last 37 years and it shows that rainfall is almost stable with some fluctuations only. As the KDP road passes through plain topography, there are many locations which will be impacted due to heavy rainfall. The drainage issue and flood prone area are observed mostly in Mithila, Lalbandi, and Nijgadh locations along the KDP road. The flooding and drainage issues are observed during June, July and August month as this period is rainy season in project area.

Beside this, for the road design has considered 11 stations for rainfall analysis. For rainfall analysis in design, spatial averaging of maximum 24 hours rainfall over the basin was estimated using

Thiessen's Polygon method. In order to estimate 100 years, return period 24 hours annual maximum rainfall (R100 yr) over the catchment, probability distribution was fitted to spatially averaged series using Cumfreq software. Using the best fit distribution 24 hours maximum rainfall for 100 years return periods was estimated. Rainfall analysis as per Draft Design Report 2022 is given in **Table 4.2**.

Table 4.2: Estimation of Point Rainfall, R100 Year

Station Name	Rainfall St. no.	No. of years	Maximum value, mm	Best fit distribution	Point R _{100yr} , mm
Amlekhgungj	907	36	399	Laplace distribution	444.95
Simara Airport	909	36	300.3	Frechet type (Fisher-Tippett 2)	345.84
Nijgadh	910	36	444.6	Laplace distribution	502.5
Pattharkot (East)	1109	36	437	Laplace distribution	448.59
Tulsi	1110	36	436.1	Laplace distribution	519.38
Chisapani Bazar	1112	36	315	log-logistic Distribution	386
HariharpurGadhi Valley	1117	36	482.2	Laplace distribution	565.41
Karmaiya	1121	36	432	Laplace distribution	465.58
UdyapurGadhi	1213	34	231.4	generalized extreme value (GEV)	396.99
Lele	1075	26	280	Burr frequency function	374.27
Timure	1001	32	191.2	Gumbel	221.17

Source: Detailed Design Report 2023

The linear trend analysis of both rainfall series historical and RCP4.5-upscaled has been undertaken in the road design of KDP. Both series show a positive trend (Detailed Design Report 2023). The trend for the RCP4.5 rainfall is an increase of 0.651 mm/year, and the trend in the historical data is 0.380 mm/year for Lakhandei basin (KDP alignment crosses Lakhandei River, Sarlahi district). For Bakraha river basin (catchment area = 450 km², originating from Churia hill, Morang district). The trend for the RCP4.5 rainfall is an increase of 0.023 mm/year, and the trend in the historical data is 0.352 mm/year. The result shows that the percentage change in projected rainfall due to climate change at Pattharkot Rain fall station (Lakhandei river basin) varies between 1.4%-21.5% for different return periods.

iii) Relative Humidity (RH)

The 37 years data of RH was collected from Simara Airport (index no. 909) which is in Bara district and Karmaiya (index no. 1121) which is in Sarlahi district of project area. The average annual rainfall was recorded from 1985 to 2021. **Annexure 4.1, Table 3** shows the average annual relative humidity of the project area during last 37 years and it shows that rainfall is almost stable with some fluctuations only. High relative humidity increases the rate of harmful or toxic chemicals in the air. It also causes dust mites in our homes, dampening the quality of air that's why relative humidity is important for air quality. The high RH is observed in the month of July and August; therefore, these two months are significant as compared to other months.

iv) Wind Speed

The three years data of wind speed was collected from Simara Airport (index no. 909) which is in Bara district and Karmaiya (index no. 1121) which is in Sarlahi district of project area. **Table 4.3** shows the average wind speed of the project area during last three years. The wind speed was more in Bara district when compared to Sarlahi district wind speed. The wind speed influences the

air pollution of the location. If the wind speed is high, then air pollution will dilute with the speed of wind. Low wind speed and stable conditions will lead to high pollution.

Table 4.3: Wind Speed of the project area (knot)

Time	Simara Airport (Avg)	Karmaiya (Avg)
01/01/2019	1.266	1.373
01/01/2020	3.144	1.308
01/01/2021	3.311	1.239

Source: DHM 2022

v) Wind Direction

The three years data of wind direction was collected from Simara Airport (index no. 909) which is in Bara district and Karmaiya (index no. 1121) which is in Sarlahi district of project area. The **Table 4.4** shows the predominant wind direction of the project area during last three years. The wind speed was more in Bara district when compared to Sarlahi district wind speed. The wind is generally blowing from SEE, SE and SSE in Bara district and from East and SEE in Sarlahi district.

Table 4.4: Wind Direction of the Project Area

Time	Simara Airport (Avg)	Karmaiya Airport (Avg)
01/01/2019	102.231 (SEE)	98.011 (E)
01/01/2020	141.175 (SE)	108.027 (SEE)
01/01/2021	158.8 (SSE)	106.108 (SEE)

Source: DHM 2022

The summary of climatic features of project area is given in **Table 4.5**.

Table 4.5: Climate Data of Nearest Stations (Simara Airport and Karmaiya)

Station	Climatic Parameters	Average from 1985 to 2021
Simara	Annual Minimum Temperature	18.22°C
	Annual Maximum Temperature	30.49°C
	Annual Rainfall	1871.45 mm
	Annual Average Humidity	74.20 %
	*Annual Average Wind Speed and Direction	2.57 m/s, 134.07°
Karmaiya	Annual Minimum Temperature	20.52°C
	Annual Maximum Temperature	31°C
	Annual Rainfall	1803 mm
	Annual Average Humidity	81.60 %
	*Annual Average Wind Speed and Direction	1.31 m/s, 104.05°

* Data available only from 2019 to 2021

Source: DHM 2022

vi) Air Quality

There are some industries in project area however most of them are small and medium scale industries e.g., oil mill, rice mill, bakery, poultry, plywood, sugar mill etc., which are mentioned in section 4.3.9. Also, some infrastructure construction projects and building construction activities are source of air pollution in the project area. In addition to these sources of pollution traffic movement and quarrying operation in riverbed areas are source of air pollution. Besides these sources of air pollution, the air quality in the project area is not an issue as discussed with local people and observed during field visit. There are upcoming infrastructure projects in the project area e.g., railways, transmission line projects and road improvement projects which may degrade the air

quality in project area. However, contribution of these projects will be not significant and localized. There will be positive impact on air quality as there will be no traffic jam and fuel consumption for per Km will be less once road will be in operation.

To establish the baseline Air Quality of the project area was monitored in the month of October 2022 to establish the air quality of the project area. The five air quality stations were identified to represent the entire project area. The monitoring stations were selected in such a manner that these stations were represent the sensitive location, residential location, commercial locations along the KDP road. These stations were Dhalkebar, Lalbandi, Paurahi, Nijgad and Dudhaura. The summary of results of air quality monitoring is given in **Table 4.6** and the Lab analysis report for air quality is given in **Annexure-4.2**. It is noticed that all the monitored parameters were within National Air Quality Standard (NAQS), Ministry of Forests and Environment, 2012.

Table 4.6: Baseline Air Quality (24 hour averaging time)

Parameters	NAQS ($\mu\text{g}/\text{m}^3$)	WHO 2021 ($\mu\text{g}/\text{m}^3$)	Results ($\mu\text{g}/\text{m}^3$)				
			Dhalkebar (Commercial)	Lalbandi (Commercial)	Paurahi (Forest)	Nijgad (Residential)	Dudhaura (Sensitive)
PM ₁₀	120	45	118	80	51	62	95
PM _{2.5}	40	15	34	26	18	21	32
TSPM	230	150	206	138	85	122	145
SO ₂	70	40	0.13	0.09	0.04	0.06	0.12
NO ₂	80	25	1.09	0.24	0.08	0.18	0.34

Source: Consultant Survey 2022

The results indicate that Air quality of the project area is within the National Air Quality Standard of Nepal, therefore in present situation air quality is not an issue in project area. However, there may be deterioration of air quality particularly during construction phase of the project. As baseline particulate matter in Dhalkebar and Dudhaura location is 118 $\mu\text{g}/\text{m}^3$ and 95 $\mu\text{g}/\text{m}^3$ respectively, therefore these locations need additional mitigation measures during construction phase of the project. The gaseous pollutants in project area are far below the national standard, therefore gaseous pollutants will not be an issue during construction phase of the project.

The air pollution during the dry season (December to April) is worst in the project area. Therefore, consider this period for additional air pollution control measures. June to August is rainy season in project area, therefore air pollution level is low during this period.

The main source of air pollution within project area is vehicular emissions, construction activities, industrial pollution, loading and unloading of sand from riverbeds.

During construction phase, dust level is expected to be high due to construction activities, transportation of construction material, loading and unloading of construction material, excavation of soil and movement of vehicles & equipment.

vii) Noise Levels

Industries adjoining to road alignment and construction activities are major source of noise pollution in the project area. In addition to these sources of pollution traffic movement and quarrying operation in riverbed areas are source of noise pollution. Besides these sources of noise pollution, the noise level in the project area is not an issue. There is some issue of noise in built-up areas, during traffic jams and congestion near bridges where sand and boulders quarrying is going on. There are planned infrastructure projects in the project area e.g., railways, transmission line projects and road improvement projects which may lead to noise pollution in the project area. However, contribution of these projects will not be significant and localized. There will be positive impact on noise levels as there will be no traffic jam/no horn and smooth movement of vehicles on upgraded road.

Baseline noise levels of the project area was monitored in the month of October 2022 to establish the baseline noise levels of the project area. The five noise monitoring stations were identified to represent the entire project area. The noise monitoring stations were selected in such a manner that these stations represented the sensitive location, residential location, commercial locations along the KDP road. These stations were Dhalkebar, Lalbandi, Paurahi, Nijgad and Dudhaura. The summary of results of noise levels are given in **Table 4.7**.

The day and night time noise levels were calculated separately for all monitoring stations. It is noticed from the results of noise that equivalent noise level at Dhalkebar and Lalbandi exceeded National Standard for Noise Level 2069 for urban residential area for night time only and day time the noise levels are within the limit for Lalbandi and slightly exceeding for Dhalkebar station. The Day and night time Leq for other stations are within limit of residential area.

The main source of noise in the project area is vehicular, construction activities, industries, loading and unloading activities from riverbeds etc.

Table 4.7: Noise Level within Project Area

Locations	Results				
	Dhalkebar	Lalbandi	Paurahi	Nijgad	Dudhaura
Equivalent Noise Level Day (LeqD)	65.32	64.42	55.48	62.05	50.38
Equivalent Noise Level Night (LeqN)	61.31	60.39	50.14	55.88	46.11

Source: Consultant Survey 2022

Table 4.8: National Ambient Sound Quality Standard

S.N.	Area/Zone	NASQS limit (dBA)	
		Day	Night
1	Commercial	75	70
2	Residential	65	55

Movement of heavy vehicles and use of machineries/equipment and construction activities during construction phase will generate noise level in the project area.

4.1.3 Hydrology

i) River System

The KDP road is in foothills towards south side of Nepal. There are 76 rivers and rivulets along the KDP alignment and tributaries of Kamala and Bagmati river basin among which Kamala Branch, Bagmati East and Bagmati West are manmade canals and rest are natural rivers and rivulets. Most of these rivers are depending upon rainfall for their runoff. The rivers, rivulets and canals crossing the KDP road along with chainage and their nature are given in **Table 1.3**.

Among these, three rivers viz. Kamala River, Bagmati River and Bakaiya River are major rivers originating from Mahabharat range and having larger catchment/watershed area.

Most of these rivers/streams are originated from Chure range, have smaller catchment area and are intermittent in nature with very low flow during dry season. Most of the river catchment mentioned above are of unstable nature, which are susceptible to heavy erosion, and thereby yielding high sediment loads. It is noticed that most of the streams and rivers within project area are of aggrading nature with siltation/sedimentation problem while only few rivers are either stable or degrading. Major siltation problems observed are in Charnath, Baluwa, Jalad, Basai, Ratu, Bhapsi, Gaushala, Bankhe, Betini, Lakhandei, Lamaha, Dhansar, Pasaha, Dudhaura etc.

Beside these, the road alignment also passes through few irrigation canals (Kamala canal at chainage 237+812, Bagmati east canal at chainage 312+070 and Bagmati west canal at chainage 313+615).

ii) Ponds

Also, there are some water ponds along the KDP alignment. The chainage wise list of these ponds is given in **Table 4.9**. They were created as borrow pits during construction of East-West Highway in the past. Most of these ponds are used by domestic animals for drinking and wallowing. Ponds within forest areas are also found to be used by wild animals for drinking water. There may be impact on these ponds during road construction.

Table 4.9: The List of Ponds along the KDP alignment

S.N.	Chainage		Length	Side	Pond Edge Distance from Center Line of Alignment (m)
	Start	End			
1	242+600	242+750	150	LHS	22.16
2	242+765	242+865	100	RHS	19.12
3	242+960	243+050	90	RHS	22
4	243+000	243+150	150	LHS	20.9
5	247+870	247+900	30	LHS	7.8
6	255+190	255+310	120	LHS	18.5
7	293+620	293+720	100	LHS	14.45
8	295+310	295+370	60	RHS	15
9	301+000	301+080	80	LHS	12
10	304+920	304+950	30	LHS	24.95
11	304+960	305+000	40	LHS	17.15

iii) Catchment area

As per Draft Design Report 2022, catchment geometry, major hydrologic characteristics of the basins along the project area are generated by the use of GIS tools. Digital elevation model (DEM) of the project area has been used to delineate the catchment area for the major crossing along the KDP alignment. The catchments of the rivers are predominantly elongated type. The Catchment area of Kamala River and Bagmati River are not elongated and can be classified as irregular geometry. The map of catchment areas for major rivers crossing KDP alignment are presented in **Figure 4.3**. Besides, Kamala, Bagmati River and Bakaiya River, that originate from Mahabharat range, all other rivers are originated from Siwalik range (Chure) depending upon rainfall for their runoff. In Siwalik region, the rivers have higher gradient where the catchment slopes from north to south and follow dendritic pattern where the slope gradually decreases from north to south for catchment of rivers/streams crossing KDP road alignment. The slope abruptly declines as rivers enter Terai region. This is the section where KDP road alignment passes east to west just below the Siwalik region (chure). Due to fragile geology with loose soil and weak rocks that are easily disintegrated, runoff from rivers and streams from Siwalik region are laden with sediments and when they enter the flat lands (Terai Plain, as of the project area) then they deposit these sediments to great extent. This is triggered by development activities (mainly road construction), agricultural practices (deforestation for agriculture, tillage) and climate change issues (intense rainfall) in the catchment area upstream. Intense rainfall and landslides in the upstream section of catchment can lead to flooding and siltation/sedimentation in the downstream section including sections within KDP road alignment.

Large alluvial fan deposits occur along the main streams. They are tens of meters thick and extend all over the project area. The fine sand and silt with clays are produced from the surrounding sloping catchment, washed away during past floods and transported due to moderate to steep gradient of the rivers and deposited in the gentle slopes of the Terai plain due to decrease in the velocity of the flood flows particularly in aggregating rivers.

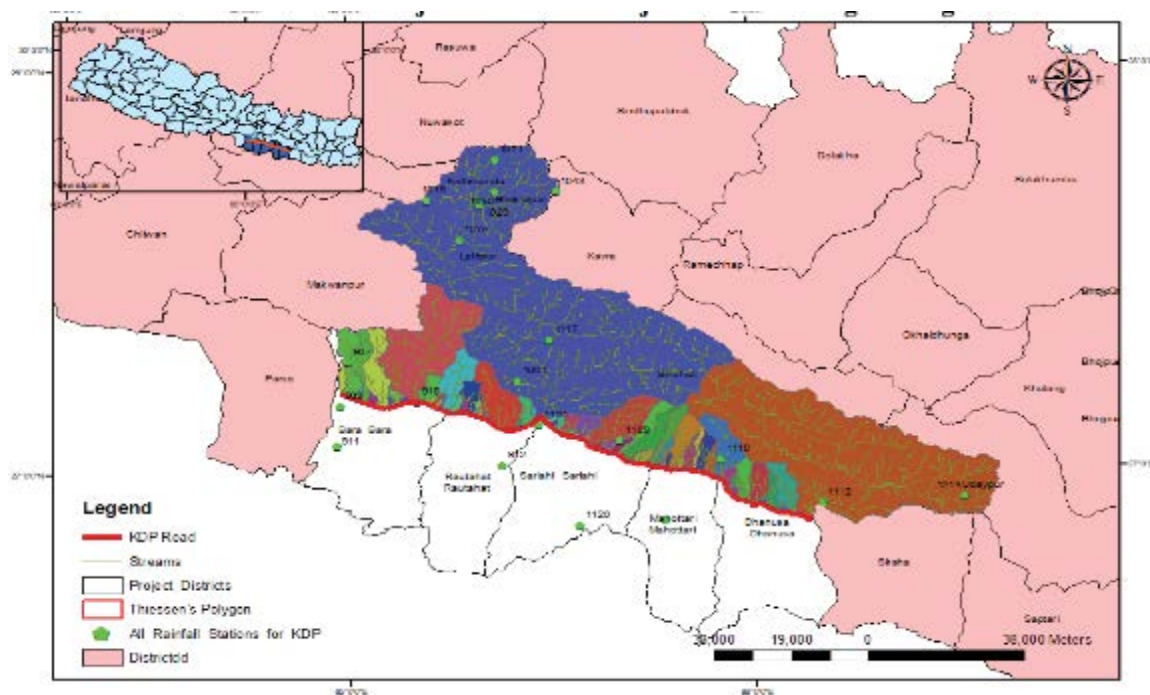


Figure 4.3: Catchment Area for Major Rivers and Cross Drainages Along KDP Alignment

iv) Flood

The proposed project area lies towards upper part of Terai region. As per the detail design report, FGDs and field observation by ESIA team during field survey, majority of the riverbanks and adjoining land within project area are subjected to bank cutting/ erosion hence requires river training works. There are total 76 rivers and rivulets along the KDP road alignment. However major risk of bank cutting and erosion is noticed in Charnath, Baluwa, Jalad, Aurahi, Basai, Badahari, Ratu, Gadhanta, Maraha, Bankhe, Phuljor, Lakhandei, Chapani, Gairi, Paurahi, Chandi, Lamaha, Dhansar, Pasaha and Balganga. Further, some locations (especially in Mithila, Lalbandi and Nijgadh area) is found to be under water logging mainly during heavy rain. High flood level of rivers within the road alignment is given in **Table 1.3**.

v) Climate Change and Hydrology

The climate of the study belongs to the tropical climate zone characterized by a distinct monsoon period from June to September, a mild winter period from November to March and a hot summer from April to September. The region has a hot and humid climate during summer and has foggy climate during winter. The project area having maximum temperature 30.49oC and minimum temperature 18.22oC. The present rainfall shows the trends of fluctuating rainfall.

During the monsoon months from June to September, all the rivers in Terai are in spate with bank-full discharges and cause flooding and inundation. The problems of flooding and inundation in the Terai are more critical due to change in climate in general and change in rainfall pattern/intensity in particular.

As mentioned above, Kamala, Bagmati, and Bakeya rivers are the only rivers originating from Mahabharat range which crosses KDP road. Runoff in Churia Rivers concentrates only in the monsoon months from June to September. Factors like short steep slope, overgrazing, deforestation, and short time of concentration produce high peak flood during the monsoon.

The Churia range contributes maximum sediment load to the rivers originating from the southern face (Sharma 1977). According to a JICA study, the annual sediment yield of the Lakhandei river is estimated as high as 178,000 m³ per year. In some stretches of the Churia rivers, almost two meters

of sediment has been deposited in the last 45 years (Dixit 1995). Due to the higher sediment load, the bed level of several rivers is rising significantly particularly in aggregating rivers along KDP. Major issues among them are noticed to be in Baluwa, Ratu, Gaushala, Belgachhi, Dholan, Lakhandei and Dhansar. Past experience shows that flooding and inundation occur following high intensity rainfall in the Churia hills and Terai. A rainfall intensity of 350 mm for consecutive 48 hours is considered as high intensity rainfall (Sharma 1988). In addition, rainfall exceeding 70 mm per hour is considered as cloudburst rainfall (Gyawali 2011) which disrupts both the slopes and channel equilibrium at the local as well as regional scales.

Precipitation events exceeding 375 mm in 24 hours have been recorded in different parts of the Terai.

The different studies (Vivitrols et al., 2011; Nepal & Shrestha, 2015; Nepal, 2016; etc.) have suggested that extreme events in future are likely to be more frequent and magnitude of such events are likely will increase. Some of the extreme events happened in past are as follow:

1. A cloudburst over the central region of the Bagmati catchment on 19-20 July 1993 caused catastrophic landslides and debris flows. The flood, estimated to be about 16,000 cumec, damaged the Bagmati barrage and flooded Sarlahi and Rautahat districts in the Terai.
2. The villages along the Kamala River's edge in the Terai were badly affected by a flood in 2007. On July 24, the Himalayan Times reported that the floodwaters, 'swamped houses, plantations, roads, markets, government offices and schools in the district headquarters of Siraha'.
3. The heavy rainfall during 11 - 12 July, 2019 caused flooding and landslides in 32 districts in Nepal including in the lower Bagmati basin and adjacent districts, which covers the districts of Bara, Parsa, Rautahat and Sarlahi of Province 2.
4. Flooding in the Kamala Basin and surrounds threatens people's lives and causes major damage. Three people died in Dhanusha in the 2017 flooding, and the Ministry of Home Affairs estimates around 127,000 people were displaced from Dhanusha and Siraha (NPC, 2017).

As many extreme climate events happened in past and there are chances that these kinds of events may happened more frequently in future. In these cases, side drains may be inadequate to quickly drain water from the road surface. Similarly, high floodwater can cause toe cutting of the road slopes. It could lead to increase 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 climate resilient structures will help reducing their vulnerability from extreme events.

vi) Water Quality

The ground water quality and surface water quality are also not a major issue in project area. Local people are generally using ground water for drinking and other domestic purposes. The surface water is used mainly for irrigation purposes. Garbage is found to be thrown haphazardly near the water sources through which leachate is generated and polluting the water bodies. As there are not many industries which causes water pollution in the project area, however there are few sugar mills in the project area which are source of water pollution. In case if there will be industries in future which generates wastewater, they may contaminate surface and ground water in the project area.

To establish the baseline water quality and to understand the existing water quality along the KDP road, drinking water and surface water quality of the project area was monitored. This can be useful in comparing whether project activities are deteriorating the surface and ground water quality or not during construction. The surface water and ground water locations were selected to represent the

entire project area of KDP road. The result of drinking water and surface water is given in **Table 4.10** and **Table 4.11** respectively. Some parameters of water quality are exceeding the standards are shown in bold numbers. The Lab analysis result for water quality is given in **Annexure-4.3**. In case of drinking water, it is noticed that beside E. coli contamination, all the other measured parameters are within Nepal Drinking Water Quality Standard (NDWQS) 2062. All the drinking water samples except that from Bagmati and Pathlaiya had E. coli contamination.

Similarly, in case of surface water, beside colour, turbidity and total coliforms, all the other parameters were within NDWQS.

Table 4.10: Drinking Water Quality within Project Area (Groundwater)

Parameters	Unit	NDWQS	Locations						
			Dhalkebar		Bardibas	Lalbandi	Chandranighapur	Bagmati	Nijgadh
Physical									
Colour	TCU	5 (10)	5	5	0	5	0	5	10
Electrical Conductivity	µS/cm	1500 (max)	180	80	180	410	360	280	130
pH	-	6.5-8.5	7.4	7.3	6.9	7.5	7.8	7.6	6.9
Taste and Ordour	-	Not Objectionable	Not Objectionable	Not Objectionable	Not Objectionable	Not Objectionable	Not Objectionable	Not Objectionable	Not Objectionable
Total Dissolved Solids	mg/L	1000	118	240	160	182	216	170	82
Total Suspended Solids	mg/L	2000	4	8	2	2	4	8	8
Turbidity	NTU	5 (15)	<0.1	1.54	<0.1	0.15	0.27	<0.1	<0.01
Chemical									
Ammonia	mg/L	1.5	0.03	0.02	0.03	<0.02	<0.02	<0.02	0.03
Arsenic	mg/L	0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chloride	mg/L	250	7.99	10.99	3.99	3.99	8.99	4.99	4.99
Iron	mg/L	0.3 (3)	<0.01	<0.01	0.07	<0.01	<0.01	<0.01	0.21
Nitrate	mg/L	50	13.84	<0.04	1.24	1.59	7.16	1.99	0.56
Total Alkalinity	mg/L	-	76	34	100	86	154	138	68
Total Hardness	mg/L as CaCO ₃	500	54	20	66	156	182	124	86
Calcium	mg/L	200	16.03	9.61	19.24	24.05	48.09	40.08	19.23
Calcium Hardness	mg/L	-	40	20	48	60	120	100	48
Magnesium	mg/L		3.4	0.97	4.37	23.33	15.06	5.83	9.23
Magnesium Hardness	mg/L	-	13	3	16	94	61	23	47
Residual Chlorine	mg/L	0.1-0.2	<0.04	<0.04	<0.04	<0.04	<0.04	<.04	<0.04
Sulphate	mg/L	250	2.09	5.09	4.26	12.22	10.87	8.26	0.6
Manganese	mg/L	0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Parameters	Unit	NDWQS	Locations						
			Dhalkebar	Bardibas	Lalbandi	Chandranighapur	Bagmati	Nijgadh	Pathlaiya
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoride	mg/L	0.5-1.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Microbiology									
E.coli	CFU/100 mL	0	10	12	3	15	0	2	0

Source: Consultant Survey 2022

Table 4.11: Surface Water Quality within Project Area

Parameters	Unit	NDWQS	Results					
			Kamala River	Ratu Khola	Bagmati River	Wetland	Pond	Bakaiya
Physical								
Appearance	-	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Temperature	°C	20-25	20	19.8	19	20.7	22.2	21
Colour	TCU	5 (10)	5	5	10	15	15	5
Electrical Conductivity	µS/cm	1500 (max)	290	70	250	540	30	230
pH	-	6.5-8.5	8.2	7.6	7.6	7.7	7.8	8.1
Dissolved Oxygen	mg/L	-	5.2	6.3	7.8	8.0	7.3	6.8
Taste and Odour	-	Not Objectable	Not Objectable	Not Objectable	Not Objectable	Not Objectable	Not Objectable	Not Objectable
Total Dissolved Solids	mg/L	1000	186	10	160	266	10	66
Total Suspended Solids	mg/L	2000	26	6	74	10	4	6
Turbidity	NTU	5 (15)	19.29	1.37	0.43	7.11	4.71	6.38
Chemical								
Ammonia	mg/L	1.5	0.04	0.02	0.05	0.05	0.09	<0.02
Biological Oxygen Demand	mg/L	2-500	11.3	9.4	11.6	8.6	11.2	10.2
Chloride	mg/L	250	2.99	7.99	9.99	2.99	14.99	1.99
Iron	mg/L	0.3 (3)	<0.01	<0.01	<0.01	<0.01	0.05	<0.01
Nitrate	mg/L	50	0.14	<0.04	10.19	<0.04	<0.04	<0.04
Total Alkalinity	mg/L	-	166	30	154	282	2	138
Total Hardness	mg/L as	500	130	18	38	160	<1	128

Parameters	Unit	NDWQS	Results				
			Kamala River	Ratu Khola	Bagmati River	Wetland	Pond
	CaCO ₃						
Calcium	mg/L	200	36.87	8.02	30.46	12.82	<1
Residual Chlorine	mg/L	0.1-0.2	<0.04	<0.04	<0.04	<0.04	<0.04
Phosphate	mg/L	3	<0.02	0.35	0.17	<0.02	<0.02
Manganese	mg/L	0.2	<0.05	<0.05	<0.05	<0.05	<0.05
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoride	mg/L	0.5-1.5	<0.05	<0.05	<0.05	<0.05	<0.05
Microbiology							
Total Coliform	CFU/100 mL	0	1	29	0	28	2
							38

Source: Consultant Survey 2022

Table 4.12: Soil Quality within Project Area

S.N.	Parameters	Unit	Results				
			241+000 (Kamala)	266+000 (Bardibas)	291+000 (Raniganj)	311+000 (Bagmati)	344+000 (Nijgadh)
1	pH	-	5.72	5.21	5.6	6.72	6.48
2	Moisture Content	%	11.85	3.62	12.04	19.18	13.23
3	Soil Organic Matter	%	6.2	2.21	3.4	5.21	5.21
4	Total Kjeldahl Nitrogen	%	0.17	0.18	0.15	0.21	0.19
5	Available Phosphorus	mg/kg	71.22	11.03	29.75	20.76	75.65
6	Total Potassium	mg/kg	1309.23	1802.3	1718.2	1725.21	2171.66
7	Sodium	mg/kg	71.23	55.21	86.1	96.47	85.62
8	Oil and Grease	%	0.09	0.10	0.11	0.08	0.08

Source: Consultant Survey 2022

4.1.4 Soil and Geology

i) Soil

The soil is in general alluvial and fine to medium textured in the project area which is suitable for agriculture. The baseline soil quality was monitored at five locations along the project area. The result of soil quality testing is given in **Table 4.12**. The lab analysis report of these soil samples is given in **Annexure 4.4**.

The soil quality was tested to establish the baseline soil quality of the project area. The baseline soil quality indicates that soil of project area is acidic in nature and suitable for agriculture purpose. However, traces of oil & grease are present in soil. This is because of commercial activities, movement of vehicles, the maintenance work of vehicles, the traces from these sources spread in project area due to rain, hence some traces of oil and grease was observed in soil.

ii) Geology and Seismicity

The KDP road alignment lies at the Gangetic Zone just pass the Siwalik Zone. This zone is further subdivided into northern terai region, middle terai region and southern terai region. Mostly the road section lies in northern terai region pass the siwalik hills (**Figure 4.4** and **Figure 4.5**). This area is mostly composed of quaternary sediments (alluvium deposits) that consists of sandy gravel with boulder, bobble, pebble, silt and clay. Large alluvial fan deposits occur along the main streams. They are tens of meters thick and extend all over the project area. The fine sand and silt with clays are produced from the surrounding sloping catchment, washed away during past floods and transported due to moderate to steep gradient of the rivers and deposited in the gentle slopes of the Terai plain due to decrease in the velocity of the flood flows particularly in aggregating rivers. It is noticed that the road alignment is close to the Chure foot hills at two sections - Chainage 262+150 and 312+000.

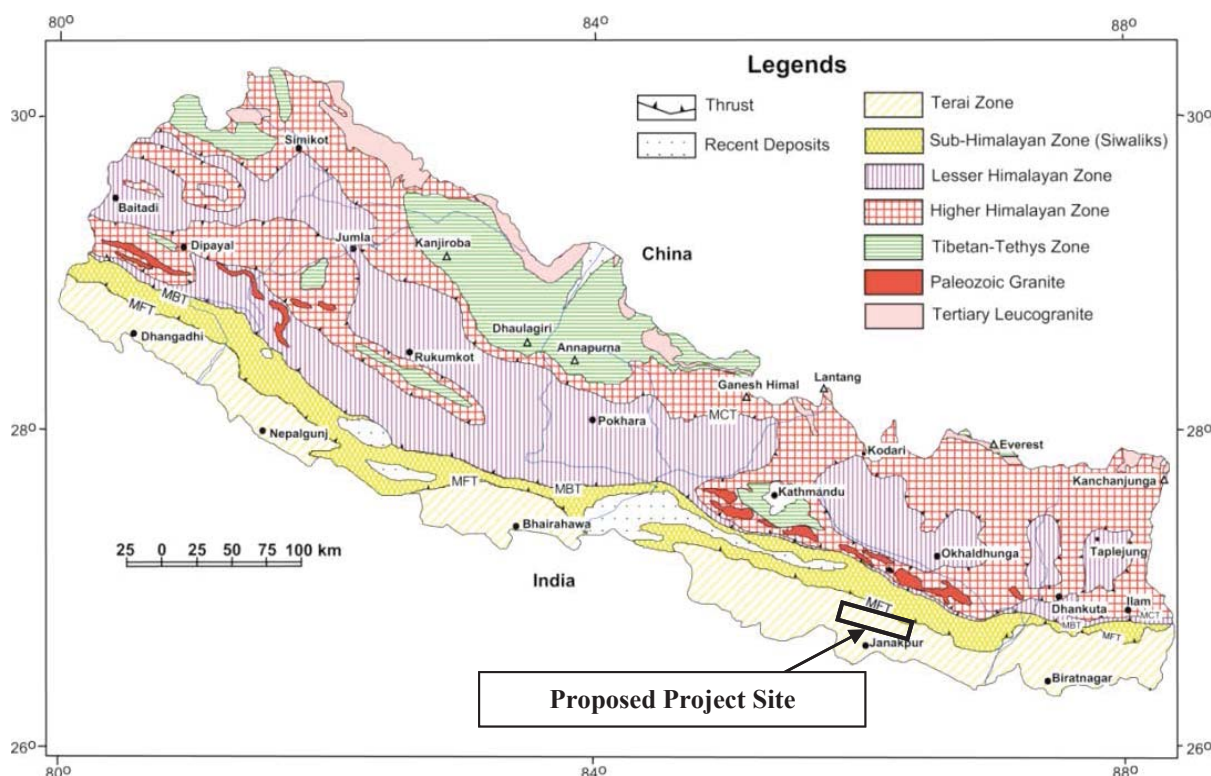


Figure 4.4: Geological Map of Nepal (Modified from Dahal 2006)

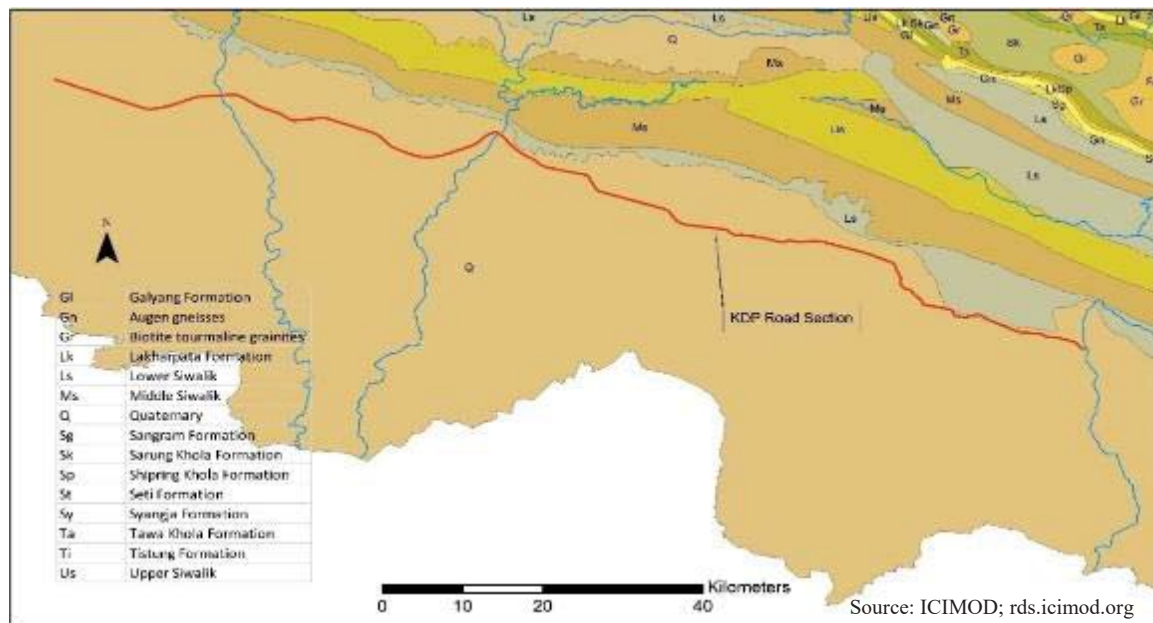


Figure 4.5: Regional Geological Map of Nepal showing Project Location

As per National Building Code (NBC 105:2020), the project area lies within seismic zoning factor (Z) equal to 0.3 (**Figure 4.6**). Further, Peak Ground Horizontal Acceleration of the Project area is around 100-200 gal. The risk of seismic hazard in the vicinity of the project area is of moderate nature, since one of the major regional thrust called the Higher frontal Thrust (HFT) is quite far away from the project site.

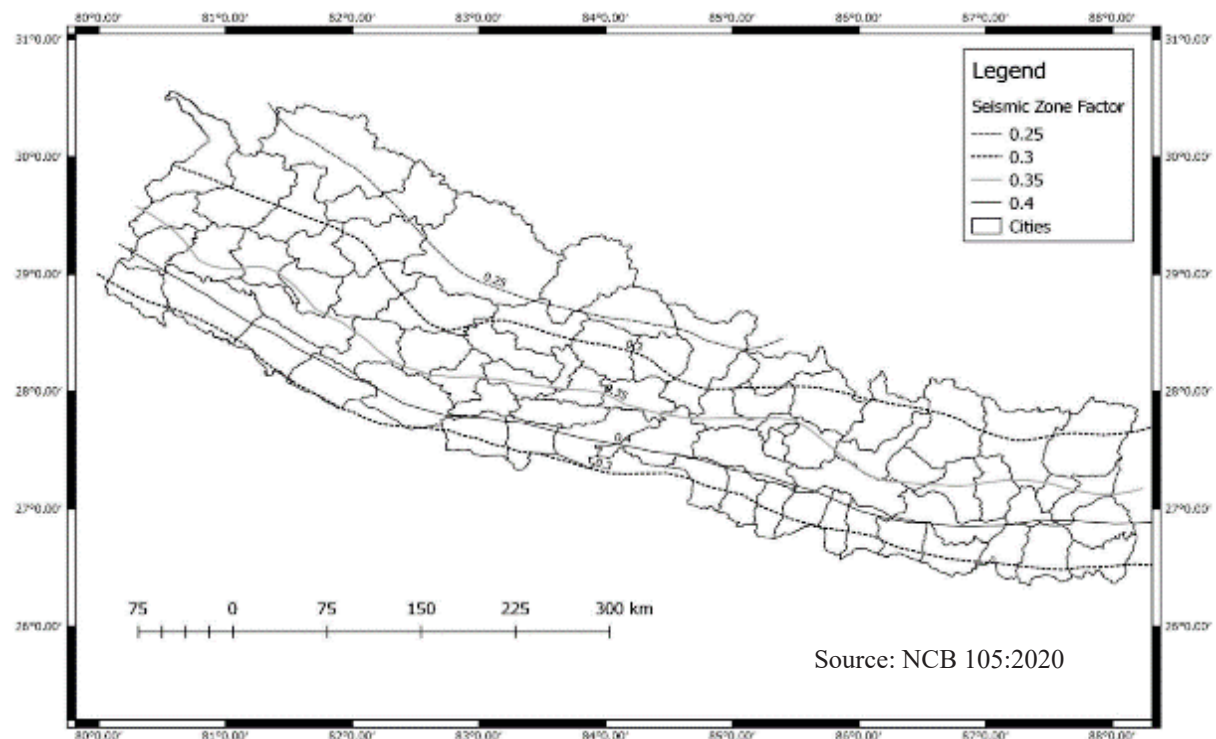


Figure 4.6: Seismic Zoning Map of Nepal

4.2 Biological Environment

4.2.1 Forest Resources

The forests along the project road are of tropical nature as per climatological condition. Because of usual adequate rainfall and sun, these forests mostly remain ever green. As per geographic condition, forests along the project road lie within Terai Mixed Hardwood Forest zone that mainly consists of Sal *Shorea robusta* trees with other associate trees. Riverine forest can be found along the banks of rivers and streams with dominant species of Sissoo (dominated by *Dalbergia sissoo*), Khair *Senegalia catechu* and Simal *Bombax ceiba*. The road alignment passes along the boundary of Parsa National Park (forming the southern boundary of the National Park), the Forest area of Sagarnath Forest Development Project, 21 community forests, 9 Collaborative forests and national forests as shown in **Table 4.13** and **Figure 4.7**. Land use map showing reserve forests and Parsa National park is shown as **Annexure 1.1**.

Table 4.13: List of Forests Along the Road Alignment

Left Side				Right Side			
S.N	Name of Forest	Chainage	To	S.N.	Name of Forest	Chainage	
		From				From	To
Forests within Division Forest Dhanusha							
				1	Kamala Community Forest	237+650	238+200
				2	Maltol Community Forest	250+000	250+800
Forests within Division Forest Mahottari							
1	National Forest	268+650	283+000	3	National Forest	268+650	283+000
Forests within Division Forest Sarlahi							
2	Sagarnath Forest Development Project	283+100	290+250	4	Bardibas Garanta Collaborative forest	268+650	277+450
3	Everest Community Forest	292+150	292+950	5	Tuteshwor Collaborative forest	277+600	283+000
4	Kalika Community Forest	293+000	293+300	6	Fuljorbaba Collaborative Forest	283+100	290+250
5	Radhakrishna Community Forest	293+300	294+000	7	Everest Community Forest	292+150	292+400
6	National Forest (Bagbani Center)	296+550	299+200	8	Kalika Community Forest	292+400	292+950
				9	Radhakrishna Community Forest	293+000	294+000
				10	Janajyoti Community Forest	296+550	297+400
				11	Nandeshwor Community Forest	297+400	299+200
Forests within Division Forest Rautahat							
7	Shreejana Community Forest	316+050	320+300	12	Gairigau Community Forest	314+430	314+850
8	National Forest	320+300	325+250	13	Bagmati Community Forest	314+850	317+150
9	Hatemalo Community Forest	327+900	329+900	14	Brahababa Community Forest	317+150	317+950
10	Rangapur Collaborative Forest	329+900	333+970	15	Deurali Community Forest	318+000	320+750
11	Jungle Saiya Collaborative Forest	334+000	339+500	16	Namuna Community Forest	320+750	322+700
				17	Judbela Community Forest	322+700	325+250

Left Side				Right Side			
S.N	Name of Forest	Chainage	To	S.N.	Name of Forest	Chainage	
		From				From	To
				18	Jana Ekata Community Forest	327+900	329+900
				19	National Forest	329+900	339+500
Forests within Bara Forest Division							
12	Tamagadhi Collaborative Forest	339+700	342+400	20	National Forest	339+650	340+650
13	Adarsa Sadabahar Community Forest	342+400	343+810	21	Janjyoti Community Forest	340+650	343+810
14	National Forest	347+650	351+225	22	Nagmadi Community Forest	347+650	350+050
15	Sahajnath Collaborative Forest	351+225	357+400	23	Parsa National Park	350+050	363+750
16	Halkhoriya Collaborative Forest	357+550	363+750	24	Gadhimai Collaborative Forest	363+900	365+950
17	Pathlaiya community forest	363+900	365+950				

Source: Field Survey/Consultation 2022

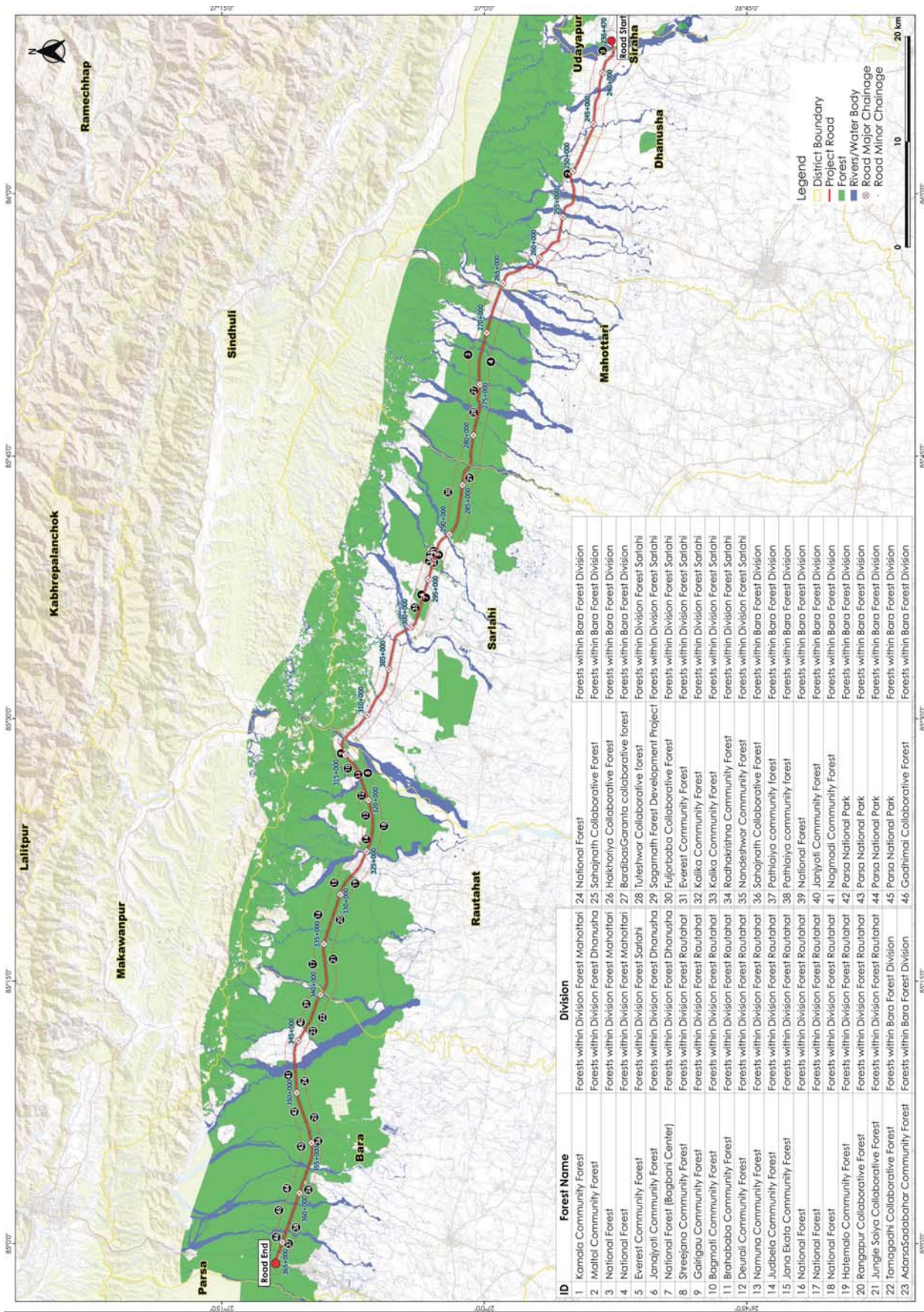


Figure 4.7: Forests along the Road alignment

4.2.2 Vegetation Commonly Found Along Road Alignment

The quadrat survey locations are shown in **Figure 3.11**. All together 30 species were recorded within 41 quadrat samples of size 10m x 10m were laid along the road alignment within which vegetation analysis was done. Among them, Sal (*Shorea robusta*) had the highest number with density of 71.61/ha. It was also the most abundant species with occurrence of 41.46%.

Major tree species and shrub and herb species within the project area are given in **Table 4.14** and **Table 4.15**.

Table 4.14: List of Major Tree Species within Project Area

S.N.	Local Name	Scientific Name	Family	CITES	IUCN	GON
1.	Sal	<i>Shorea robusta</i>	Dipterocarpaceae		LC	National list of timber trees banned for felling, transport or export
2.	Sindure	<i>Mallotus philippensis</i>	Euphorbiaceae		LC	
3.	Banjhi	<i>Anogeissus latifolia</i>	Combretaceae			
4.	Masala	<i>Eucalyptus camaldulensis</i>	Myrtaceae		NT	
5.	Asna	<i>Terminalia elliptica</i>	Combretaceae			
6.	Kyamuna	<i>Cleistocalyx operculata</i>	Myrtaceae			
7.	Padke	<i>Albizia odoratissima</i>	Fabaceae		LC	
8.	Teak	<i>Tectona grandis</i>	Verbenaceae			
9.	Botdhairo	<i>Lagerstroemia parviflora</i>	Lythraceae		LC	
10.	Pithari	<i>Stereospermum suaveolens</i>	Bignoniaceae		LC	
11.	Bhalayo	<i>Semecarpus anacardium</i>	Anacardiaceae		LC	
12.	Ashare	<i>Lagerstroemia sp.</i>	Lythraceae			
13.	Peepal	<i>Ficus religiosa</i>	Moraceae		LC	
14.	Satisal	<i>Dalbergia latifolia</i>	Fabaceae	II	VU	National list of timber trees banned for felling, transport or export
15.	Sisoo	<i>Dalbergia sissoo</i>	Fabaceae	II	LC	
16.	Simal	<i>Bombax ceiba</i>	Malvaceae		LC	
17.	Jamuno	<i>Syzygium cumini</i>	Myrtaceae		LC	
18.	Khair	<i>Senegalia catechu</i>	Fabaceae		LC	
19.	Khirro	<i>Sapium insigne</i>	Euphorbiaceae			
20.	Dudhe	<i>Euphorbia hirta</i>	Euphorbiaceae			
21.	Karma	<i>Haldina cordifolia</i>	Rubiaceae			
22.	Kadam	<i>Neolamarckia cadamba</i>	Rubiaceae			
23.	Kusum	<i>Schleichera oleosa</i>	Sapindaceae		LC	
24.	Barro	<i>Terminalia bellirica</i>	Combreteceae		LC	
25.	Harro	<i>Terminalia chebula</i>	Combreteceae		LC	
26.	Timilo	<i>Ficus auiculata</i>	Moraceae		LC	
27.	Palas	<i>Butea monosperma</i>	Fabaceae		LC	

Note: LC – Least Concern, NT – Near Threat, EN – Endangered, VU – Vulnerable, DD – Data Deficit

Source: Field Survey/ Consultation 2022

Table 4.15: List of Major Shrubs and Herbs Species within Project Area

S.N.	Local Name	Scientific Name	Family	CITES	IUCN	GON
1.	Kanikeghas	<i>Euphorbia prostrata</i>	Euphorbiaceae	II		
2.	Parajivi	<i>Aerides multiflora</i>	Orcidaceae	II	LC	
3.	Harjor	<i>Cymbidium aloifolium</i>	Orcidaceae	II		

S.N.	Local Name	Scientific Name	Family	CITES	IUCN	GON
4.	Grey Orchid	<i>Vanda tessellate</i>	Orcidaceae	II	LC	
5.	Ketuki	<i>Agave americana</i>	Agavaceae		LC	
6.	Bhedekuro	<i>Syzygium nervosum</i>	Acanthaceae			
7.	Datiwan	<i>Achyranthes aspera</i>	Amaranthaceae			
8.	Kuro	<i>Bidens pilosa</i>	Asteraceae			
9.	Dhaiyaro	<i>Woodfordia fruticosa</i>	Lythraceae		LC	
10.	Asuro	<i>Justicia adhatoda</i>	Acanthaceae		LC	
11.	Dhursul	<i>Colebrookea oppositifolia</i>	Lamiaceae		LC	
12.	Bhorla	<i>Phenera vahlii</i>	Fabaceae			
13.	Rudilo	<i>Pogostemon benghalensis</i>	Lamiaceae			
14.	Dudhejhar	<i>Oxalis acetosella</i>	Oxalidaceae			
15.	Ankuriphul	<i>Oxalis corniculata</i>	Oxalidaceae			
16.	Thakal	<i>Argemone mexicana</i>	Papavaraceae			
17.	Pire	<i>Persicaria barbata</i>	Polygonaceae		LC	
18.		<i>Aerides multiflora</i>	Orcidaceae	II		
19.	Taro	<i>Colocasia esculenta</i>	Araceae		LC	
20.	Aank	<i>Calotropis gigantean</i>	Apocynaceae		LC	

Source: Field Survey/Consultation 2022

4.2.3 Important Species within Project area as per Ethnobotany

Ethnobotanical aspect within the project area was found to be significant. Different ethnic communities with their own distinct traditional healing practices were quite unique. The list of some ethnobotanical significant plants along with their uses are given in **Table 4.16**.

Table 4.16: List of Ethnobotanical Significant Plants within Project Area

SN.	Plants	Local Name	Uses
1.	<i>Terminalia chebula</i>	Haritaki	Gastrointestinal disorders
2.	<i>Terminalia bellirica</i>	Bahera	Tonic and gastrointestinal disorders
3.	<i>Cybidium aloifolium</i>	Harajor	Fractures and sprain
4.	<i>Eclipta prostrate</i>	Bhringraj	Skin allergy
5.	<i>Dalbergia sissoo</i>	Sisham	Furniture and wood craft
6.	<i>Bambusa sp.</i>	Bamboo	Weaving

Source: Field Survey/ Consultation 2022

4.2.4 Tree within ROW

Tree Inventory within ROW showed that all together there are 28,120 trees. Top 10 dominant species include Sal (*Shorea robusta*) 24.99 % followed by Sindure (*Bixa Orellana*) 14.61%, Banjhi (*Anogeissus latifolia*) 10.35%, Eucalyptus (*Eucalyptus citriodora*) 6.70%, Asna (*Terminalia elliptica*) 5.69%, Kyamuna (*Syzygium nervosum*) 2.91%, Datrungo (*Ehretia laevis*) 2.27%, Padke (*Annona squamosa*) 2.18%, Pyari (*Buchanania latifolia*) 2.18% and Teak (*Tectona grandis*) 2.17%. Forest unit wise list of trees within ROW of the road alignment is given in **Table 4.17**.

Table 4.17: Forest wise Number of Trees within ROW

S.N.	Name of Adjoining Forest	Trees within RoW	S.N.	Name of Adjoining Forest	Trees within RoW
1	National Forest	4431	18	Tuteshwor Collaborative forest	432
2	Settlement	3433	19	Bardibas Garanta Collaborative forest	354
3	Jungle saiya Collaborative Forest	2774	20	Adarsa Sadabahar Community Forest	180
4	Sahajnath Collaborative Forest	2338	21	Gadhimai Collaborative Forest	180
5	Sagarnath Forest Development Project	2071	22	Hatemalo Community Forest	179
6	Parsa National Park	1697	23	Brahababa Community Forest	173
7	Halkhoriya Collaborative Forest	1749	24	Nandeshwor Community Forest	159
8	Rangapur Collaborative Forest	1276	25	Kalika Community Forest	90
9	Tamagadhi Collaborative Forest	1009	26	Everest Community Forest	62
10	Janjyoti Community Forest	752	27	Janajyoti Community Forest	78
11	Fuljorbaba Collaborative Forest	864	28	Maltol Community Forest	109
12	Namuna Community Forest	740	29	Radhakrishna Community Forest	70
13	Shreejana Community Forest	650	30	Jana aakata Community Forest	73
14	Judbela Community Forest	639	31	Gairigau Community Forest	77
15	Bagmati Community Forest	504	32	Kamala Community Forest	28
16	Deurali Community Forest	462	33	Radhakrishna Community Forest	11
17	Pathlaiya community forest	466	34	Nagmadi Community Forest	10
Grand Total					28120

Source: Field Survey/Consultation 2022

Similarly, species wise number of trees within ROW along the proposed road alignment is given in **Annexure 4.5**. It is noticed that there are altogether 108 tree species with the greatest number of Sal (7060) followed by Sindure (3894), Banjhi (3003), Eucalyptus (1950), Asna (1746) and so on. There are 55 religious trees within RoW.

4.2.5 Wildlife within Project Area

As per the primary survey field observation and detailed consultations with wildlife department and local people, major fauna found within the project area is listed in **Table 4.18**.

Table 4.18: List of Potentially Occurred Wildlife Species around Project Area

S.N	Common Name	Scientific Name	Family	CITES	IUCN	GON
Mammals						
1.	Chital	<i>Axis axis</i>	Cervidae		LC	VU
2.	Nilgai	<i>Boselaphus tragocamelus</i>	Bovidae		LC	VU
3.	Rhesus monkey	<i>Macaca mulatta</i>	Cercopithecidae	II	LC	LC
4.	Terai Grey Langur	<i>Semnopithecus hector</i>	Cercopithecidae	I	NT	LC
5.	Northern Palm Squirrel	<i>Funambulus pennanti</i>	Sciuridae		LC	LC
6.	Indian Bush Rat	<i>Golunda ellioti</i>	Murinae		LC	LC
7.	Eurasian Wild Boar	<i>Sus scrofa</i>	Suidae		LC	LC
8.	Indian Crested Porcupine	<i>Hystrix indica</i>	Hystriidae		LC	DD
9.	Bengal Fox	<i>Vulpes bengalensis</i>	Canidae		LC	VU
10.	Common Leopard	<i>Panthera pardus</i>	Felidae	I	VU	VU
11.	Tiger	<i>Panthera tigris</i>	Felidae	I	EN	EN
12.	Elephant	<i>Elephas maximus</i>	Elephantidae	I	EN	EN
13.	Golden Jackal	<i>Canis aureus</i>	Canidae	III	LC	LC
14.	Barking Deer	<i>Muntiacus vaginalis</i>	Cervidae		LC	VU

Birds						
1.	Indian Peafowl	<i>Pavo cristatus</i>		III	LC	
2.	Greater Coucal	<i>Centropus sinensis</i>	Cuculidae		LC	
3.	Rose-ring Parakeet	<i>Psittacula krameri</i>	Psittacidae		LC	
4.	Black drongo	<i>Dicrurus macrocercus</i>	Dicruridae		LC	
5.	House Crow	<i>Corvus splendens</i>	Corvidae		LC	
6.	Common Tailorbird	<i>Orthotomus sutorius</i>	Cisticolidae		LC	
7.	House Sparrow	<i>Passer domesticus</i>	Passeridae		LC	
8.	Common Myna	<i>Acridotheres tristis</i>	Sturnidae		LC	
9.	Asian Koel	<i>Eudynamys scolopaceus</i>	Cuculidae		LC	
10.	Large billed Crow	<i>Corvus macrorhynchos</i>	Corvidae		LC	
11.	Red-vented Bulbul	<i>Pycnonotus cafer</i>	Pycnonotidae		LC	
12.	Cattle Egret	<i>Bubulcus ibis</i>	Ardeidae		LC	
13.	Little Egret	<i>Egretta garzetta</i>	Ardeidae		LC	
14.	Black Kite	<i>Milvus migrans</i>	Accipitridae		LC	
15.	Red headed vulture	<i>Sarcogyps calvus</i>	Accipitridae	II	CR	EN
16.	Shikra	<i>Accipiter badius</i>	Accipitridae	II	LC	
17.	Steppe Eagle	<i>Aquila nipalensis</i>	Accipitridae	II	EN	VU
18.	Kalij Pheasant	<i>Lophura leucomelanos</i>	Phasianidae	III	LC	
19.	Red Jungle Fowl	<i>Gallus gallus</i>	Phasianidae		LC	
20.	Oriental Turtle Dove	<i>Streptopelia orientalis</i>	Columbidae		LC	
21.	Spotted Dove	<i>Spilopelia suratensis</i>	Columbidae		LC	
22.	Slaty headed Parakeet	<i>Psittacula himalayana</i>	Psittacidae	II	LC	
23.	Common Kingfisher	<i>Alcedo atthis</i>	Alcedinidae		LC	
24.	Indian Roller	<i>Coracias benghalensis</i>	Coraciidae		LC	
25.	Indian Grey Hornbill	<i>Ocyrceros birostris</i>	Bucerotidae		LC	
26.	Yellow wagtail	<i>Motacilla flava</i>	Motacillidae		LC	
27.	Grey wagtail	<i>Motacilla cinerea</i>	Motacillidae		LC	
28.	Eurasian Tree Sparrow	<i>Passer montanus</i>	Passeridae		LC	
29.	Scarlet Minivet	<i>Pericrocotus speciosus</i>	Campephagidae		LC	
30.	Grey Bushchat	<i>Saxicola ferreus</i>	Muscicapidae		LC	
31.	Verditer Flycatcher	<i>Eumyias thalassinus</i>	Muscicapidae		LC	
32.	Rufous Treepie	<i>Dendrocitta vagabunda</i>	Corvidae		LC	
33.	Coppersmith Barbet	<i>Megalaima haemacephala</i>	Megalaimidae		LC	
34.	Oriented Pied Hornbill	<i>Anthraceroceros albirostris</i>	Bucerotidae		LC	
35.	Pied Kingfisher	<i>Ceryle rudis</i>	Cerylidae		LC	
36.	Alexandrine Parakeet	<i>Psittacula eupatria</i>	Psittacidae		NT	
37.	Large -tailed Nightjar	<i>Caprimulgus macrurus</i>	Caprimulgidae		LC	
38.	Yellow -footed Green Pigeon	<i>Treron phoenicoptera</i>	Columbidae		LC	
39.	Common Kestrel	<i>Falco tinnunculus</i>	Falconidae		LC	
40.	Asian Paradise - flycatcher	<i>Terpsiphone paradisi</i>	Corvidae		LC	
41.	Small Minivet	<i>Pericrocotus cinnamomeus</i>	Corvidae		LC	
42.	Common Iora	<i>Aegithina tiphia</i>	Corvidae		LC	
43.	Plain Prinia	<i>Prinia inornata</i>	Cisticolidae		LC	
44.	Baya Weaver	<i>Ploceus philippinus</i>	Passeridae		LC	
Amphibians						
1.	Asian black-spined toad	<i>Duttaphrynus melanostictus</i>	Bufonidae		LC	
2.	Indian bull frog	<i>Hoplobatrachus tigerinus</i>	Dicroglossidae	II	LC	
3.	Common Indian tree frog	<i>Polypedates maculatus</i>	Rhacophoridae		LC	
4.	Indian softshell turtle	<i>Aspideretes gangeticus</i>	Anguillidae	I	EN	
Reptiles						
1.	Common garden lizard	<i>Calotes versicolour</i>	Agamidae		LC	
2.	Yellow-bellied house gecko	<i>Hemidactylus flaviviridis</i>	Gekkonidae		LC	

3.	Keeled indianmabuya	<i>Eutropis carinata</i>	Scincidae		LC	
4.	Bengal Monitor Lizard	<i>Varanus bengalensis</i>	Varanidae	I	NT	
5.	Indian gamma snake	<i>Boiga trigonata</i>	Colubridae		LC	
6.	Asiatic rat snake	<i>Ptyas mucosa</i>	Colubridae	II	LC	
7.	Buff-striped keelback	<i>Amphiesma stolatum</i>	Natricidae		LC	
8.	Spectacled cobra	<i>Naja naja</i>	Elapidae	II	LC	
Butterflies						
1.	Restricted Demon	<i>Notocrypta curvifascia</i>	Hesperiidae		LC	
2.	Rice Swift	<i>Borbo cinnara</i>	Hesperiidae		LC	
3.	Dark Palm Dart	<i>Telicota aneilla</i>	Hesperiidae		LC	
4.	Common Mormon	<i>Papilio polytes</i>	Papilionidae		LC	
5.	Lime Butterfly	<i>Papilio demoleus</i>	Papilionidae		LC	
6.	Common Grass Yellow	<i>Eurema hecabe</i>	Pieridae		LC	
7.	Mottled Emigrant	<i>Catopsilia pyranthe</i>	Pieridae		LC	
8.	Long-banded Silverline	<i>Spindasis lohita</i>	Lycaenidae		LC	
9.	Common Cerulean	<i>Jamides celeno</i>	Lycaenidae		LC	
10.	Common Pierrot	<i>Castalius rosimon</i>	Lycaenidae		LC	
11.	Pale Grass Blue	<i>Pseudozizeeria maha</i>	Lycaenidae		LC	
12.	Striped Tiger	<i>Danaus genutia</i>	Nymphalidae		LC	
13.	Common Crow	<i>Euploea core</i>	Nymphalidae		LC	
14.	Common Evening Brown	<i>Melanitis leda</i>	Nymphalidae		LC	
15.	Common Sergeant	<i>Athyma perius</i>	Nymphalidae		LC	
16.	Painted Lady	<i>Vanessa cardui</i>	Nymphalidae		LC	
17.	Blue Pansy	<i>Junonia orithiya</i>	Nymphalidae		LC	
18.	Peacock Pansy	<i>Junonia almanac</i>	Nymphalidae		LC	
19.	Lemon Pansy	<i>Junonia lemonias</i>	Nymphalidae		LC	
Fish (Recorded from Bagmati and Kamala River)						
1.	Indian Mottled Eel	<i>Anguilla bengalensis bengalensis</i>	Anguillidae		NT	
2.	Chaguni	<i>Chagunius chagunio</i>	Cyprinidae		LC	
3.	Catla	<i>Catla catla</i>	Cyprinidae		LC	
4.	Gurdi	<i>Labeo gonius</i>	Cyprinidae		LC	
5.	Rohu	<i>Labeo rohita</i>	Cyprinidae		LC	
6.	Mungri	<i>Clarius batrachus</i>	Clariidae		LC	
7.	Indian spiny eel	<i>Macrognathus pancalus</i>	Mastacembelidae		LC	
8.	Tengra	<i>Mystus tengra</i>	Bagridae		LC	
9.	Pothi	<i>Puntius sophore</i>	Cyprinidae		LC	
10.	Olive barb	<i>Systemus sarana</i>	Cyprinidae		LC	
11.	Bhote/ Spotted snakehead	<i>Channa punctatus</i>	Channidae		LC	
12.	Guntea loach	<i>Lepidocephalus guntea</i>	Cobitidae		LC	
13.	Mrigal	<i>Cirrhinus cirrhosus</i>	Cyprinidae		LC	

Source: Field Survey/Consultation 2022, www.iucnredlist.org, www.cites.org

4.2.6 Status of Wildlife Habitat within Project Area

KDP Road section is passing along to Parsa National Park (PNP) touching the southern boundary near Pathlaiya. a section of 14 km stretch, from Chainage km 350+00 to km 366+420) is running parallel to the Parsa National Park as shown in **Figure 4.8**.

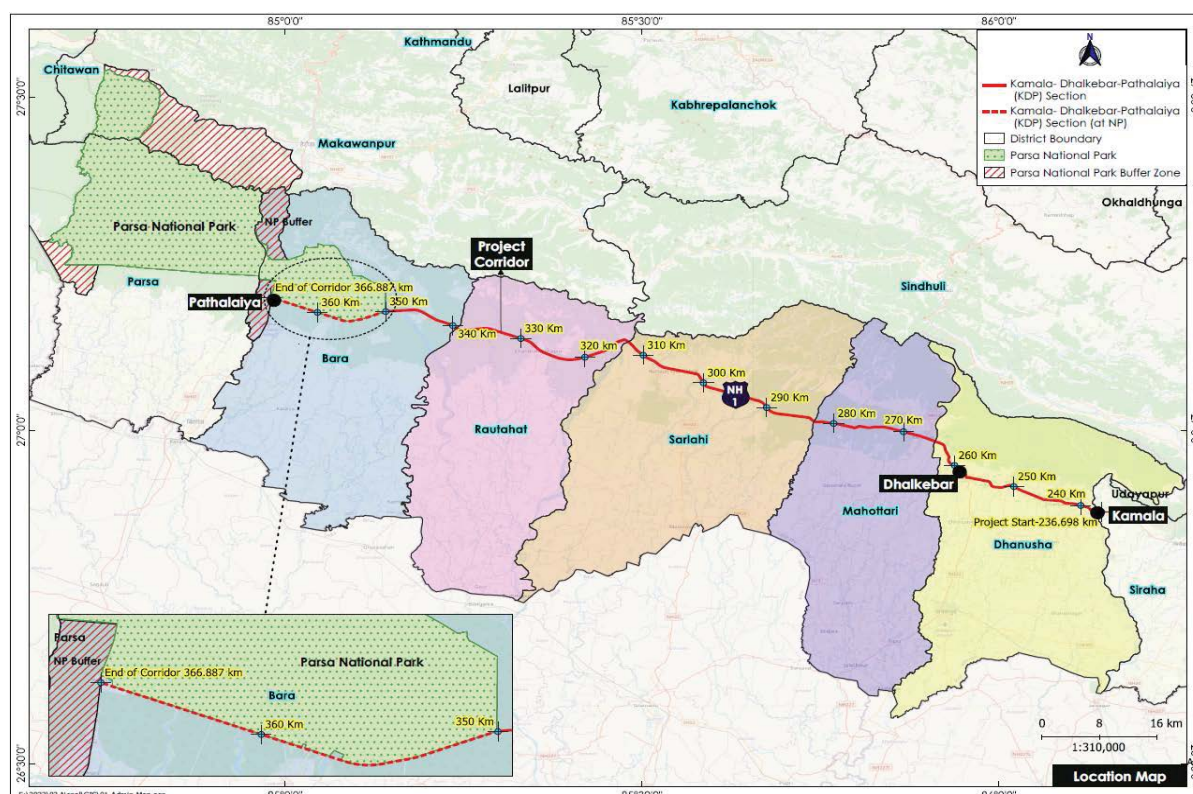


Figure 4.8: Project Road Passing Along the Parsa National Park

Parsa National Park (PNP):

Parsa National Park (PNP) is located in central Nepal of Province 2, 3 in Parsa, Bara, and Makwanpur districts. It adjoins Chitwan National Park (CNP) on its western side. PNP was initially established as **Parsa Wildlife Reserve (PWR)** in 1984 with an area of 499 km². Additionally, an area of 128.39 km² of Bara district was added to it including Halkhorlia lake as one of the major wildlife habitat making a total area of 627.39 km² covering parts of Parsa, Bara, and Makwanpur districts Through the gazette of Bhadra 07, 2072 (August 24, 2015). With this extension, the status of Wildlife Reserve was changed to **National Park** on Ashadh 19, 2074 (July 03, 2017). About 65 km of East-West highway passes through Buffer Zone (BZ) and the Park as well.

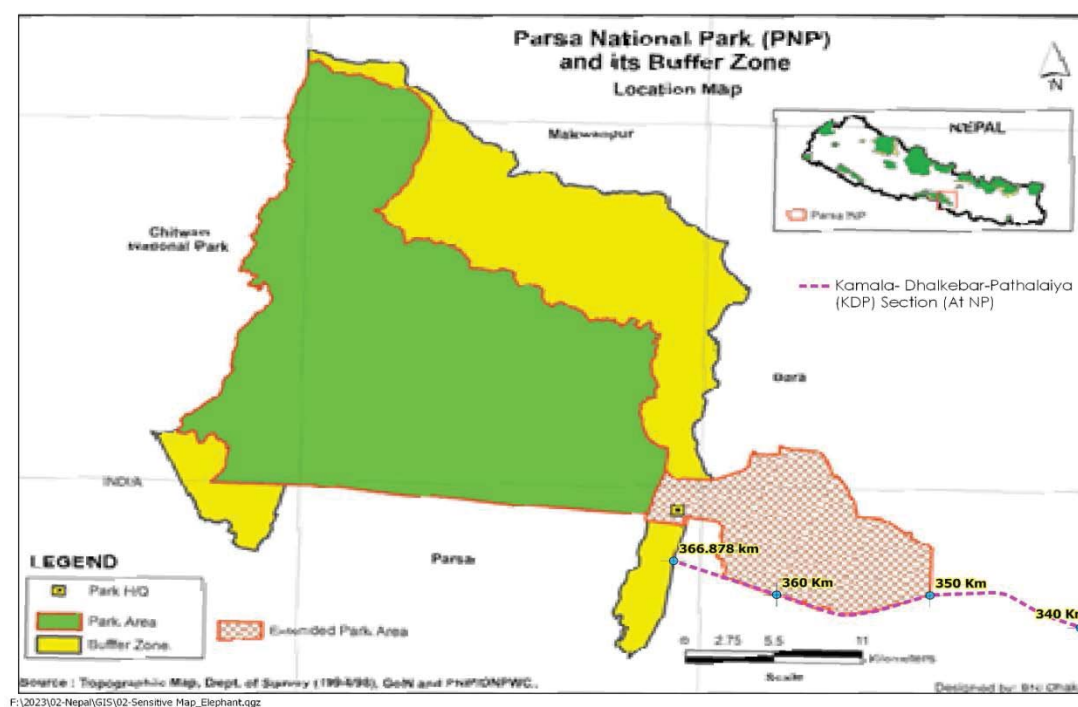
Table 4.19: Salient Features of Parsa National Park

Parsa WR Declaration	Parsa Wildlife Reserve declared on 18 th April, 1983 (2040 Baisakh 05, Monday) and gazetted on 21st May, 1984 (2041 Jestha 08); Area- 499 km ² .Districts Covered- Parsa and Makwanpur.
Community Involvement	Park and People Programme was launched in 1994
Buffer Zone Declaration	Declaration of Buffer Zone on 27th June 2005 (2062 Ashadh 13) Area- 286 km ² .Districts Covered- Bara, Parsa and Makwanpur
Area Extension	National Forest of 129 km ² in Bara district including Halkhorlia Lake is added to the Park on 24th Aug, 2015 (2072 Bhadra 07)
Parsa NP Declaration	Parsa Wildlife Reserve has been converted into Parsa National Park by government decision on 8th May, 2017 (2074 Baisakh 25) and Gazetted on 3rd July, 2017 (2074 Ashadh 19); Area- 628 km ² ; Districts- Parsa, Bara and Makwanpur.
Park HQ	Aadhavar, Bara District, Bagmati Zone, Pradesh 2, Nepal
Biodiversity	Mammals- 37 species; Birds- 490 species; Reptiles- 13 species; Butterflies-31 species; Pisches- 8 species; Plants- 336 species
Endangered Species	Asian Elephant- 60 to 65; Tiger- 7; Gaur- 105; Rhinoceros- 5
IUCN Category	II

Source: Parsa National Park Office

4.2.7 Ecological Significance

PNP covers a part of Terai Bhawar area having 90% Sal forest (dominated by *Shorea robusta*) and 10% other mixed hardwood and riverine forest of Sissoo (dominated by *Dalbergia sissoo*) and Khair (*Acacia catechu*) forests with small area of grassland. The strategic location of the Park provides opportunities to link the PAs of Nepal from north to south and east to west. PNP is connected with Chitwan National Park-CNP in the west, which is further extended westward and linked to Mahabharat forests in the north through Barandabhar forest, and to Indian PAs in the south through Valmiki Tiger Reserve-VTR. In the east, the PNP is connected to the national forests extending up to Bagmati River in Rautahat district. The Park also exhibits potential to link north through a stretch of forest near Lothar in Makwanpur. Together with VTR of India, CNP and PNP of Nepal, a total of coherent 2,460 km² represents the Tiger Conservation Unit (TCU).



Source: Parsa National Park Office⁸.

Figure 4.9: Location of Parsa National Park and its Buffer Zone

4.2.8 Wildlife Corridor Connectivity

PNP is connected with Chitwan National Park-CNP in the west, which is further extended westward and linked to Mahabharat forests in the north through Barandabhar forest, and to Indian PAs in the south through Valmiki Tiger Reserve-VTR. In the east, the PNP is connected to the national forests extending up to Bagmati River in Rautahat district. The Park also exhibits potential to link north through a stretch of forest near Lothar in Makwanpur. Together with VTR of India, CNP and PNP of Nepal, a total of coherent 2,460 km² represents the Tiger Conservation Unit (TCU).

Parsa National Park, serves as a wildlife corridor and habitat for tigers, elephants, and other flagship species. Establishment of ecological connectivity of PNP with other protected areas such as Chitwan National Park and Valmiki Tiger Reserve are shown in **Figure 4.10**.

⁸ PNP 2018, Parsa National Park and its Buffer Zone Management Plan, FY 2075/76-2079/80
Parsa National Park Office, Aadhar, Bara, Nepal



Source: Abhaya Raj Joshi 2022⁹

Figure 4.10: Ecological Connectivity of Parsa National Park with other Protected Areas

4.2.9 Elephant Distribution

Asian elephant (*Elephas maximus*) is a mega-herbivore. Nationally assessed as Endangered as per both the Nepal Red list series¹⁰ and the IUCN Red list Asian elephant are also listed on CITES Appendix I species and Nepal's Protected species as per NPWC Act 1973. In Nepal it is distributed in the lowlands in four isolated population eastern, central, western and far western regions of Nepal (DNPWC/MoFSC/GoN, 2009). Project area falls under central and eastern parts of the elephant population in Nepal as shown in **Figure 4.11** and **Figure 4.12**.

An attempt has been made to understand the historical distribution of Elephant near the KDP Road section (Pathaliya). KDP Road section falls in the central region, eastern parts of the elephant population in Nepal, it is estimated that a population of 25 to 30 elephants are largely resident within the Parsa Wildlife Reserve and Chitwan National Park (ten Velde 1997; DNPWC 2008). Elephants in Parsa National Park are dispersing into Chitwan region in search of water and more suitable habitat during the dry months starting from February-May (Petra Furaha ten Velde 1997¹¹). Movement of elephants outside the Parsa National Park and associated wildlife reserve was evident due to unsuitable habitat in all seasons, reduced supply of food and water, and encroachment by human beings (Puja Sharma 2019¹²).

⁹ <https://india.mongabay.com/2022/05/tiger-movements-between-india-and-nepal-become-increasingly-restricted-even-as-numbers-rise/>

¹⁰ Jnawali, S.R., et al. (2011), The Status of Nepal Mammals: The National Red List Series, Department of National Parks and Wildlife Conservation, Kathmandu, Nepal.

¹¹ A Status Report on Nepal's Wild Elephant Population Petra Furaha ten Velde, 1997

¹² Sharma, P., H. Adhikari, S. Tripathi, A.K. Ram & R. Bhattarai (2019). Habitat suitability modelling of Asian Elephant *Elephas maximus* (Mammalia: Proboscidea: Elephantidae) in Parsa National Park, Nepal and its buffer zone. *Journal of Threatened Taxa* 11(13): 14643–14654;
<https://doi.org/10.11609/jott.4467.11.13.14643-14654>

There is a noticeable change in elephant distribution since 2007 can be well explained by the studies conducted by Narendra M. B. Pradhan Et al.

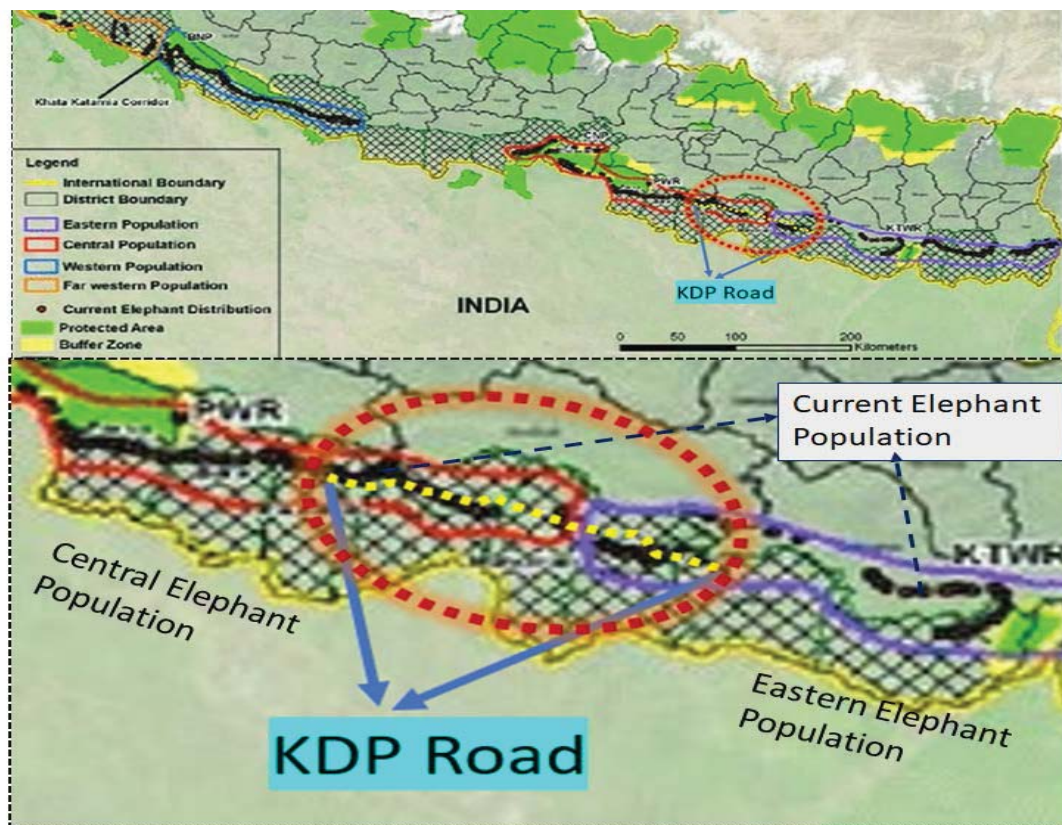
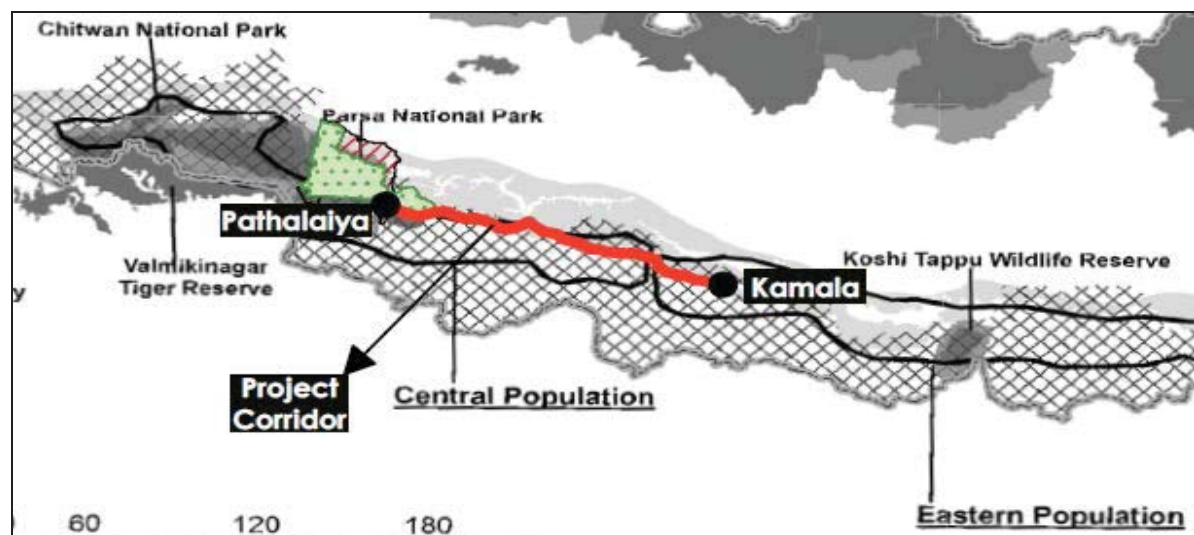


Figure 4.11: Elephant Distribution (brown dots) as in 2011 near the KDP Road Section

Same trends were also noticed in the studies conducted by Kanchan Thapa in the year 2019, reported active elephant movement near the KDP Road section i.e., central region of Nepal/ Parsa National Park and Chitwan National Park. Elephant range distribution near the KDP Road section reported by Kanchan Thapa (2019) was shown in the **Figure 4.12**.



Source: <https://doi.org/10.1371/journal.pone.0216504.g002>

Figure 4.12: Elephant Distribution Range near KDP Road

Elephant movement was noted between the road stretch of km 363+100 to km 334+500. By connecting the information gathered by all possible sources estimated population was between 6-7 individuals which are partial migrants with in the Parsa National Park and associated community reserves. Movement of elephant was noticed near the village Piluwa Village which is 300 m

distance from the km 357+800, Tangia Basti 2.5 km distance from the km 351+000. Residential and migratory elephants move from Chitwan National Park towards the east in Bara and Rautahat and destroy crops massively. The photographs of evidence of Elephants presence are given in **Annexure-4.7**. Also, the stakeholder's consultation regarding wildlife movement is given in **Annexure-4.8**.

4.2.10 Elephant Movement Mapping

Project Road:

Using the primary data collection by the project team, distribution map of elephant movements along the project road was prepared. Majority of the elephant movement was noticed between the chainage starting from Pathlaiya to Nijgadh area. Near the project road pattern of elephant movement is as follows,

- Pathlaiya CH 365+600 to CH 349+100 along the Parsa National Park and nearby community reserves forests namely Shreejana Community Forest Hatemalo, Rangapur, Tamagadhi, Adarsa Sadabahar, Sahajnath, Halkhoriya, Pathlaiya and other community forest. In general, a group of 5-7 elephant movement were recorded as per the primary survey findings supported by consultations with forest, local forest users and road commuters connecting the link between forest-local people and road users,
- Second pattern of elephant movement was to be in monsoon season starting from June to September with a estimated group of 12-18 annually. This is a seasonal migration from the Chitwan National Park to Parsa National Park which is connected with the KDP road section from CH 365+600 to CH 349+100 and nearby community reserves forests.
- **Peak Road Crossing Seasons:** Connecting the information collected from different stakeholders, two peak seasons for road crossings were recorded which include one during maize or wheat maturing time (June – July) and other during paddy maturing time (Sep. – Nov.). Most of the movement of elephants were reported to occur at night.
- Within the Parsa National Park there's a naturally occurring wetland with a pond of about 3 sq.km. known as Halkhoriya. The pond was regularly visited by elephants, especially during the dry season, (April to May) when water inside the Reserve Forest under Parsa National Park was scarce. Halkhoriya is 3.8 km distance from km 358+100. Elephant Movement was more frequent in dry season.



Figure 4.13: Halkhoriya Wetland

Elephant distribution map was prepared by integrating the primary evidence of presence of elephants collected during the study period as shown in **Figure 4.14** below.

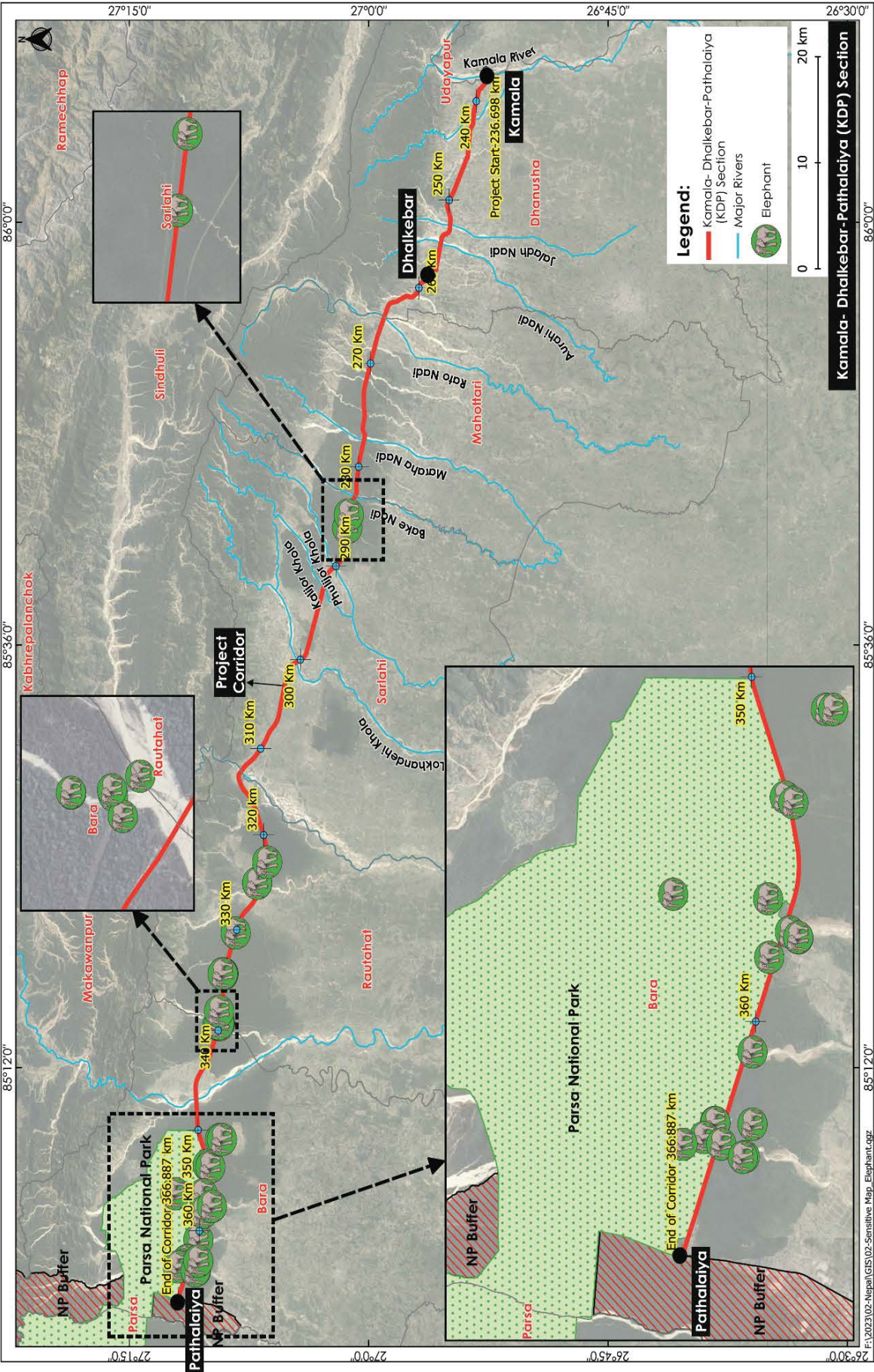


Figure 4.14: Distribution of Elephants along the Project Corridor along with zoomed portion near Parsa NP section from CH 350+600 to end

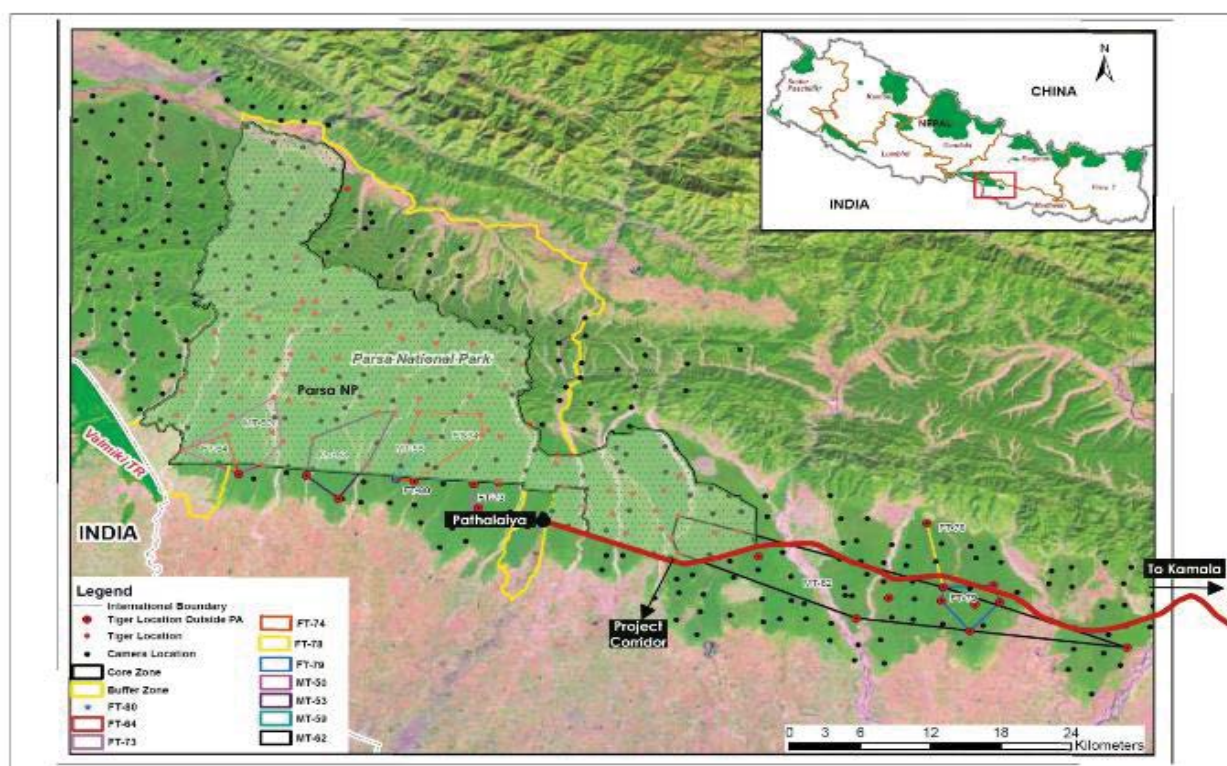
Based on the primary findings, main elephant crossing points were between the section CH 350 to 366 which is near the Parsa National Park and Halkhoriya wetland near to CH 358+100. Followed by Dhansar river near CH 339+300 as per the consultations elephant movement near this chainage is of refugee population where no migration of the group (2 to 3 individuals) is envisaged.

4.2.11 Tiger and Ungulates Movement

Tiger (*Panthera tigris*) is a flagship species that inhabits a wide range of interconnected habitats, it has been listed as ‘Endangered’ in the IUCN’s Red List and under Appendix I in Convention on International Trade in Endangered Species of Wild Fauna and Flora. Nepal has also listed the species under Schedule I in its National Parks and Wildlife Conservation Act, 1973.

Tiger Movement near KDP road

As per the Status of Tigers¹³ in Nepal, 41 tigers were estimated with Minimum individuals identified was 31 tigers in Parsa National Park and adjoining forests. Tiger population Near Parsa National Park was increased from 18 to 41 individuals from the year 2018 to 2022. With reference to the project road, as per the recent tiger census, it was noticed that range distribution of two Tigers namely FT-79 & FT-78 were reported part of the project road. These locations were identified between the chainage 333+100 to 327+700, this section is outside the Parsa National Park. Map illustrating the distribution of tigers near the project road (Pathlaiya) as per the tiger census 2022 is shown in the **Figure 4.15**.



Survey was conducted with the help of forest department trained personnel walked along high probability tiger sign areas such as forest trails, fire lines and more prominently along the riverbeds, bridges, and streams. Considerable number of signs of tiger pugmarks, prey signs including dung/pellets, footprints, sightings and consultation was done with frequent livestock grazing and fodder collection. Distribution of Tigers along the project corridor as per field study are shown in **Figure 4.16** and the evidence of presence of tiger given in **Annexure-4.7**.

4.2.12 Prey Animals and Ungulates

Major prey species were recorded, which include spotted deer (*Axis axis*), Sambar (*Rusa unicolor*), Barking deer (*Muntiacus vaginalis*), Blue bull (*Boselaphus tragocamelus*), Wild boar (*Sus scrofa*), and Gaur (*Bos grunniens*). Rhesus macaque (*Macaca mulatta*) and Grey langur (*Semnopithecus entellus*) were commonly sighted along the project road. Except direct evidence of Barking deer & Gaur, direct evidence was noticed along the project road. Distribution of Ungulates along the project road are also shown in **Figure 4.16** and evidence of presence (direct sightings) along the Project road is given in **Annexure-4.7**.

Major ungulates between the km 364+00 to 347+500 includes spotted deer, Sambar deer, Barking deer, Wild boar and Gaur. Ungulates reported in rest of the project road includes blue bull (Neel Gai), Wild boar & spotted deer. However spotted deer was not noticed from the km 268+500 to 236+698, blue bull was more predominant in these section due the influence of agricultural crops.

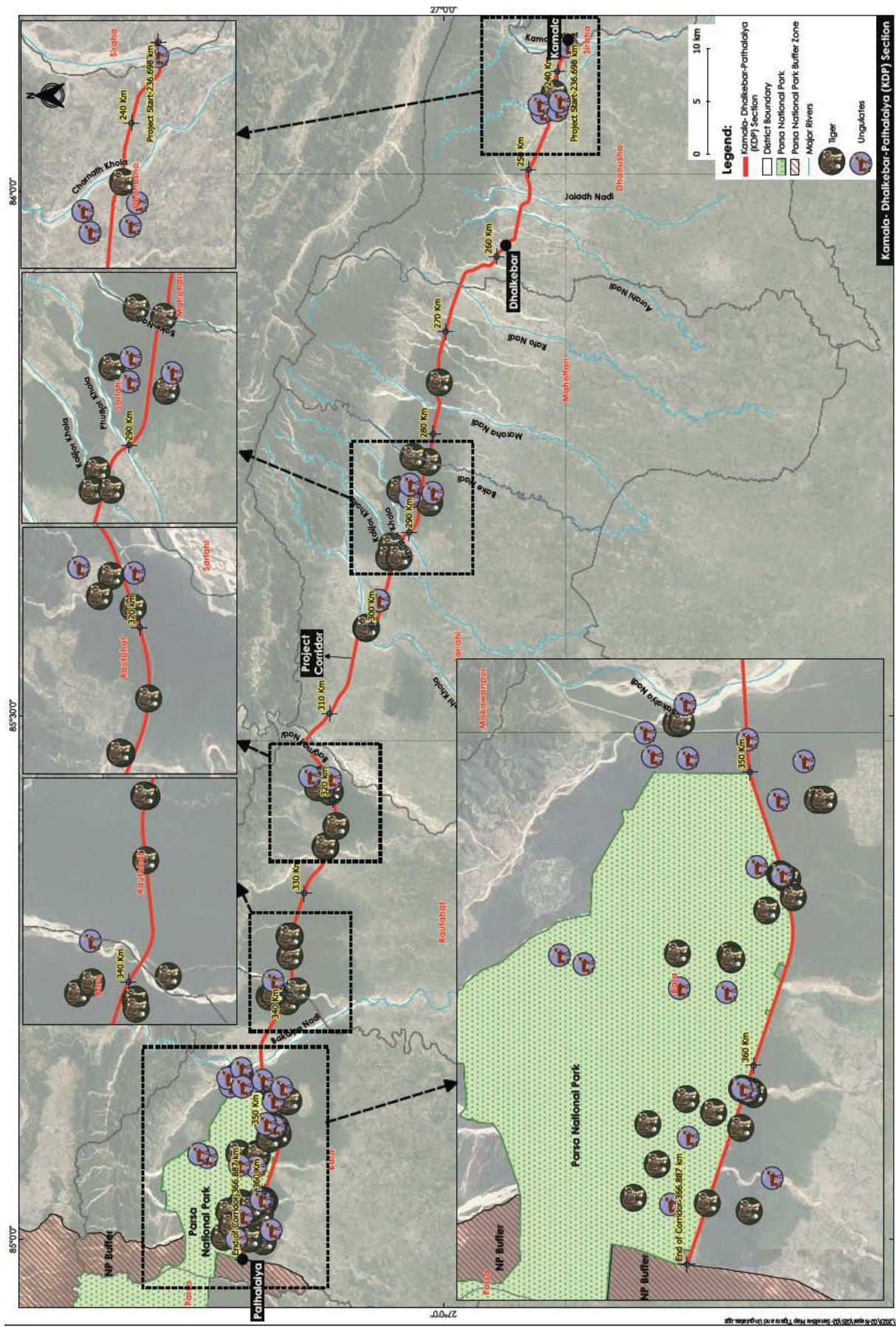


Figure 4.16: Distribution of Tiger and Prey Animals along the Project Corridor

Prey Animals and Ungulates

Major prey species were recorded, which include spotted deer (*Axis axis*), Sambar (*Rusa unicolour*), Barking deer (*Muntiacus muntjak*), Blue bull (*Boselaphus tragocamelus*), Wild boar (*Sus scrofa*), and Gaur (*Bos grunniens*). Rhesus macaque (*Macaca mulatta*) and Grey langur (*Semnopithecus entellus*) were commonly sighted along the project road. Except for direct evidence of Barking deer & Gaur, direct evidence was noticed along the project road. Major ungulates between the km 364+00 to 347+500 include spotted deer, Sambar deer, Barking deer, Wild boar and Gaur. Ungulates reported in rest of the project road includes Blue bull, Wild boar & spotted deer. However spotted deer was not noticed from the km 268+500 to 236+698, blue bull was more predominant in these section due the influence of agricultural crops.

Arboreal animals

Major arboreal animals reported near Parsa National Park¹⁴ includes species such as Asian palm civet (*Paradoxurus hermaphroditus*), Rhesus monkey (*Macaca mulatta*) and Terai Grey Langur (*Semnopithecus hector*), Oriental garden lizard (*Calotes versicolour*), Monitor lizard (*Varanus bengalensis*), Green tree pit viper (*Trimeresurus albolabris*) & Golden skink (*Eutropis carinata*). Out of which two species namely Rhesus monkey (*Macaca mulatta*) and Terai Grey Langur (*Semnopithecus hector*) were noticed during field survey.

	
Spotted Deer 1.8 km from CH 363+300	Nepal Grey Langur at multiple location
	
Rhesus macaque at CH:364+200, CH:357+500, CH:349+200, CH:340+900, CH:336+400, CH:330+700	Nilgai Juvenile near CH 236+500

Figure 4.17: Prey Animal Directing Sightings along the Project Road

¹⁴ Bhattarai S, Pokheral CP, Lamichhane BR, Regmi UR, Ram AK, Subedi N. 2018. Amphibians and reptiles of Parsa National Park, Nepal. Amphibian & Reptile Conservation 12(1) [General Section]: 35–48 (e155)

4.2.13 Assessment of Avifauna

A total of 44 bird species were reported near the Parsa National Park and associated community reserves.

Common birds include Peafowl, Rose-ring Parakeet, Black drongo, Kalij Pheasant, Red Jungle Fowl, Oriental Turtle Dove, Spotted Dove, Slaty headed Parakeet, Verditer Flycatcher, Rufous Treepie, Coppersmith Barbet, Oriented Pied Hornbill, Pied Kingfisher, Alexandrine Parakeet, Common Kestrel, Asian Paradise -flycatcher, Small Minivet and Common Iora. Threatened species includes Steppe Eagle (*Aquila nipalensis*) and Alexandrine Parakeet (*Psittacula eupatria*).

Vultures

Himalayan griffon vulture (*Gyps himalayensis*), it is listed as Near Threatened as per the IUCN Red List. A pair of individuals has been noticed near the dumping site at the bank of Puljor River near at Chainage 292+700, roosting site was noticed 350 m towards north from the project road. Location of the vulture sighted is shown in the **Figure 4.18**.



Figure 4.18: Location of Himalayan Griffon Vulture

Nesting of birds:

No bird nests were found along the proposed right of way, suggesting that this area does not serve as a nesting site for local bird populations. Instead, bird nesting is primarily confined to the protected areas within the interior forest patches of Parsa National Park and nearby community forests.

4.2.14 Status of Aquatic Life Habitat within Project Area

Many seasonal streams and perennial rivers flow within the project area. Seasonal streams like Pasaha, Lamaha Khola and important river like Bagmati provide regulatory ecosystem services to the project area. Additionally, there are few natural and man-made water holes in the Parsa National Park that are important in creating wildlife-valuable water resource during summer season water holes. All these aquatic streams like Pasaha, Lamaha Khola and important river like Bagmati support diverse fish fauna including globally threatened Indian Mottle Eel (*Anguilla bengalensis bengalensis*), CITES indexed amphibian species like Indian Bull Frog (*Hoplobatrachus tigerinus*) and Indian Soft-shell Turtle (*Aspideretes gangeticus*) are also found near the streams of project area near the bridges/river crossings namely 329+666 Amu – 1, 333+842 Lamaha, 339+381 Dhansar, 353+612 Terhakilo, 357+337 Pasaha, 361+003 Balganga & 363+687 Dudhaura.

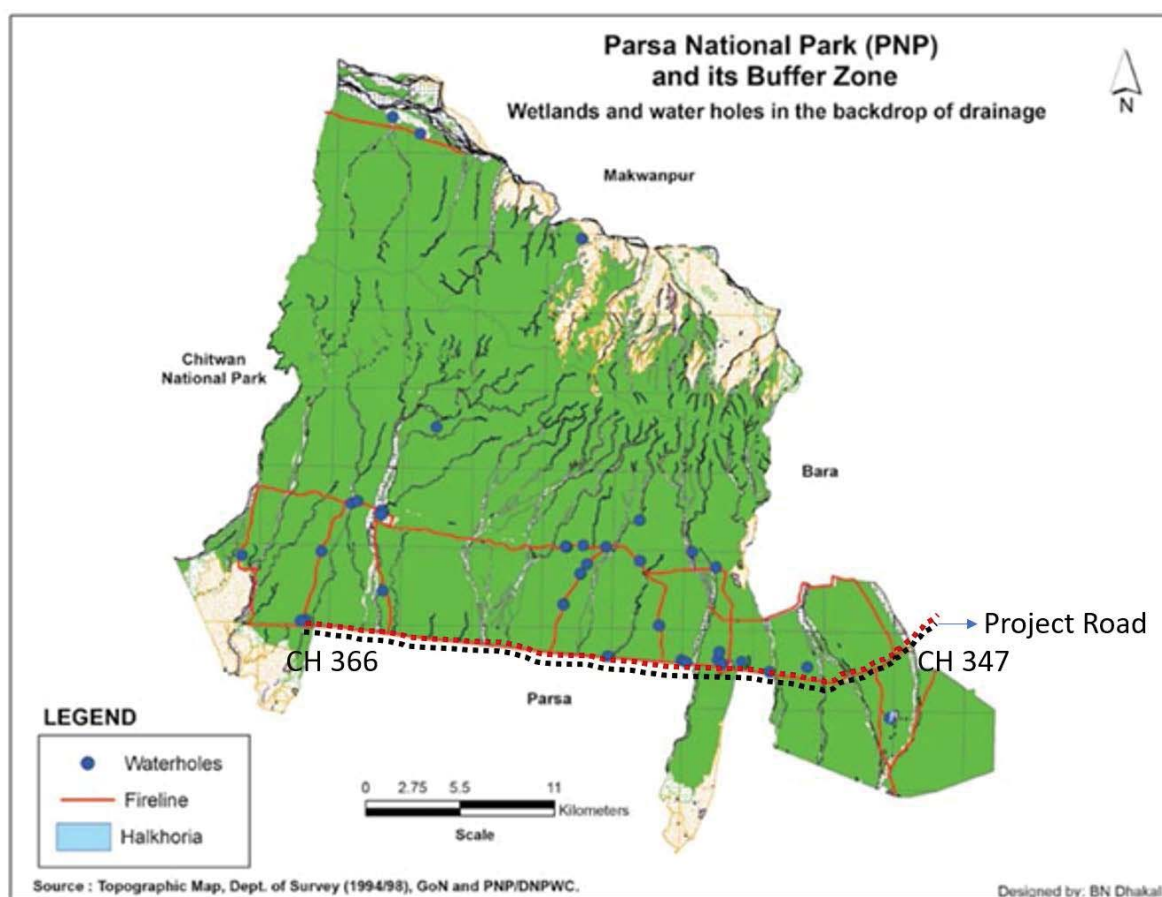


Figure 4.19: Locations of Existing Waterholes in the Parsa National Park

4.2.15 Critical Habitat Assessment

Based on the information collected in section above and further desk-based review has been carried out using IBAT screening, referring to the IUCN red list data and other relevant literature a critical habitat assessment (CHA) was carried out as per ESS6 of world bank.

ESS6 states the following:

- Criterion (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 (b): Habitat of significant importance to endemic or restricted-range species
- Criterion (c): Habitat supporting globally or nationally significant concentrations of migratory or congregatory species
- Criterion (d): Highly threatened or unique ecosystems
- Criterion (e): Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d)

Summary of Critical Habitat-Qualifying biodiversity Assessment in the Project area are shown in **Annexure I of BMP** and **Annexure 4.9** of this report. IBAT data generated for 50 km buffer generate list of 1229 species of fauna. Among them, 38 species are considered critical as per Critical Habitat-Qualifying biodiversity Assessment which includes Reptiles 12 species, Birds 16 species and Mammals 10 species. Out of 38 species 2 species namely Asian elephant and Royal Bengal Tiger were reported near the project area. IBAT report is given as **Annexure II of BMP**. Apart from this prey animals for tiger such as Sloth Bear, Striped hyaena are considered as they are

Endangered in the Nepal red list. Barking deer, Spotted deer, Wild boar, Nilgai & Gaur were also considered under Criterion (e) as these species are required as prey to support viable tiger populations, and therefore essential to maintain the ecological functions or characteristics that are needed to maintain the viability of the biodiversity values.

An attempt has been made to establish the status of population at global scale as per IUCN range distribution maps and local scale by site investigation studies, stake holder consultation with locals & forest/wildlife department. Movement of higher vertebrates is more evident for namely Asian elephant (*Elephas maximus*) and Royal Bengal Tiger (*Panthera tigris*).

Asiatic elephant (*Elephas maximus*): The Asian elephant is distributed across 13 range countries with a population of about 41,000 to 52,000 (Sukumar 2006; Williams et al. 2020). The number of Nepal's resident elephants is estimated in 227 individuals. Number of elephants known to be present near the project road ranges from 4-8 individuals, however during monsoon season it will be increase from 12-18 individuals. Therefore, the area can be considered as a refuge habitat of the Asian elephant. Nevertheless, prior precautionary measures will be taken to avoid any disturbance to the Asian elephant in the project area.

Tiger (*Panthera tigris*): The Tiger is a keystone species, crucial in maintaining the integrity of the ecosystems in which it thrives. Based on the most recent national estimates, the global Tiger population numbers between 3,726 and 5,578 individuals and is restricted to ten countries. Current surveys estimate a population of 235 tigers in Nepal (July 2022). With reference to the project road, as per the recent tiger census, it was noticed that range distribution of two Tigers namely FT-79 & FT-78 were reported part of the project road. These locations were identified between the km 333+100 to 327+700, this section is outside the Parsa National Park.

Table 4.20: Species level Critical Habitat-Assessment in the Project Road

Biodiversity type (Species/ Site)	Critical Habitat criterion qualified ¹⁵					Justification
	(a)	(b)	(c)	(d)	(e)	
Asian Elephant	√	X	X	X	X	Number of elephants known to be present near the project road ranges from 4-8 individuals, however during monsoon season it will be increase from 12-18 individuals, which represents up to 8% of the national population. Therefore, the area a refuge habitat of significant important for Asian elephant. - From Km 130-100, it was noticed that the elephant movement is mostly seasonal during the larger trans-border migratory herds 12-18 individuals from the Chitwan National Park. - From Km 100-50, it was noticed that the elephant movement is mostly due to the Small and isolated populations of wild elephants' number ranging from 4-7 individuals. The assessment of critical habitat reveals the habitat within the project area has significant importance for the survival of Asian elephants in Nepal, and this species is therefore included as a critical habitat feature. Prior precautionary (avoidance) measures will be taken to avoid any disturbance to the Asian elephant in the project area.
Royal Bengal	√	X	X	X	X	With reference to the project road, as per the recent tiger census, it

¹⁵√ = likely attracting Criterion/ Criteria; x = not attracting Criterion/ Criteria; ? = possibly qualifies area as Critical Habitat. Based on available information.

Biodiversity type (Species/ Site)	Critical Habitat criterion qualified ¹⁵					Justification
	(a)	(b)	(c)	(d)	(e)	
Tiger						was noticed that range distribution of two Tigers namely FT-79 & FT-78 were reported part of the project road. These locations were identified between the km 333+100 to 327+700, this section is outside the Parsa National Park. As per the site investigation, 8-10 sightings (pug marks) locations were identified near the different river crossings along the project road. The assessment of critical habitat reveals Royal Bengal Tiger occur in several parts of the KDP route, representing more than 4 individuals and exceeds 1.7% of the national population. The habitat within the project area has significant importance for the survival of tigers in Nepal, and this species is therefore included as a critical habitat feature. Construction of the road could impact tigers through fragmentation or road kills, however these impacts can be addressed through provision of appropriate wildlife crossings.
Sloth Bear	√	X	X	X	X	National Red List: Endangered IUCN Red List Category: Vulnerable Sloth Bear preferring habitat of forest, savanna, shrubland, grassland, artificial/terrestrial, historical distribution includes a large portion of India, Bangladesh, and Sri Lanka, as well as the southern lowlands of Nepal and presumably Bhutan. No data available related to local and global population As per the IUCN range distribution map, Sloth bear is distributed near the project area. https://www.iucnredlist.org/species/13143/166519315 Hence the species is qualifying as a criterion (a) species. Therefore, it is identified that the project area is a critical habitat for the particular species and the habitat has significant importance for survival this species at the national level
Striped hyaena	√	X	X	X	X	National Red List: Endangered IUCN Red List Category: Near Threatened Striped hyaena preferring habitat of forest, savanna, shrublands, grasslands, wetlands (India). Species widely distributed from Africa, India, Himalayan foot hills and Nepal No data available related to local and global population As per the IUCN range distribution map, Striped hyaena is distributed near the project area. https://www.iucnredlist.org/species/10274/45195080 Hence the species is qualifying as a criterion (a) species. Therefore, it is identified that the project area is a critical habitat for the particular species.
Barking deer	X	X	X	X	√	National Red List: Vulnerable IUCN Red List Category: Least Concern

Biodiversity type (Species/ Site)	Critical Habitat criterion qualified ¹⁵					Justification
	(a)	(b)	(c)	(d)	(e)	
						Barking deer preferring the habitats such as forest, savanna, shrubland, grassland, artificial/terrestrial. This species occurs in Sri Lanka, most of India, northern Pakistan, Nepal, Bhutan, Bangladesh and southern China No data available related to local and global population As per the IUCN range distribution map, Barking deer is distributed near the project area. https://www.iucnredlist.org/species/136551/22165292 Hence the species is qualifying as a criterion (e) species. Therefore, it is identified that the project area is a critical habitat for the particular species and the habitat has significant importance for survival this species at the national level
Spotted deer	X	X	X	X	√	National Red List: Vulnerable IUCN Red List Category: Least Concern Spotter deer preferring habitats such as forests, savannas, grasslands. No data available related to local and global population As per the IUCN range distribution map, Spotted deer is distributed near the project area. https://www.iucnredlist.org/species/41783/22158006 As the species supports tiger population in the Terai plains of Parsa National Park (Bhagawan Raj Dahal 1 Jan.2023). Hence the species is qualifying as a criterion (e) species. Therefore, it is identified that the project area is a critical habitat for the particular species and the habitat has significant importance for survival this species at the national level
Wild boar	X	X	X	X	√	National Red List: Least Concern IUCN Red List Category: Least Concern Wild boar preferring the habitats such as forest, savanna, shrubland, grassland, wetlands (inland), desert. No data available related to local and global population As per the IUCN range distribution map, Wild boar is distributed in the project area. https://www.iucnredlist.org/species/41775/44141833 As the species supports tiger population in the Terai plains of Parsa National Park (Bhagawan Raj Dahal 1 Jan.2023). Hence the species is qualifying as a criterion (e) species. Therefore, it is identified that the project area is a critical habitat for the particular species and the habitat has significant importance for survival this species at the national level
Nilgai	X	X	X	X	√	National Red List: Vulnerable IUCN Red List Category: Least Concern Nilgai preferring the habitats such as forest, savanna, shrubland, grassland. Distributed in India and in the lowland zone of Nepal No data available related to local and global population

Biodiversity type (Species/ Site)	Critical Habitat criterion qualified ¹⁵					Justification
	(a)	(b)	(c)	(d)	(e)	
						As per the IUCN range distribution map, Nilgai is distributed in the project area. https://www.iucnredlist.org/species/2893/115064758 As the species supports tiger population in the Terai plains of Parsa National Park (Bhagawan Raj Dahal 1 Jan.2023). Hence the species is qualifying as a criterion (e) species. Therefore, it is identified that the project area is a critical habitat for the particular species.
Gaur	√	X	X	X	√	National Red List: Vulnerable IUCN Red List Category: Vulnerable Gaur preferring the habitats such as forest, savanna, shrubland, grassland. Distributed throughout mainland south and southeast Asia and Sri Lanka No data available related to local and global population As per the IUCN range distribution map, Gaur is distributed in the project area. https://www.iucnredlist.org/species/2891/46363646 As the species supports tiger population in the Terai plains of Parsa National Park (Bhagawan Raj Dahal 1 Jan.2023). Hence the species is qualifying as a criterion (e) species. Therefore, it is identified that the project area is a critical habitat for the particular species and the habitat has significant importance for survival this species at the national level

Criterion as per ESS6:

- Habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches.
- Habitat of significant importance to endemic or restricted-range species.
- Habitat supporting globally or nationally significant concentrations of migratory or congregatory species.
- Highly threatened or unique ecosystems.
- Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).

4.3 Baseline Information on Socio-Economic and Cultural Environment

Proposed KDP road section (130 km) is a part of East West (Mahendra) Highway. The road stretch lies within Madhesh Province and covers 6 Districts and 16 Municipalities. The socio-economic and cultural information of the project area collected through desk study and field studies is presented in following sub-chapters.

4.3.1 Socio-economic Profile of the Project Area

The socio-economic profile of the project area, which consist of settlement pattern, demography, age, occupation, literacy, religion, caste & ethnicity, Indigenous population, language and infrastructure is described in following sections

Settlement Pattern

The settlements of the project area are predominantly rural, cluster in market areas and ribbon along the road alignment. Also, major section of the road is passing through the forest land. The project area lies within 16 municipalities (including 1 sub-metropolitan city and 15 municipalities) from 6 districts in Madhesh Province. Survey settlement within the project area include the major settlements adjoining to the KDP section of East West (Mahendra) Highway from Kamala River Bridge to Pathlaiya. Settlement pattern of market centers within the project area are compact whereas the settlement pattern of the remaining settlements is scattered. Major market settlements along the road are Godar Bazar, Birendra Bazar, Dharapani, Puspapur, Dhalkebar, Badahari, Lalgadh, Bardibas, Phuljor, Raniganj, Lalbandi, Nawalpur, Harion, Bagmati, Chandranigahpur, Nijgadh and Pathlaiya. The land use along the project road is combination of commercial, residential, agriculture and a few stretches with forest lands. The major settlements along the KDP road section are presented in the **Table 4.21**.

Table 4.21: Project District, Municipality, Wards, and Settlements along the KDP Road

District	Municipality/ Wards	Settlements in the Project Area
Dhanusha	Ganeshman Charnath (Ward 1, 4, 6, 7 & 8)	Portaha, Bhoreni, Godaar, Birendra Bazaar, Tallo Godar
	Dhanusadham (Ward 6, 8 & 9)	Bhimwan, Kanchi bazaar, Dharapaani, Pushpalpur, Saraswatipur
	Mithila (Ward 3, 4, 5, 6, 7, 8, 9 & 10)	Shripur, Hariharpur, Dhalkebar, Lalbhitti, Jamunibas, Laalgadh
Mahottari	Bardibas (Ward 1 & 14)	Adhikari Tol, Bardibas Bazaar, Bardibas Chowk, Subham Basti Bardibas, Sugam Tol, Sukumbashi Basti Tol
Sarlahi	Lalbandi (Ward 1, 6, 7, 9 & 17)	Bastipur, Lalbandi, Nawalpur, Ranigunj
	Ishworpur (Ward 5)	Fuljor, Ishworpur
	Harion (Ward 4, 9, 10 & 11)	Nayaroad Chowk, Harion Bazaar, Sukepokhari
	Bagmati (Ward 1, 4, 11 & 12)	Aadarsha Chowk, Milchowk, Paanitanki Chowk, Purano Chauki, Putali Chowk, Raimajhi Chowk, Shanti Tol
Rautahat	Chandrapur (Ward 1, 4 & 5)	Bagmati, Canteen Bazaar, Mangalpur Purano Basti, Chapur, Srijana Tol, Thada Tol
Bara	Nijgadh (Ward 7, 8 & 9)	Bagiya, Buddha Chowk, Chauki Tol, Hulak Tol, Ismritinagar, Bhamara, Nijgadh Bazar, Rampul Tol, Lachka, Sahid Chowk, Shanti Tol, Yojana Tol
	Jeetpursimara (Ward 1 & 4)	Dudhaura, Pathlaiya, Thanimai Mandir (Purba Tol)

Source: Field Survey 2022

Demography

As stated above the project road is passing through six districts and 16 municipalities (including 1 sub-metropolitan city and 15 municipalities) of Madhesh province. As per Population Census (2021), the households of project affected municipalities are 199,044 with population 963,829 out of these 475,474 populations are male and 488,355 females. Percent of male population is 49.3 and female population is 50.7. Average household size is 4.8. The municipality wise information is given in **Table 4.22**.

Table 4.22: Household and Population within Project Affected Municipalities

Municipality	Number of Households	Population			Average Household Size	Sex Ratio
		Total	Male	Female		
Karjanha	8289	38557	18649	19908	4.7	93.68
Ganeshman Charnath	9167	44082	21425	22657	4.8	94.56
Dhanushadham	10588	52024	25185	26839	4.9	93.84
Mithila	10656	48676	24314	24362	4.6	99.80
Bardibas	16824	74361	36711	37650	4.4	97.51
Lalbandi	14446	66419	32883	33536	4.5	98.05
Gaushala	14873	72481	36250	36231	5.0	100.05
Ishwarpur	10740	68377	33808	34569	5.1	97.80
Harion	10768	49988	24405	25583	4.7	95.40
Bagmati	13521	47106	23015	24091	4.4	95.53
Brindaban	16820	49742	24894	24848	6.1	100.19
Chandrapur	9575	81807	40304	41503	4.9	97.11
Gujara	8142	54033	26396	27637	5.6	95.51
Nijgadh	8424	37687	18446	19241	4.5	95.87
Kolhabi	10561	51182	24862	26320	4.8	94.46
Jeetpur simara SM	25650	127307	63927	63380	5.0	100.86
Total	199044	963,829	475,474	488,355	4.8	96.89

Source: Population Census/CBS 2021

Socio-economic Sample Survey

Out of 16 municipalities mentioned above, only 11 project affected municipalities and their 40 wards (**Table 4.21**) have settlements within the direct impact area (DIA) where socio-economic sample survey was conducted (20% household survey). Total number of surveyed households are 858 and population 4,929, out of these 2,563 populations are male and 2,366 females. Out of total population, about 52 percent are male population and 48 percent are female population within DIA as shown in **Table 4.23**.

Table 4.23: Household and Population within the sample Households

SN	Municipality	HHs	Total			Family Size
			Pop.	Male	Female	
1	Ganeshman Charnath	93	578	307	271	6.2
2	Dhanusadham	64	360	196	164	5.6
3	Mithila	197	1167	629	538	5.9
4	Bardibas	81	440	224	216	5.4
5	Lalbandi	153	844	435	409	5.5
6	Ishworpur	14	76	38	38	5.4
7	Harion	66	370	183	187	5.6
8	Bagmati	31	167	88	79	5.4

SN	Municipality	HHs	Total			Family Size
			Pop.	Male	Female	
9	Chandrapur	70	395	195	200	5.6
10	Nijgadh	65	399	202	197	6.1
11	Jeetpur simara SM	24	133	66	67	5.5
	Total	858	4929	2563	2366	5.7
	Percent (%)			52.0	48.0	

Source: Household Survey 2022

Age Groups

Age category within surveyed households have been classified under 0-4 years (infant), 5-14 years (child), 15-59 years (adult/economically active population) and 60 years and above (old). It is found that among the total surveyed population (4,929) in the project area, 316 population that is 6.4 percent is within the age group of 0-4 years, 770 that is 15.6 percent is within the age group of 5-14 years, and 3296 that is 66.9 percent is within the age group of 15-59 years. The population of above 60 years is 547 that is 11.1 percent. Population by age group within surveyed household is given in **Table 4.24**.

Table 4.24: Population by Age Group within Surveyed Household

Municipality	0-4 yrs	5-14 yrs	15-59 yrs	60 yrs and above	Total
GaneshmanCharnath	48	111	384	35	578
Dhanusadham	17	55	248	40	360
Mithila	84	193	779	111	1167
Bardibas	19	66	301	54	440
Lalbandi	48	120	560	116	844
Ishworpur	3	11	54	8	76
Hariwon	27	49	246	48	370
Bagmati	8	20	122	17	167
Chandrapur	32	63	257	43	395
Nijgadh	25	63	253	58	399
Jeetpur simara SM	5	19	92	17	133
Total	316	770	3296	547	4,929
Percent (%)	6.4	15.6	66.9	11.1	100

Source: Household Survey 2022

Occupation

Total 3,296 are economically active persons who fall under age groups of 15-60 years. Among them, 2,450 persons are engaged in different occupation such as trade and business (24.4%), household chores (20.2%), job/service (11.0%), agriculture and livestock (10.2%), foreign employment (5.3%) and wage labour (3.3%). Remaining 846 persons are economically inactive, which consists students (22.4%) and unemployed (3.3%). Detailed information is shown in **Table 4.25**.

Table 4.25: Population by Occupation Status in the Surveyed Household

Municipality	Economically Active Population	Population having Occupation						Economically Inactive Population	
		Agriculture and Livestock	Trade and Business	Job/Service	Household work	Wage Labour	Foreign Employment	Student	Unemployed
GaneshmanCharnath	384	31	106	16	82	36	35	59	19
Dhanusadham	248	41	50	16	44	8	21	56	12
Mithila	779	108	169	82	146	25	32	185	32
Bardibas	301	13	84	46	43	7	9	83	16
Lalbandi	560	57	131	70	117	9	30	139	7

Municipality	Economically Active Population	Population having Occupation						Economically Inactive Population	
		Agriculture and Livestock	Trade and Business	Job/Service	Household work	Wage Labour	Foreign Employment	Student	Unemployed
Ishworpur	54	6	8	6	12	5	3	12	2
Harion	246	13	76	17	53	2	16	63	6
Bagmati	122	17	22	21	24		8	28	2
Chandrapur	257	20	65	39	65	12	6	46	4
Nijgadh	253	29	72	37	47	2	10	49	7
Jeetpursimara	92	2	21	12	32	2	4	18	1
Total	3296	337	804	362	665	108	174	738	108
Percent	100	10.2	24.4	11.0	20.2	3.3	5.3	22.4	3.3

Source: Household Survey 2022

Literacy

Literacy is ability to read and write. Literacy rate is calculated considering the population of 5 years and above. Out of total population aged 5 years and above (4613) within the surveyed households, 4582 population are found literate and 31 illiterates. Household survey within the project area showed that the literacy rate in the project area is 92.2 percent, which is higher than the province (63.5%) literacy rate and national literacy rate (76.3%) as per CBS 2021. The reason may be due to better access, opportunities, awareness and economic conditions. The male and female literacy rate in the project area is as shown in **Table 4.26**. It is found that literacy rate of female (93.7%) is slightly higher than male (92.2%) within the surveyed households. As per CBS 2021, female literacy rate of Madhesh Province is only 54.7 percent and male literacy rate is 72.5 percent. Similarly, male literacy rate of Nepal is 83.6 percent while female literacy rate is 69.4 percent.

Table 4.26: Literacy Status of Population by Sex within Surveyed Household

Municipality	Total Survey Pop.	Infant Pop. (<5 years)	Pop. 5 yrs and above	Illiterate Pop.	Literate Population					
					Total		Male		Female	
					Population	Literate Population (%)	Population	Literate (%)	Population	Literate (%)
Ganeshman Charnath	578	48	530	5	525	90.8	277	90.2	248	91.5
Dhanusadham	360	17	343	3	340	94.4	183	93.4	157	95.7
Mithila	1167	84	1083	10	1073	91.9	575	91.4	498	92.6
Bardibas	440	19	421	3	418	95.0	213	95.1	205	94.9
Lalbandi	844	48	796	3	793	94.0	403	92.6	390	95.4
Ishworpur	76	3	73	1	72	94.7	34	89.5	38	100.0
Harion	370	27	343	0	343	92.7	171	93.4	172	92.0
Bagmati	167	8	159	1	158	94.6	82	93.2	76	96.2
Chandrapur	395	32	363	4	359	90.9	174	89.2	185	92.5
Nijgadh	399	25	374	1	373	93.5	188	93.1	185	93.9
Jeetpursimara	133	5	128	0	128	96.2	64	97.0	64	95.5
Total	4,929	316	4613	31	4582	93.0	2364	92.2	2218	93.7

Source: Household Survey 2022

Religion

The major religions in the project area are Hinduism and Buddhism; however, there are some populations of Islam and Christianity. The religion of household respondents includes Hindu (88.6%) Buddhist (9.8%), Muslim (1.2%) and Christians (0.5%) by faith as shown in **Table 4.27**. As per CBS 2011, national average of Hindu population is 81.3 percent, Buddhist is 9.0 percent, Muslim is 4.4 percent and Christian is 1.4 percent. Similarly, within Madhesh Province, percent of Hindu population is 82.8 percent, Muslim is 9.0 percent, Buddhist is 4.4 percent and Christian is 1.3%.

Table 4.27: Religion of the Surveyed Households

SN	Municipality	Hindu	Buddhist	Christian	Muslim/ Islam	Total
1	GaneshmanCharnath	89	3		1	93
2	Dhanusadham	45	16		3	64
3	Mithila	184	13			197
4	Bardibas	75	4	2		81
5	Lalbandi	135	13	1	4	153
6	Ishworpur	7	7			14
7	Harion	59	6		1	66
8	Bagmati	27	4			31
9	Chandrapur	63	6		1	70
10	Nijgadh	60	5			65
11	Jeetpur simara SM	16	7	1		24
	Total	760	84	4	10	858
	Percent (%)	88.6	9.8	0.5	1.2	100

Source: Household Survey 2022

Caste and ethnicity

The project area has multi-ethnic/caste groups which include Brahman, Chettri, Janjati, Dalit, Terai Caste and Muslim. Among surveyed households, Brahmins are 19.7 percent, Chhettris are 13.5 percent, Jananjatis are 24.4 percent, Dalits are 16.5 percent, Madheshi /Terai Castes are 24.5 percent and Muslims are 1.3 percent respectively. Detail of caste/ethnic groups in the area is given in **Table 4.28**.

Table 4.28: Caste & Ethnic Composition of the Surveyed Household Population

SN	Municipality	Braman	Chettri	Janjati	Dalit	Terai Caste groups	Muslim	Total
1	GaneshmanCharnath	17	40	94	138	283	6	578
2	Dhanusadham	8	21	122	74	115	20	360
3	Mithila	133	78	231	332	393		1167
4	Bardibas	73	114	115	89	49		440
5	Lalbandi	264	132	180	63	181	24	844
6	Ishworpur	12	9	45	0	10		76
7	Harion	38	87	79	62	97	7	370
8	Bagmati	36	55	67	0	9		167
9	Chandrapur	115	63	99	44	68	6	395
10	Nijgadh	223	40	128	4	4		399
11	Jeetpur simara SM	53	26	45	9			133
	Total	972	665	1205	815	1209	63	4,929
	Percent (%)	19.7	13.5	24.4	16.5	24.5	1.3	100

Source: Household Survey 2022

Indigenous Population

According to the sampled (20%) household survey, Indigenous People found in the KDP project area are belonged to highly marginalized category (Danuwar), Marginalized (Tharu, Bhujel and Tamang),

Disadvantaged (Gurung, Magar, Rai and Limbu) and Advance category (Newar). Detail number of surveyed IPs households and population is given in **Table 4.29**.

Table 4.29: Number of HH and Population of IPs by NEFIN classification

SN	Classification of IPs by NEFIN	Surveyed IPs in the KDP Road Corridor	No of Surveyed HHs	Population
1	Endangered-10 (Bankariya, Hayu, Kisan, Kusbadiya, Kusunda, Lepcha, Meche, Raji, Raute, Surel)	--	--	--
2	Highly Marginalized-12 (Bote, Baramu, Chepang, Danuwar, Dhanuk, Jhagar, Majhi, Santhal, Shiyar, Shingsawa, Thami, Thudam)	Danuwar	1	6
3	Marginalized-20 (Bhote, Bhujel, Darai, Dhimal, Dolpo, Dura, Gangai, Kumal, Larke, Lhopa, Mugal, Pahari, Phree, Rajbansi, Sunuwar, Tajpuriya, Tamang, Tharu, Topkegola, Walung)	Tharu, Bhujel, Tamang	117	651
4	Disadvantaged-15 (Baragaule Thakali, Byansi, Chhantyal, Chhairotan, Gurung, Jirel, Limbu, Magar, Marphali Thakali, Rai, Sherpa, Tangbe, Tingaule Thakali, Yakkha, Yolmo)	Gurung, Magar, Rai, Limbu	45	235
5	Advanced-2 (Thakali, Newar)	Newar	59	313
	Total-59		222	1205

Source: Adopted from NEFIN Classification 2005 & Household Survey 2022

Among the surveyed households within the DIA, 222 households and 1205 population belonged to IPs category. Out of these, only one household with 6 population was reported from the highly marginalized category (Danuwar) of IP. Likewise, 177 households of marginalized (Tharu, Bhujel and Tamang) IP with 651 population were reported among the surveyed households. Similarly, 45 households and 235 population are belonged to disadvantaged category (Gurung, Magar, Rai and Limbu) of IP. In addition, 59 HH and 313 population are belonged to advanced category (Newar) of IP as shown in table above. The detail information of project affected IPs within the RoW is provided in IPDP report separately.

Language

Nepali, Maithili, Tamang, Magar, Newari, Bhojpuri, Tharu, Hindi and Rai are major languages spoken in the project area. About 57.8 per cent of the respondents in the project area speak Nepali language as mother tongue. It is found that some ethnic groups like Gurung and Limbu are also using Nepali language. The second most spoken language of the respondents is Maithili (34.4%) followed by Tamang (1.9%), Magar (1.6%), Newari (1.5%), Urdu (1.2%), Bhojpuri (0.7%), Tharu (0.5%), Hindi (0.3%) and Rai (0.1%). The details of mother tongue/language spoken by household respondents are presented in the **Table 4.30**.

Table 4.30: Mother Tongue/Language Spoken by Household Respondents

Municipality	Nepali	Maithili	Hindi	Tharu	Rai	Newari	Magar	Tamang	Bhojpuri	Urdu	Total
Ganeshman Charnath	12	79		1						1	93
Dhanusadham	31	23			1	1	3	2		3	64
Mithila	66	116	2			3	5	5			197
Bardibas	60	17				2	1	1			81
Lalbandi	116	28		1		1	1	2		4	153
Ishworpur	13	1									14

Municipality	Nepali	Maithili	Hindi	Tharu	Rai	Newari	Magar	Tamang	Bhojpuri	Urdu	Total
Harion	40	20				2		2	1	1	66
Bagmati	28	1				1		1			31
Chandrapur	47	9		1		2	2	3	5	1	70
Nijgadh	60	1	1	1		1	1				65
Jeetpursimara	23						1				24
Total	496	295	3	4	1	13	14	16	6	10	858
Percentage	57.8	34.4	0.3	0.5	0.1	1.5	1.6	1.9	0.7	1.2	100

Source: Household Survey 2022

4.3.2 Economic Profile

This section deals with the economic status of the surveyed household including land holding (ownership, type, size and price), agriculture and livestock activities, food sufficiency, house and household assets, household income and household expenditure.

Land Holding

It is found that none of the surveyed households are landless. Out of 858 surveyed households, 705 households have extra land beside land with structure and rest 153 HHs have land with structures (built up area) only as shown in the **Table 4.31**.

Table 4.31: Land Holding Status of the Surveyed HHs

Municipality	Households		
	Having both Agriculture land and Structure	Having Built up Area Only	Total
GaneshmanCharnath	60	33	93
Dhanusadham	51	13	64
Mithila	166	31	197
Bardibas	65	16	81
Lalbandi	134	19	153
Ishworpur	10	4	14
Harion	61	5	66
Bagmati	27	4	31
Chandrapur	56	14	70
Nijgadh	59	6	65
Jeetpur simara SM	16	8	24
Total HHs	705	153	858
Per cent (%)	82.2	17.8	100

Source: Household Survey 2022

Landholding by Gender

Within the surveyed households, males are found typically the owner of family land and assets. About 46.2 percent male have ownership on land and property whereas only 20.2 percent female have ownership on land and property, which is almost equal (20%) to the national average. Also, about 33.6 percent households have joint ownership (both male and female) on land and property as shown in **Table 4.32**.

Table 4.32: Land and Property Ownership by Gender

Activities	Land and Property Ownership Status		
	Male	Female	Joint (male & female)
Lands	64	15.6	20.4
House	67	17.6	15.4
Cash	65.9	5.5	28.6
Animals	17.2	14.9	67.9
Bank Deposit	55.9	4.0	40.1

Activities	Land and Property Ownership Status		
	Male	Female	Joint (male & female)
Ornaments	7.0	63.8	29.2
Overall	46.2	20.2	33.6

Source: Household Survey 2022

Type of Land

Extra land among 705 HHs is being used mostly for agriculture/farming (76.98%) followed by commercial land/ghaderi (21.7%). Around 1.31 percent of land is found to be river flood plain/barren land. Within agricultural land, 71 percent of land is khet (irrigated) and 5.98 percent of land is bari (non-irrigated). Type of extra land of surveyed households is presented in **Table 4.33**.

Table 4.33: Type of Land of the Surveyed HHs (in ha)

District	Municipality	Agricultural Land		Commercial land/ Ghaderi	River Flood Plain/ Barren Land	Total (ha)
		Khet	Bari			
Dhanusha	GaneshmanCharnath	35.7	2.6	8	1.9	48.2
	Dhanusadham	16.6	0.3	12.1		29.0
	Mithila	70.4	9.7	23.8	0.7	104.6
Mahottari	Bardibas	18.2	4.4	7.4	0.2	30.1
Sarlahi	Lalbandi	48.7	4.0	11.9	0.7	65.3
	Ishworpur	0.2	1.0	0.5		1.7
	Hariwon	23.1		26.1	1.4	27.5
	Bagmati	15.4	0.2	16.3		16.5
Rautahat	Chandrapur	25.4	0.4	28	0.1	28.6
Bara	Nijgadh	34.9	1.7	12.3	0.5	49.3
	Jeetpur simara SM	0.3	0.2	5.8		6.3
Total Land Area (ha)		289.00	24.36	88.33	5.35	407.04
Number of HHs having land		415	31	507	8	705
Average Land (ha)		0.7	0.8	0.5	0.7	0.6
Percent (%)		71.00	5.98	21.7	1.31	100.00

Source: Household Survey 2022

Landholding Size

It is found that about 67 percent of the surveyed households have less than 0.5 ha land, 17.3 percent households have 0.5-1.0 ha land, 9.5 per cent households have more than 1.0 to 2.0 ha land, 4.8 per cent household have more than 2.0 to 5.0 ha land and 1.4 per cent households have more than 5.0 ha land for agriculture as shown in **Table 4.34**.

Table 4.34: Landholding Size (Area) of Survey Households in the Project Area

Municipality	< 0.5 Ha.	0.5-1 Ha.	>1-2 Ha.	>2-5 Ha.	> 5 Ha.	Total Surveyed HHs having Extra Land
GaneshmanCharnath	36	9	11	2	2	60
Dhanusadham	34	7	6	3	1	51
Mithila	88	46	21	10	1	166
Bardibas	49	5	5	6		65
Lalbandi	100	23	5	5	1	134
Ishworpur	9		1			10
Harion	47	5	5	4		61
Bagmati	18	4	3	2		27
Chandrapur	44	6	4	1	1	56
Nijgadh	32	17	6	1	3	59
Jeetpursimara	15				1	16
Total	472	122	67	34	10	705
Per cent (%)	67.0	17.3	9.5	4.8	1.4	-

Source: Household Survey 2022

Price of Land

As per the focused group discussion (FGD) findings, the market price of land for *Ghaderi* (commercial land) adjoining to the highway ranges from NRs. 50,00,000 to NRs. 80,00,000 per kattha (338.63 sq.m.) whereas the market price of the land adjoining to branch road behind the highway ranges from NRs. 20,00,000 to NRs. 40,00,000 per kattha within the survey area. The price of agricultural land ranges from NRs. 10,00,000 to NRs. 20,00,000 per kattha.

4.3.3 Agriculture and Livestock Activities

Agriculture Cultivation

As per FGD participants, agricultural practice in the survey area is mostly traditional and agriculture production system is conventional. Farmers are producing mainly rice, wheat and maize as cereals crops, and mustard, wheat, sugarcane, banana, mango and leechi as cash crops at subsistence level.

Banana farming for commercial production is being started by some enthusiast farmers in the survey area. However, the farmers have encountered with some risk of wind/ storm and diseases. Hence, they are in doubt to invest further in banana farming. Sugarcane is another cash crop but the farmers have not been paid by the sugar mills for long time. Mango and *Leechi* are seasonal fruits the farmers grow and sell in few quantities.

Lack of irrigation and fertilizer is the main problem of farmers in the project area according to FGD participants. Other agricultural related problems prevailing in the project area are uncertain rainfall, flooding and riverbank cutting.

Livestock Rearing

It is found that among 858 surveyed household, 364 households are involved in livestock rearing for both subsistence and commercial purpose. Most of the households (156) are rearing goat followed by buffalo (93 households), cow/ox (84 households), poultry (24 households) and pig (7 households). It is found that there are 4 animals per HHs on an average. Average number of poultries per household is 11. Average number of goats and pig per HHs is 4 each whereas average number of cow/oxen and buffalo per HHs is only 2. Number of households having domestic animals is presented in **Table 4.35**.

Table 4.35: Number of Surveyed Households having Domestic Animals

Municipality	Total Number of Households Having Animals					Total
	Cow/Ox	Buffalo	Goat	Pig	Poultry	
GaneshmanCharnath	14	10	19	1	1	45
Dhanusadham	4	13	21	1	1	40
Mithila	24	32	37	2	9	104
Bardibas	9	5	11	0	3	28
Lalbandi	10	13	23	3	3	52
Ishworpur	0	0	4	0	2	6
Harion	3	1	6	0	0	10
Bagmati	4	6	10	0	3	23
Chandrapur	5	5	16	0	0	26
Nijgadh	8	7	7	0	1	23
Jeetpursimara	3	1	2	0	1	7
Total HHs Having Animals	84	93	156	7	24	364
Total Animals	136	186	682	28	262	1293
Average Number of Animal per Household	2	2	4	4	11	4

Source: Household Survey 2022

4.3.4 Household Income and expenditure

Household Income: When asked about the monthly household income, Rs. 67,829 per month was reported on average. The monthly household income reported by surveyed household was multiplied by 12 to get an average annual household income of the surveyed households. The average per capita income of the surveyed population is Rs. 142,412 (lower than the national average) according to the HH survey 2022 (**Table 4.36**). Per capita income for a household is calculated by dividing the household income by its population. Similarly, per capita income of Nepal is Rs. 164,598 in 2022 (Source: CBS). Major sources of household income are reported to be own business/industry/trade (51.2%) followed by service/job/salary (17%), remittance (11.3%), sale of agriculture production (7.4%), house and property rent (5%), daily wage labour (2.4%), pension/social security allowance (2%), bank interest/ share investment (0.4%) and other sources (3.3%) as per the sample household survey.

Table 4.36: Average Income of the Surveyed Households

Municipality	Family Total Income (Rs)		Population	Per Capita Income (Rs)	
				(Per capita Income=Total HH Income/HH Population)	
	Annual	Monthly		Annual	Monthly
Ganeshman Charnath	84,154,000	7,012,833	578	145,595	12,133
Dhanusadham	42,277,800	3,523,150	360	117,438	9,787
Mithila	141,104,200	11,758,683	1,167	120,912	10,076
Bardibas	67,961,000	5,663,417	440	154,457	12,871
Lalbandi	133,612,000	11,134,333	844	158,308	13,192
Ishworpur	7,958,000	663,167	76	104,711	8,726
Harion	59,538,000	4,961,500	370	160,914	13,409
Bagmati	33,898,000	2,824,833	167	202,982	16,915
Chandrapur	48,182,000	4,015,167	395	121,980	10,165
Nijgadh	59,603,000	4,966,917	399	149,381	12,448
Jeetpur simara SM	23,660,800	1,971,733	133	177,901	14,825
Average	701,948,800	67,829	4,929	142,412	11,868

Source: Household Survey 2022

Household Expenditure: When asked about the monthly household expenses, Rs. 35,525 per month was reported on average. The monthly household expenditure reported by the surveyed household was multiplied by 12 months to get an average annual expenditure. The average annual household expenditure of the surveyed household is Rs. 426,305. The household expenditure of the project area is presented in **Table 4.37**. The expenditure pattern of the survey households includes food and beverage (29.4%), education/clothes/transportation (24.1%), festival celebration (7.7%), medical treatment (7.5%), Meat and fruits (7.0%), utilities (5.5%), cooking energy (5.4%), maintenance and tax (4.5%), milk / curd/ ghee (4.2%), agriculture/ farming (2.6%) and other expenditures (2.1%) as per the Baseline Survey Report of KDP Road, 2022.

Table 4.37: Average Expenditure of Surveyed Households

Municipality	Total Expenses (Rs)	Family Average Expenses (Rs)		Population
		Annual	Monthly	
Ganeshman Charnath	41,787,600	449,329	37,444	578
Dhanusadham	21,041,000	328,766	27,397	360
Mithila	81,849,750	415,481	34,623	1,167
Bardibas	34,937,200	431,323	35,944	440
Lalbandi	70,681,400	461,970	38,497	844
Ishworpur	4,848,800	346,343	28,862	76
Harion	28,907,050	437,986	36,499	370
Bagmati	14,725,500	475,016	39,585	167
Chandrapur	24,712,150	353,031	29,419	395

Municipality	Total Expenses (Rs)	Family Average Expenses (Rs)		Population
		Annual	Monthly	
Nijgadh	29,695,700	456,857	38,071	399
Jeetpur-simara SM	12,583,100	524,296	43,691	133
Overall Average	365,769,250	426,305	35,525	4,929

Source: Household Survey 2022

4.3.5 Migration Status

Migration from hill to Terai and rural area to urban areas is common phenomenon in Nepal, which is similar in the project area. People from hilly area have migrated in the project area since generations, who are IPs and non-IP groups by ethnicity. This trend is continued along the proposed road section. The main cause of migration reported by the survey respondents include for better economic opportunities and better living conditions. The employment, service and education are the major causes of out- migration the project area.

In the past history, the project area was thinly populated by tribal groups like Tharu, Majhi, Bote, Danuwar etc. Since the eradication of Malaria and the down of Democracy in Nepal, Hill to Terai migration trend started. The magnitude of the migrations was varied in different Decades, now most of the adjacent societies/communities have become densely populated areas and heterogeneous groups of living by nature.

4.3.6 Sanitation and Water Supply

Most of the population in the project area has toilet facilities at their home compound. Nepal Government has declared an “Open Defecation Free (ODF) Nation” in 2019. Approximately 75 percent population are using Piped/tap water followed by underground water (18 %), and river/khola/spring six percent as sources of water for domestic use.

4.3.7 Energy Sources

Electricity is the main source of lighting energy in the project area. LPG gas is the main source of cooking energy in the project area. Firewood, kerosene, solar, biogas and cow dung are being less used as energy sources in the project area. In contrary, use of electricity for cooking has been increased in the project area as per the survey respondents.

4.3.8 Market Centers and Service Providers

Major market centers within the project area are Dhalkebar, Bardibas, Lalbandi, Harion and Nijgadh. Every settlement has their typical chain of market system in which small shops, hotels, lodges, restaurants and so on are involved. Weekly Hat bazars in all above-mentioned major settlements play the vital role in transaction of goods and product such as clothing, home appliances, agriculture products (grain, meat, fish, fruits and vegetables), food and beverages of this area which is given in **Table 4.38**.

Table 4.38: Detail Information of Hat Bazars along the KDP Alignment

Municipality	Name of Settlement	Name of Hat Bazar	No. of Event per week	Supporting agency for Hat Bazar
GaneshmanCharnath	Godar	Godar	1	Hat Bazar Management Committee of each Bazar
	Birendra Bazar	Birendra Bazar	2	
Mithila	Dhalkebar	Dhalkebar	3	
	Badahari	Badahari	2	
Bardibas	Bardibas	Bardibas	2	
Lalbandi	Lalbandi	Lalbandi	2	

Municipality	Name of Settlement	Name of Hat Bazar	No. of Event per week	Supporting agency for Hat Bazar
Harion	Harion	Harion	2	
Chandrapur	Mangalpur	Mangalpur	2	
Nijgadh	Nijgadh	Nijgadh	2	

Source: Field Survey/Focus Group Discussion 2022

4.3.9 Industries within the Project Area

As per FGD participants, 29 different types of industries were reported within the project area, which include carpet, grill, crusher, rice mill, oil mill, noodle, vehicle repair, furniture, garment, bakery, soap, cement and brick block, dalmoth, spice, incense stick and candle, hume pipe, oxygen gas, bag, dairy, poultry, plywood, bamboo product, banana product, toothpick, water processing, paper, pickle, and saw mill etc.

4.3.10 Municipality Offices and Police Stations

Municipality offices and Police Stations for the people of KDP corridor are easily accessible. Among 11 project affected municipalities (within the survey area), 4 municipality offices are adjoining to the KDP road, 4 municipality offices are within a kilometer from KDP alignment and remaining 3 municipalities offices are within 5 to 8 kilometers away from the KDP alignment. Similarly, among 40 ward offices (within the survey area), 20 ward offices are adjoining to the KDP road, 15 ward offices are within 1 km and 5 ward offices are within 3 km from KDP road. Fourteen (14) police stations within the survey area are adjoining to the KDP road.

4.3.11 Other Public Services

Other public services available in the project area include schools, college, hospital/health posts/centers, local hat bazars, market and ward/municipality offices and district headquarters.

Transportation Facilities

Both public and private transportation facilities are available within the project area in all seasons. The bus, tractor, truck, motorcycle, ambulance, auto rickshaw, tempo, magic/van and so on are available in the survey area. The public transport to reach district headquarters, municipality and ward offices, police stations, education institutions, health posts/hospitals are available. There are some difficulties in accessibility since the condition of road in rainy season become worse in both sides along the East West (Mahendra) Highway including KDP section.

Infrastructure Development Status and Ongoing and Planned Projects

Physical infrastructure facilities like electricity, drinking water, school buildings, linking roads are good in condition. Regular maintenance for inner roads is essential. There are some on-going and future projects/programs being implemented/to be implemented in and around project area, which may bring cumulative impact to the KDP road and bridges upgrading sub-project. Following are the on-going projects around the project area as in **Table 4.39**.

Table 4.39: Ongoing and Future Projects near the KDP alignment

No	Project/Program	Line Department	Description of Project	Location	Situation
1	Mechi- Mahakali Electrified Railway Link Railway to Simra to Birganj. This Link Railways starts from	Department of Railways, Nepal.	Runs parallel with the KDP Road section and crosses near Nijgadh Bazar	Near Nijgadh Bazar	Preparation of DPR within our section

No	Project/Program	Line Department	Description of Project	Location	Situation
	Chocha (Near Nijgad)				
2	Kathmandu- Birgunj Railway, Electrified Railway	Department of Railways, Nepal	Route not finalized but will be close to Nijgad area of KDP Project.	Starting from Birganj, goes to Simra and then turn towards east side that Nijgad and finally reach Kathmandu.	Feasibility Study
3	Kathmandu-Nijgad Fast track Road (Express Way)	Nepal Army	Joins KDP road near Nijgad	Near Nijgad (western side of Nijgad) and perpendicular to KDP.	Under construction
4	Nijgad Airport	Civil Aviation Authority of Nepal	Though supreme court has cancelled the project; it is still under study by modifying design/area	Near Nijgad (South-West side of Nijgad Town/Bazar)	Presently Rejected by Supreme court and alternatives under study.
5	Transmission Line Project: Dhalkebar to Loharpatti 132 KVA	Nepal Electricity Authority	Upgradation of Dhalkebar Substation	Dhalkebar	Under Design
	Hetauda- Dhalkebar-Duhabi 400 KV Transmission Line Project		New TL of 400 KV	Somewhat Parallel of KDP	Under Construction
	Labandhi-Saenpur 132 KVA transmission line		New TL of 132 KV	Joining KDP road at Lalbandi	Design complete
	Nijgad-Harnaya 400 KVA transmission line		New TL of 400 KV	Joining KDP road at Nijgad	Under Design
6	Nawalpur-Sub Station		New Substation	Nearby KDP road at Nawalpur	Design Completed
7	Adjoining Roads and Major junctions	Department of Roads/Provincial and Local Roads	Adjoining East West (Mahendra) Highway towards east and west of KDP, Major Junctions of Strategic roads joining KDP with district headquarters and major cities	Joining with KDP road	Operation and under Periodic Upgradation/main tenance

Source: Focus Group Discussion and KII/Field Survey 2022

4.3.12 Gender Status

According to focus group discussion (FGD) findings, early marriages, poor socio-economic status, dependency and low level of literacy rates of the population including women in general are seen in some extent in the project area. Gender status in the project area has also been assessed through the household survey. About 71.44 percent surveyed households opined that the socio-economic status of both man and women is equal, and in very few cases it is unequal (8.51%). In 11.89 percent surveyed households, women are engaged in household activities only whereas in 4.08 percent households, women are also involved in public services as well as involved in community works and social activities through women's group, CBOs/NGOs, saving credit groups etc.

In addition, gender related concerns and issues as reported by the FGD participants include the following:

- Gender equality should be taken into consideration for employment.

- More involvement of women in construction and project work.
- Issue of gender-based discrimination in terms of wages and works.
- Gender based violence issues to be addressed
- Gender-friendly working environment and accommodation.
- Counter-Trafficking in Person (C-TIP) programs for awareness and coordinate with concern stakeholders and law enforcement agencies including Nepal-India boarder help desk.

Gender Role in Agricultural Activities:

Among population within the surveyed households (4929), male population is 2563 (52%) and female population is 2366 (48%). When asked about the gender roles in agricultural works, it was reported that male involvement is 42.5 percent female involvement is 31.4% and both equal involvements is 26.1 percent in overall.

Gender Role in Household Activities:

It is found that females are found typically involved in household activities more than male in within the surveyed households. Sole involvement of female in household activities is 51.9 percent, male involvement is 19.9 percent and both/ equal involvement is 28.2 percent.

Gender Role on Decision Making:

It is noticed that decision making role in family matters is more on male (44%) than female (12.2%) within the surveyed households. However, there is an equal role of both male and female (43.8%) in decision making within the surveyed households.

Ownership of Land and Property by Gender:

Within the surveyed households, males are found typically the owner of family land and assets/property. About 46.2 percent male have ownership on land and property whereas only 20.2 percent female have ownership on land and property, which is almost equal (20%) to the national average. Also, about 33.6 percent households have joint ownership (both male and female) on land and property.

Literacy and Skill Training Status of women:

Female literacy rate within the surveyed households is 93.7 percent as shown in **Table 4.26** above. Similarly, 417 female population within the survey households have received skill training on Masonry, Carpentry, Clothes Cutting and stitching, Tailoring, Iron works, Cobbler, Vehicle Driving, Technical/Mechanical Works and Computer trade/occupation.

Gender Based Treatment while Travelling:

As per the Household Survey findings, 74.8 percent of the women travellers within the surveyed households have faced difficulties in getting seat while travelling in public vehicle. About 0.5 percent women travellers expressed their concerns for not having toilet facilities at the bus stands. Safety is a major concern for 14.7 percent women travellers within the survey households. Detail information on types of problems faced in types of public vehicles.

Involvement of women in Social Activities:

Females from surveyed households are reported to be involved in different local organizations such as farmer groups, Cooperatives, forest user groups, women groups, drinking water user groups, irrigation user groups, saving and credit groups, Non-Government Organization and Youth Club. Out of 833 population involved in social organizations, 434 females are reported to be involved in these

organizations as a general member whereas 30 females are involved as an executive member in the same organizations.

4.3.13 Gender Based Violence Situation in Project Area

According to the Nepal police factsheet, 5521 cases of GBV in the FY 2022/23 in Madhes province was recorded – the highest among all 7 provinces with domestic violence at the highest followed by rape, and polygamy. The prevalence of criminal activities, especially trafficking, is notably higher along highways near borders as highlighted in the SRCTIP GBV mapping study of 2019 and the World Bank’s 2020 study on ‘Vulnerability to Human Trafficking in Nepal from Enhanced Regional Connectivity.’ Mahottari, Dhanusha, Bara, Parsa, Rautahat, and Sarlahi (Madhes Pradesh), which, excluding Bara, are among the top 26 trafficking hot spots identified by the Government of Nepal. The Safety assessments from the human trafficking vulnerability study indicate that the percentage of individuals feeling unsafe is greater in Corridors 2 (Birgunj-Pathlaiya) and 3 (Pathlaiya-Dhalkebar) than in Corridor 1 (Kathmandu-Mugling-Naubise). Specifically, 30 percent of respondents in Corridor 2 and 31 percent in Corridor 3 reported harassment on public transport. Additionally, 47 percent in Corridor 2 and 48 percent in Corridor 3 believe cross-border security is insufficient.

As per INSEC (a human right advocacy NGO), Human Rights violations including gender-based violence (GBV) has been prevalent in Terai/Madhesh (project area) since long. There were 86 victims (7 female and 79 male) of Human Rights violations and 672 victims (508 female and 164 male) of abuses documented by INSEC in 2021 in project districts. Similarly, 223 were victims of Child Rights Violation, 228 were victims of Women Rights Violation, 87 were victim of beating, 24 were victims of abduction, 20 were injured, and 73 were victims of killing among the documented victims of abuses, according to INSEC 2022.

As per the FGD participants, cases of Gender based violence are evident within the survey area. Poverty, unemployment, drug/alcohol addiction and lack of awareness are the key factors for increase in gender-based violence. Generally, the cases related to gender-based violence has been settled at local level discussion. Control in alcohol consumption and engage in income generation activities through training will be a tool to minimize these incidents. Awareness programs to young girls and boys are necessary to minimized gender-based violence in the society.

As per Nepal Child Labour Report 2021, child labour is the highest in Karnali (24.6%) followed by Sudurpashchim (20.9%), Koshi (17.6%), Gandaki (16.1%), Lumbini (15.8%), Madhesh (11.5%), and the lowest in Bagmati (8.9%). Most common sectors for child labour are hospitality and daily wage work including construction related work.

GBV Response Services in the Project Area

During project operational stage there may be emerging risk of Gender Based Violence (GBV) and Sexual Harassment (SH) from labour influx as there is a chance of human trafficking and prostitution for the short period of time.

The available public services in the project area include government services provided by the sector line agencies and local government bodies (Municipalities and Ward Offices), Police Offices/ Children and Women Cell, Women’s Groups and networks, NGOs, private sectors and others. There is a country wide network of Maiti Nepal (NGO) and Mechi-Mahakali Buhari Samyukta Awaj (NGO) working in the project area also.

Prevalence of GBV in project areas validates the findings of the SRCTIP GBV/SEA mapping research conducted in 2019 which found that KDP project areas had existing high volume and various forms of GBV/SEA; lack of institutional and infrastructure capacity of service providers to respond to survivors; and lack of well-defined and coordinated response mechanism. The estimated 1000

labourers will further change community dynamics and potentially abet SEA/SH related incidences, in particular, making women and girls of the project areas more vulnerable to GBV/SEA/SH risks. Therefore, SEA/SH risk of the project areas can be substantial.

4.3.14 Poverty Situation in Project Area

Poverty refers to the lack of adequate financial resources such that individuals and households don't have the means to obtain the basic necessities such as food, clothing, shelter, and basic medicines. According to the Nepal Living Standard Survey (NLSS Survey 2021), the revised official poverty line of 2022-23 is estimated NRs.72, 908 per person per year. It has also aggregated the food items and non-food items and the expenses required to be above the poverty line. Accordingly, the income required for providing adequate calories (2,236 kilocalorie) for an average Nepali to be active is Rs. 35,029 at 2023 prices is required, and for non-food is Rs.37,879 is required at 2022/23 prices.

Based on the official poverty line at NRs.72,908 per capita per year, 199 (23.2%) households with 1223 (24.8%) population fall below poverty line among 858 sample surveyed households and 4929 surveyed population. According to HH survey, average annual income of below poverty line population is NRs. 51,602 per person per year and that of the below poverty line households is NRs. 317,133 per HH per year as shown in **Table 4.40**.

Table 4.40: Average Annual Income of the Surveyed Households under Poverty

Municipalities	No. of HHs under Poverty	No. of Population under poverty	Total Annual Income of HHs (Rs)	Annual Average Income (Rs) per House	Per Capita Income
Ganeshman Charnath	34	200	9,610,000	282,647	48,050
Dhanusadham	25	165	8,223,000	328,920	49,836
Mithila	56	362	17,241,500	307,884	47,628
Bardibas	11	60	3,533,000	321,182	58,883
Lalbandi	30	185	10,235,000	341,167	55,324
Ishworpur	2	16	810,000	405,000	50,625
Harion	9	54	3,240,000	360,000	60,000
Bagmati	7	42	2,448,000	349,714	58,286
Chandrapur	19	108	6,292,000	331,158	58,259
Nijgadh	3	16	826,000	275,333	51,625
Jeetpur-simara SM	3	15	651,000	217,000	43,400
Total	199	1223	63,109,500	317,133	51,602
Overall	23.2% (of 858 HHs)	24.8% (of 4929 Pop)	-	-	

Source: Household Survey 2022

4.3.15 Health Facilities in Project area

It is reported that among 858 surveyed households, 749 households have encountered with some kinds/types of illness/ diseases last year. Major diseases found within the survey households are Typhoid in 116 households followed by Gastric in 110 Households and Common Cold/Fever in 98 households. Other diseases include Diarrhea, Malaria, Jaundice, Pregnancy/Gyne -related, Uterus, skin disease, Asthma, Eye infection, Cholera, HIV/AIDS, Diabetics, Thyroid, TB, Cancer, Paralysis, Heart attack, Ortho, Kidney, Liver, Dengue, Accident, Blood pressure, Stomach disorder/ ache, Tumor and other diseases.

4.3.16 Cultural Environment

The project area is rich in cultural sites, situated within the alignment area. The National Park, Forest areas, temples and architecture are all representatives of the rich historical and cultural sites of the

project area. Although the project does not consist of any important area of the world heritage sites; there are still other pilgrimage sites holding great historical and cultural importance.

4.3.17 Historical and Cultural Heritage

In the project area, there are numerous historical and cultural site and places of importance that add value to the area. Some of them are:

- Shiva Mandir (temple), Kali Mandir, Hanuman Mandir and Radhakrishna Mandir are main religious places in Dhalkebar area.
- Park situated at Dhalkebar chowk also has an aesthetic value. Since its construction during of East -West (Mahendra) Highway, people have been visiting and taking photographs of the park.
- Kamalamai is the place where people come to take religious bath in Teej and Maghesakranti festivals from remote areas which can be taken as religious and tourism site.
- Bharat Tal of Bagmati Municipality which is in area of 121 bigha land has become a new tourist destination for boating, fishing and scenery /sight-seen for natural beauty.
- Horticulture center at Lalbandi is one of the sites which has aesthetic value and can attract tourist for beautiful scenario. Many people visit to buy fruits like mango and *leecchi* in the season.
- Bagmati River, Dam of Bagmati irrigation project, and park close to irrigation dam are the religious and attraction center for national and international tourists.
- Aurahi Baba Kuti of Mithila Municipality is also the religiously important place which can be utilized for internal tourism.
- Sagarnath Forest Project is important site for environmental perspectives in the project area.
- Different temples and other sites are helpful to promote internal tourism in small scale in every settlement as Madhesh province has rich culture and tradition.

4.3.18 Festivals and Other Practices

Festivals in project area are unique in their own way and they are much similar to the festivals of India. Major festivals and ceremonies include Jurshital, Chaurchan, Jitiya /Jivitputrika, Sama Chakeva, Fagu Purnima/holi, Shivaratri, etc. besides other national festivals like Dashain, Tihar/Deepawali, Teej, Lhosar, festival of Muslim community (Ramadan, Eid-ul-Fitar, Eid-ul-Adaha, Eid-Milad-un-Nabi, Moharram, Shab-i-Qadar and Shab-i-Barat), etc. as multicultural communities reside along the KDP road.

4.3.19 Private and Public Properties within ROW of KDP Road

Private and public properties within ROW of KDP road (50 m, 25 m either side from central line of road) is summarized in **Table 4.41**. Details of these properties and compensation for affected persons are given in Resettlement Action Plan.

Table 4.41: Details of Project Affected Structures

S.N.	Descriptions	No.	Remarks
Private Structure			
1	Private Structures	66	64 HHs-(330 Population)
2	Extended Hosing Structures	204	204 (Structure Owners)
3	Petrol Pump	4	4 owners

S.N.	Descriptions	No.	Remarks
Public/Community Structures			
4	Public Structures (including structures of Dharapani Army Barack)	48	Police Post-4, Removal Part of RCC Structures-5, Public Toilets-3, Wall-11, other structures-4 and Gate-5 = (32) Well-1, Main and small Gate-2, Duty Posts-2, ATM-1, Observation Post-1, waiting sheds-1, Concrete sentry post-2, Toilet-1, Motorcycle Stand-1, Durga Mandir-1, Electric poles-2 and Boundary wires-300m = (16)
5	Community Structures	168	Waiting Sheds-69, Bar/Pipal Chautara-55 Small Temples/shrines-35, Wells-8, and structure of a Park
6	Electric Poles	2221	959 left side and 1262 right sides (including 140 are solar Poles)
7	Drinking Water supply system	16.58/16.58 km (33.16 both sides)	Main Settlement Areas (Birendra Bazar, Dhalkebar, Bardibas, Lalbandi, Harion, Chapur and Nijgadh etc.)

Source: RAP Survey, 2022

4.3.20 Project Affected Households

There is no land acquisition in KDP road as proposed RoW is available for road development. There are found some private and public/community structures from the topographic survey design team that established within the RoW area. The project will affect 66 structures of 64 HHs completely and 204 temporary extended structures partially. The 64-project affected HHs and their 66 affected structures were assessed as per standard methodology through census enumeration and inventory assessment respectively to determine compensation cost and livelihood restoration programs. It was determined cut-off- date in RAP as per census date to discourage further encroachment which will be lured to get compensation as of occupying after enumeration date. After joint verification survey while published notice for compensation through CDC that will be accepted as cut-off-date authentically for the compensation procedure. Moreover, numerous public and community structures which were distributed within the RoW as mentioned in the above table were also assessed and cost calculation for the relocation and rehabilitation as possible.

Profile of Project Affected People

This sub-chapter presents the socio-economic profile of the directly affected project households which describes the socio-economic condition of the population and households, caste/ethnicity, aged groups, religion, education and literacy, land use and ownership, occupation, income level of PAF, vulnerable households and the status of food sufficiency of PAFs. This baseline study provides a high-level understanding of the socio-economic profile of the Project Affected Families to include in the Resettlement Action Plan (RAP) as required.

Within the project area, a total of 64 households consisting of 330 project-affected households, have been identified. Among these affected persons, males represent 53.6%, while females make up 46.4%, a figure slightly under the national average of 51%. The average family size in these project-affected households stands at 5.1, which is higher than the national average of 4.8. Details are presented in **Table 4.42**.

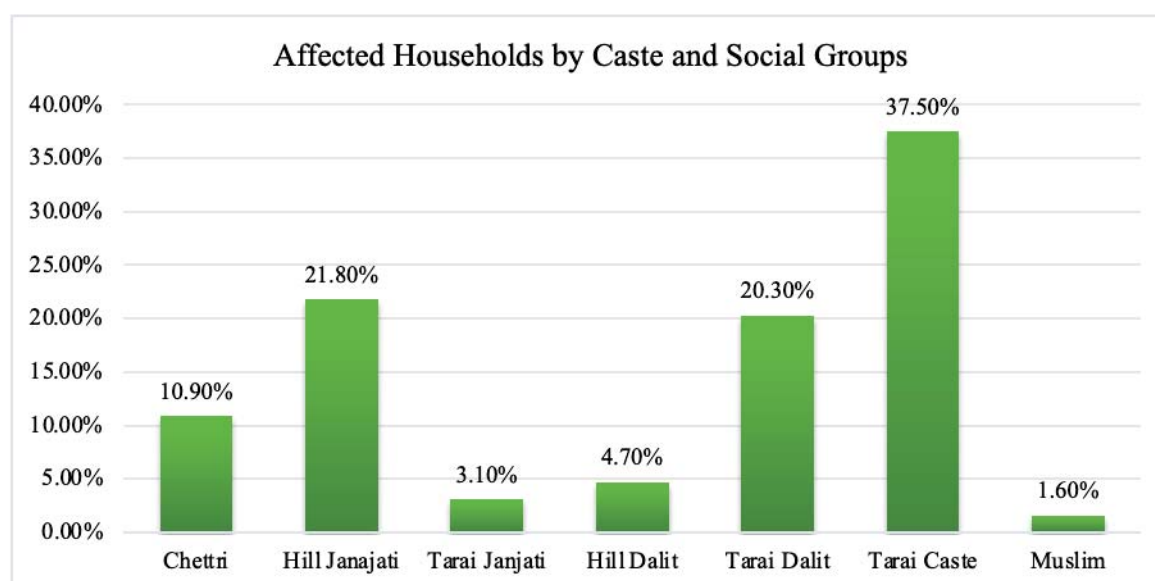
Table 4.42: Population Distribution of the project affected surveyed HHs

District	Municipality	Household	Population			Family Size
			Male	Female	Total	
Dhanusha	Ganeshman Charanath Municipality	17	59	52	111	6.5
	Dhanusadham Municipality	2	3	5	8	4
	Mithila Municipality	20	58	46	104	5.2
Mahottari	Bardibas Municipality	7	21	15	36	5.1
	Gaushala Municipality	6	15	8	23	2.9
Sarlahi	Ishworpur Municipality	3	4	7	11	3.7
	Hariwon Municipality	3	5	6	11	2.8
	Bagmati Municipality	3	8	6	14	3.5
Rautahat	Chandrapur Municipality	2	3	5	8	4
Bara	Nijgadh Municipality	1	1	3	4	4
Total		64	177	153	330	5.1
Percentage			53.6	46.4	100	

Source: Census Survey 2022

Caste and Ethnic Composition of PAHs

Terai Castes group like Mahato, Shah, Jha, Halwai etc. are 37.5% followed by Hill *Janajati* as Tamang, Magar i.e., 21.8%. Chhetri (Bhandari, Basnet, Khatri) represents 10.9% of the affected households, while the representation of Terai *Janajati* (Chaudhary, Kalwar etc.) is 3.1%. The Hill Dalit (Sarki, Pariyar) make 4.7%, and the Terai Dalit (Paswan, Dom) and Muslim populations each constitute 1.6% of the households within the ROW. The communities who have been residing near ROW are encroachers of ROW also, Hill *Janajati* who migrated from nearby areas got settled down within the KDP project areas. As stated above the 330 persons of the 64 HHs will be impacted by the KDP project. The composition of affected households by caste and ethnic group is presented in **Figure 4.20**.



Source: Census Survey, 2022

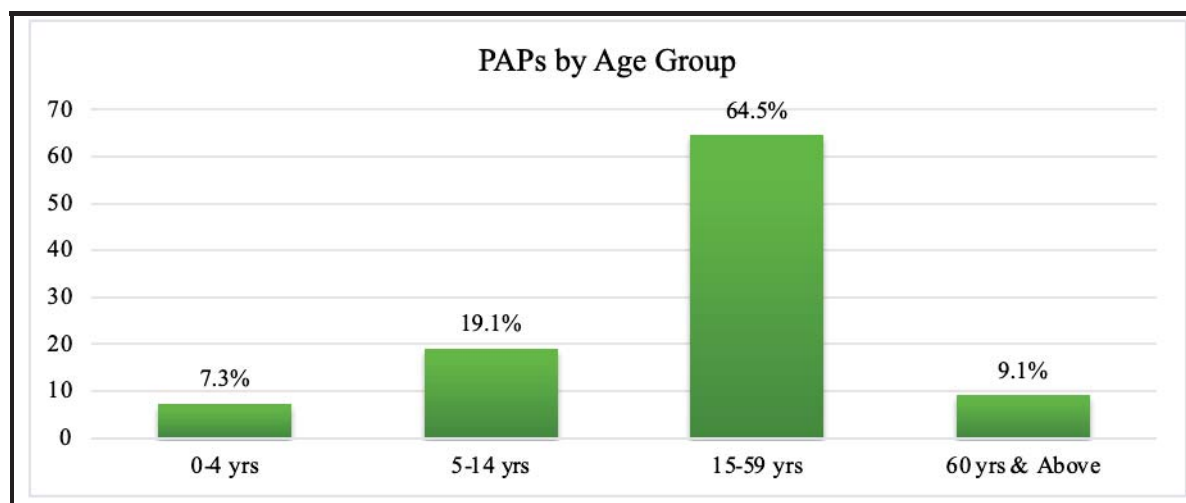
Figure 4.20: Distribution of Project Affected Households by Caste/Ethnic Groups

Project Affected IPs: Among the project affected households, 14 households are IP households. Out of the project affected 14 IPs households 12 are from marginalized group and 2 are from

disadvantaged group. Among this project affected IPs households, 7 are female-headed household also falls in vulnerable category. The project affected 14 IP households will lose both residential structures and business (small tea and snacks shops) including livelihoods due to KDP road upgrading works. There is no disproportionate impact on IPs since there is no impact on communal land and natural resources. Detail information on IPs is provided in RAP and IPDP reports separately.

Aged Group

The survey shows that the minor population aged group (between 0-14 years) are 26.4%. The economically active population i.e., 15-59 years are 64.5%. The 60 years and above are 9.1% of total population. Nearly two-third of them are economically active population which shows that the displaced age group can easily settle down outside. **Figure 4.21** below shows a distribution of the project affected persons by age group.

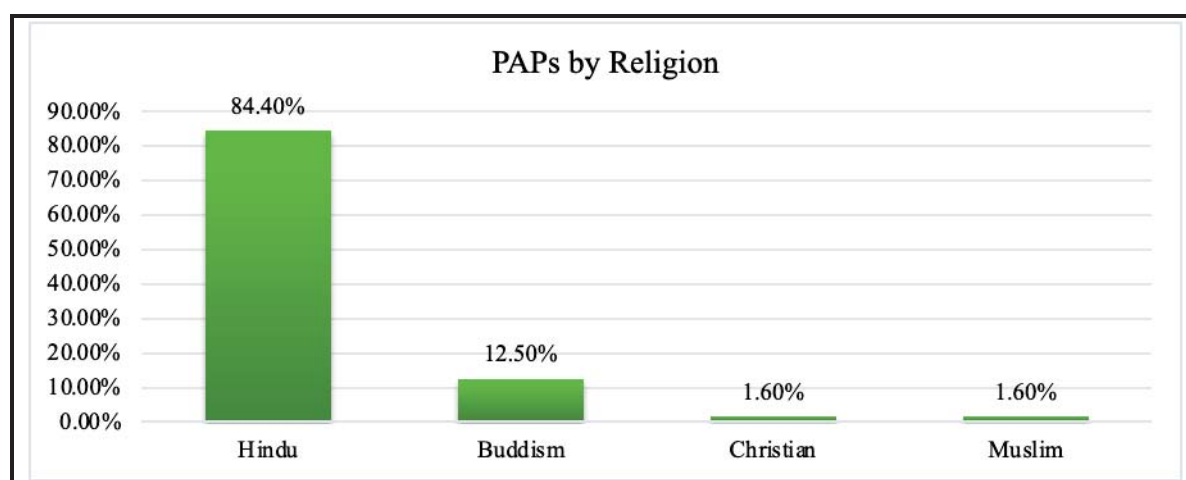


Source: Census Survey, 2022

Figure 4.21: Distribution of the Project Affected Population by Aged group

Religion

The major religions of the project affected HHs are Hindu, Buddhist, Islam and Christian respectively. The 84.4% of the households are Hindu, 12.5% are Buddhist, 1.6% are Muslim and 1.6% are Christians by religion as shown in the **Figure 4.22**.



Source: Census Survey September, 2022

Figure 4.22: Distribution of PAPs by Religion

Education and Literacy

The total project affected surveyed population is 330. Out of this, 24 persons are below school age. Excluding the below school-age children, other population of the project affected surveyed households are 306. The literacy percent of the surveyed HHs is 82.2%. And the educational status among the literate are as; can read and write as literate by 4.2%, 1-10 class by 55.5%, the educational status of S.L.C. passed by 10.1%, 12 or Intermediate passed by 9.8%, graduate and above are by 2.62% while illiterate populations are (17.8%) that indicating varying degree of educational status of the project affected surveyed population along the KDP road alignment.

Land Use and Ownership

The census survey revealed that 62.5% of the total project affected households' have own both land for agriculture and housing outside from the project area, while 37.5% of them have owned some piece of land with small house outside the RoW only.

Livelihood, Income & Expenditure

Livelihoods/Occupation status: Among total affected population of 330, 186 are found to be economically active and rest 144 are minor aged (below 14 years) economically inactive population and students. The census survey of the project affected population that engaged into trade and business is 48.3 percent. The main purpose of residing into the ROW seems to do business activities. Similarly, 18.2 percent populations are engaged in household works, 13.4 percent engaged into labour, 8 percent foreign employment, 5.9 percent agriculture, 4.3 percent services and 1.6 percent getting pension. The occupation distribution is shown in the **Table 4.43**.

Table 4.43: Distribution of Occupations by Population (above 14 years of population)

District	Municipality	Agriculture	Trade and Business	Service	Household work	Labour	Foreign Employment	Pension	Total
Dhanusha	Ganeshman Charnath M.	5	23	3	14	7	8	1	61
	Dhanusadham Municipality		2	3					5
	Mithila Municipality	4	30		10	4	4		52
Mahottari	Bardibas Municipality		13	1	2	4	2		22
	Gaushala Municipality		12			4	1	1	18
Sarlahi	Ishworpur Municipality		3			2			5
	Hariwon Municipality		1	1	3	3			8
	Bagmati Municipality	2	3		3	1		1	10
Rautahat	Chandrapur Municipality		2		2				4
Bara	Nijgadh Municipality		1						1
Total Population		11	90	8	34	25	15	3	186
Percentage		5.9	48.3	4.3	18.2	13.4	8.0	1.6	100

Source: Census Survey, 2022

Household Income Range of PAH: The project affected households have been calculated based on standard norms and practice. Based on this calculation, 36 households (56%) out of the 64 project affected households were identified as Below Poverty Level (BPL) in terms of their average annual household income as reported by them. Another 44 % households are found above the poverty level as per their family income. **Table 4.44** below provides the breakdown of income levels of affected households as per the average annual income range.

Table 4.44: Average Annual Income Range of the Project Affected People (NPRs)

Income Range	KDP road Project Affected households	
	In No. HHs	In Percent
<50000	1	1.6
50,000-152,000	6	9.4
152,001-204,001	6	9.4
204001-371831	23	35.9
Greater than > 371831	28	43.8
Total	64	100.0

Source: Census Survey, 2022

Below Poverty Households: According to the Nepal Living Standard Survey (NLSS Survey 2021), the revised official poverty line in 2022-23 is estimated NRs.72, 908 per person per year. It has also aggregated the food items and non-food items and the expenses required to be above the poverty line. Accordingly, the income required for providing adequate calories (2,236 kilocalorie) for an average Nepali to be active is Rs. 35,029 at 2023 prices. For non-food items, for an average, the average income required is Rs.37,879 at 2022/23 prices.

Based on the official poverty line at NRs.72,908 per capita per year, 36 households with 166 population fall below poverty line among 64 project affected surveyed households. The average annual income of below poverty line population is NRs. 51,675 per person per year and that of the below poverty line households is NRs. 238,278 per HH per year as shown in **Table 4.45**.

Table 4.45: Average Annual Income and Per-Capita Income of PAH and PAPs

District	Municipality	Total Income	No of HHs	Average Income		Population	Per Capita Income	
				Annual	Monthly		Annual	Monthly
Dhanusha	Ganeshman Charanath Municipality.	2,321,000	8	290,125	24,177	40	58,025	4,835
	Mithila Municipality	2,306,000	10	230,600	19,217	45	51,244	4,270
Mahottari	Bardibas Municipality	905,000	4	226,250	18,854	23	39,348	3,279
	Gaushala Municipality	1,154,000	5	230,800	19,233	18	64,111	5,343
Sarlahi	Ishworpur Municipality	280,000	2	140,000	11,667	8	35,000	2,917
	Hariwon Municipality	240,000	1	240,000	20,000	6	40,000	3,333
	Bagmati Municipality	772,000	3	257,333	21,444	14	55,143	4,595
Rautahat	Chandrapur Municipality	480,000	2	240,000	20,000	8	60,000	5,000
Bara	Nijgadh Municipality	120,000	1	120,000	10,000	4	30,000	2,500
Overall		8,578,000	36	238,278	19,856	166	51,675	4,306

Source: Census Survey 2022. Considering the average HH size of 5.1 for KDP project, the poverty line for this KDP project is assumed to be Rs.3,71,831 per household per year at 2022/23 prices. The census household's survey shows that about 36 (56%) household's per capita income is less than Rs. 3,71,831 which denotes below poverty line households.

Vulnerability and Vulnerable Groups

Vulnerable groups are persons, households, or groups who, due to their existing challenges, may become unable to meet their daily needs as a result of project impacts. These vulnerable groups have been considered as old aged people, women-headed households, differently able households, below poverty line, vendors within the ROW of KDP road. Vulnerable groups might suffer disproportionately from adverse project impacts and/or be less able to access the project benefits and compensation,

including livelihood restoration and assets compensation, when compared to the rest of the project affected persons.

Among 64 project affected households, 43 HHs are identified as vulnerable households where 3 HHs are old aged (senior citizens) headed, 3 HHs are women headed, 1 HH is differently-abled headed and remaining 36 HHs are below poverty level. Beside this, it is noticed that 80 number of road side vendors who are doing their business within ROW will be displaced from the market areas and hence they are also considered as vulnerable.

Food Security

Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. The status of food security is not that high in the project area because most of the affected HHs do not have their land for farming and own production, they have to depend other sources of income for food security. About 49 HHs (76.57%) have only food sufficiency less than 3 months by their own production. Among the 64HHs surveyed households, only 15HHs (23.43%) have entertained up to 6 months of food sufficiency by their own product. So, they managed remaining of food stuffs by other sources like business, wage labour and foreign employment for coping food insufficiency against their own production,

Land Tenure and access to Natural Resources

Through the construction of the road, the tenorial arrangements of the land may undergo substantial changes. The trends of leasing land will substantially increase for commercial farming, establishing and operating home stays, developing business centers, running hotel enterprises, installing market centers, establishing crushing industries and other types of industries and others along the road corridor. There will be increased depletion and degradation of locally available natural resources such as land, forest, water bodies and others due to construction of the road resulting from over exploitation, use of/demand for natural resources at local levels. The risks of increased deforestation, ecosystem degradation and species loss along the road alignment are likely to occur during the construction phase of the road. This will result from the felling of trees along the forest and private lands, many crop species will be destroyed and ultimately the ecosystem will be degraded at local levels causing many ecological and environmental problems. The inflow of labourers in the camp site will create pressure on deforestation of the jungle while collecting firewood for cooking purposes. Also, there will be increased pressure on and competition for resources and infrastructure along the road alignment. The regular incomes coming from the rents of the building and shopping complexes will be positive impact for people at local levels.

Affected forest: The road rehabilitation will affect three types of forests: community forests, Collaborative forests and national forests. The forests are used for firewood, grazing and fodder by communities. The road widening is confined within RoW and will be limited impacts on the usage on this livelihood activities.

Affected ponds: There are 11 ponds along the roads within ROW as listed in **Table 4.9**. These ponds are located on government land. They were created as borrow pits during construction of East-West Highway in the past. Most of these ponds are used by domestic animals for drinking and wallowing. Ponds within forest areas are also found to be used by wild animals for drinking water. Due to road widening, some sections of these ponds may need to be buried leading to decrease in size of the pond. However, there are other alternative options like wetlands, ditches and rivers where domestic animals and wildlife can rely on.

River Based Livelihood: There are some perennial rivers crossing the road alignment supporting aquatic life. Construction of bridges over these rivers can impact temporarily on aquatic life. However, no fishery-based livelihood is noticed along KDP road alignment.

Conflict of Land and uses of Natural Resources: The road widening will be confined within ROW only which is under the ownership of DOR. There is no conflict of land and uses of natural resources.

4.3.21 Labour and Production Systems

The construction of road requires workers (skilled, semi-skilled and unskilled labourer). The major positive socio-economic impact will be in the sphere of temporary employment generation to very substantial numbers for the local community. The upgrading and improvement of KDP road project is likely to foster opportunities to local labourers in the construction works. The technical skills and know-how of labourers are likely to be enhanced thereby helping the labourers earn more daily wages. The direct economic opportunities are likely to pertain to the employment in the project as semi-skilled or unskilled workers. The indirect economic opportunities are likely to result from the creation of markets for small shops and businesses to cater to the project and its workforce.

The construction stage of the project should provide an incentive to the local community, especially the younger population, to return to their original settlements. This may be done through the creation of direct and indirect economic opportunities for the local community. The risk of social unrest and conflict due to the increased presence of the migrant population in the construction sites of the project causing threats to human security in local levels during the construction stage. There will be complaints by the local community if the interface between the outsider labourers (workers) and local community appears due to inter-cultural differences between them (migrated workers may have social, racial and religious conflict with the local community).

4.3.22 Access to Public Services

The major markets in Madhesh province are Birgunj, Janakpur, Rajbiraj, Lahan, Mirchaiya, Jaleswar, Bardibas, Malangwa, Kailaiya, Chandranigahapur and Simara. The main production of this state is mango, sugarcane, wheat and many other seasonal crops and vegetables. The cement is main industrial product. Bus, mini bus, jeep, car, taxi, tempo, Rickshaw, bike and motor bike are means of transportation for travelling and the truck, mini truck and tractor are available for transportation of goods in the project area. Heavy vehicles like trucks and buses run for long distance on the highway. Tippers and tractors are used for transporting construction materials in the project area. Public services available in the project area include schools, college, hospital/health posts/centers, local hazzars, market and ward/municipality offices and district headquarters.

CHAPTER-V: STAKEHOLDER ENGAGEMENT AND PUBLIC CONSULTATIONS

5.1 Introduction

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 stakeholder consultation is 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.

5.2 Mapping of Stakeholders

The potential stakeholders of the KDP upgrading work have been identified by the stakeholder mapping process (FGD, KII, Public Hearing, etc.). The key identified stakeholders are: local governments, 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, local user groups (forest, water, irrigation etc.), local journalists, traffic police officers and army officer, travel agency, drivers and road users (travelling passengers), NPWC offices, District Forest Offices, Forest division, other forest offices, forestry campus/academic institution and so on.

5.3 Affected Parties

Project Affected Families (PAFs) or Project Affected Persons (PAPs); Severely Project Affected Families (SPAFAFs); project affected vulnerable households (both last groups include HHs losing private residence and residence & trade opportunities along KDP road); Indigenous Peoples (IPs) and their organizations and networks; Marginalized communities (Dalits, Janajatis/Adibashis) 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 centers; Various Market actors, Local Security, Media, Transport organization, and others alike.

5.4 Other Interested Parties

General Group: Civil society, Mother Groups; Youth clubs; Farmer Groups; Users' Committees; NGOs/CBOs and Associations working at local levels; Trade centers; Various Market actors, Local Security, Media, Transport organization, differently abled people organization.

Government Line Agencies includes the District Level (District Administration Office (DAO); District Coordination Committee (DCC); District Land Revenue Office (DLRO); District Forest Office (DFO); Parsa National Park; 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.

5.5 Methods of Stakeholder Engagement and Public Consultations

Transect Walk, Focus Group Discussion (FGD), Key Informants Interview (KII), mixed group discussions and public hearing were tools for consultations with different stakeholders. The stakeholder consultation carried out during ESIA preparation covers the issues of directly and indirectly affected groups including local government line agencies. Additional stakeholder consultations were carried out at Birendrabazar of Dhanusha, Lalbanhi of Sarlahi and Jitpur Simara of Bara districts to incorporate the issues of directly affected groups and other interested parties based on draft EIA/ESIA report and to share what are the issues incorporated in the draft ESIA and detailed design report as the concerns of stakeholders raised during baseline information collection, preparation of ESIA etc. Provisions in design report and ESIA/EIA report were presented through power point presentation and documents regarding project information were also shared with stakeholders and their views were noted.

5.6 Stakeholder Consultation

The stakeholder's consultation was carried out during different phases of ESIA. First level of consultation done was during scoping phase where 46 group discussions were carried at different locations of Ganeshman Charnath, Dhanushadham, Mithila, Bardibas, Lalbandi, Harion, Bagmati, Chandrapur, Nijgadh Municipality and Jitpur Simara Sub metropolitan City from May to June, 2022. Total 663 participants took part with Bahun/Chhetri-254, Adiwasi/Janajati-186, Madhesi-172, Dalit-38, and Muslim-13. Along with consultations, key persons within the project area (Mayor, ward chief, local leaders, school teachers, division forest officers, warden and other officers of Parsa National Park etc.) were interviewed for knowing the environmental, biological and socio-economic and cultural setting within project area. Altogether, 44 KII were conducted along the road alignment. Further, public notice seeking issues/impacts due to project and suggestions were pasted among different stakeholders and similar notice was also published in national daily newspaper. Household survey covering 20% of households within DIA of the Project was done to identify the baseline scenario of the project area.

Major issues of locals include crossing structures as PUP, VUP, Service roads, overhead pedestrian bridges, shelters, safety measures as signs & markings, railings, wildlife crossing structures etc. The major issues noted during consultation's are Safety provision with universal access and inclusive design for school children & elderly people, women, cattle crossings, requirement of VUP & PUP, temples, shrines, waiting sheds, Haat bazar, Bus stops, zebra crossings, lights, gender/child/differently able friendly public toilets, management of 8 wells, cycle lane, electric poles and other facilities should be rebuilt in consultation with of local administration and local people. The issues raised by public are mostly considered in design. Service roads in 26 places, 5 nos. VUP/PUP, 127 no culverts, 18 no cattle crossings and enhancement of haat bazar at Lalbandi, Bathing ghats at Bagmati & Kamala Rivers has also been proposed. Establishment of project level GRM including division for CSEA/SH and Workers related, as provisioned in SEP. Priority in local employment and promotion of local products will be applied during project implementation phase and was also concerns of local people.

The supplementary consultations were carried out at 12 different locations of the affected Municipalities focusing on directly affected people (21 females and 111 males out of 132 participants) in October 2022. 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. Further 64 census household survey were conducted among project affected households to identify their baseline condition and view on project based on which resettlement plan has been prepared.

Nine focused group discussions were also done among indigenous settlements within the project area (among the people of Tamang, Majhi, Magar, Bote, Newar and Danuwar community) for identifying their view on the project and their aspects from the project based on which IPDP has been prepared. These FGDs were conducted from 30th February 2022 to 3rd January 2023. The total numbers of participants were 132; among them 60 were male and 72 were female participants.

Wildlife consultations

Field visits and stakeholder consultations were undertaken during the wildlife assessment with NGOs, Forest/Wildlife Department both higher officials, ground level staff, indigenous peoples, ethnic groups, forest-dependent people whose livelihoods are dependent on forest to a greater or lesser extent and sustainable harvesting of NTFPs from community managed forests.

Stakeholders for KDP Road Project date and type of consultation done and summary of issues discussed is given in **Table 5.1**.

Table 5.1: Stakeholders and Consultations

Stakeholder	Date	Type of Consultation	Major Issues Discussed	Key issues raised by the stakeholders	Response and reflection in the ESIA (where the responses are reflected in the ESIA report)
DoR- DCID	Continuous	Consultations, meetings	- Speed up the field work for ESIA - Review of reports and feedbacks - Overall Support	- Quality of the Report - Time of delivery ESIA reports.	Will do accordingly
World Bank	Continuous	Consultations, meetings	Technical Support for ESIA Study	Provision of technical support if required	Will seek if required
Local Level and (Wards and Municipal Offices)	28 th May to 7 th June, 2022	Key Informants Interview & Group Discussions	- Safety provision for school children and elderly people, Wild Animals, Cattle & Awareness program to minimize the road accidents. - Plantation in the median of road side - Plant to maintain greenery & to manage the cutting of tree during construction time, - River training works to control flooding and water logging in heavy rainfall at settlement area, preserve and manage the ponds which are nearby right of way - Road improvement/widening works should start rapidly cooperation with the authorities of National Park and other stakeholders - Employment priority should be given to the project affected households among them vulnerable, disadvantaged groups and female - Gender equality should be taken into consideration for employment - Awareness program to minimize the	Provisions of Road Safety, adequate measures for pedestrian crossings, resolving water logging issues, priority to local for employment	- Road has been designed considering road safety. PUPs have been proposed at 5 locations (in total 10 PUPs), 27 junction improvement, sufficient at-grade crossings with safety measures. Issues regarding water logging is supposed to be resolved through modified drainage system. - Priority to local employment will be given during road construction

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Stakeholder	Date	Type of Consultation	Major Issues Discussed	Key issues raised by the stakeholders	Response and reflection in the ESIA (where the responses are reflected in the ESIA report)
Residents within DIA	5 th Sep to 25 th Oct, 2022	20% Household Survey	- gender-based violence - Gender-based discrimination in terms of wages and works - Community related grievances (due to labour influx) - Awareness program to minimize the road accidents - Road improvement/widening works should start rapidly - Priority should be given to use available local resources in project activities - All the public infrastructures such as temples, shrines, electric poles, waiting sheds and taps should be rebuilt with the communication and cooperation of local government	- Awareness on road safety - Relocation of community structures	- Awareness on road safety will be provided - All the affected community structures will be relocated
Households within ROW	5 th Sep to 25 th Oct, 2022	Census Household Survey	- Employment priority should be given to the Project Affected Households among them vulnerable, disadvantaged groups and female - Awareness program to minimize the road accidents - Enhancement of technical skills & promotion of local business - Livelihood restoration training	- Employment to project affected households - Enhancement of technical skills	- The project will prioritize affected households for employment - The project has planned for providing skill enhancement trainings
Project Affected People and Local Representatives	8 th Sep 2022- 22 nd Oct, 2022	Focus Group Discussion	- Minimize the impact on ponds and other community properties which are nearby RoW - Priority should be given to use available local resources in project	Minimal impact in structures, adequate road safety measures to be provided	- Affected structures will be compensated/relocated - Adequate safety measures have been designed

Stakeholder	Date	Type of Consultation	Major Issues Discussed	Key issues raised by the stakeholders	Response and reflection in the ESIA (where the responses are reflected in the ESIA report)
IPs within DIA	30 th Feb 2022- 3 rd Jan, 2023	Focus Group Discussion	activities - Community people have requested to construct the bridge and other physical works on the basis of the existing RoW - Community people are committed to support project implementation activities - Bus stops, zebra crossings, lights, public toilets, refresh center, cycle lane and other facilities should be rebuilt - Road improvement/widening works should start rapidly.	- Adequate facilities for pedestrian movement and crossing - Employment of project affected households	- Adequate facilities like footpath and cycle lane in urban sections, VUPs and PUPs at 5 locations, sufficient at-grade crossings with safety measures etc. have been designed. - Priority will be given to affected households for employment.

Further, public hearing was conducted at 8 different locations for covering all the project affected municipalities and wards to participate in the public hearing/stakeholder consultations. Summary of recommendations/suggestions from the public hearing is discussed in **Table 5.2**:

Table 5.2: Summary of Recommendations/Suggestions from Public Hearing

Date	Meeting Location and Stakeholders	Attendees	Key Suggestions and Issues Discussed	Response
2080/02/08 (22 May, 2023)	Mithila 7 Dhalkebar	42	- Design should be done considering water logging/flooding issues in Mithila Municipality ward 10 and other areas. - Masala tree (Eucalyptus) should be removed from road side and plantation of green, fruit and flower bearing plants should be done. - Ratu, Auri and Jalad rivers are areas for elephant movement, so they should be included in the report. - The contents of the report should be implemented and the road construction should be completed quickly and efficiently. - The park in Dhalkebar Chowk should be protected and the Dhalkebar Chowk should be managed through fly over and underpass. - Existing road is different than road jurisdictions and this issue needs to be addressed. - Underpass should be constructed in different junctions especially in areas with schools and hospitals. - A structure reflecting the Mithila culture should be built at Dhalkebar Chowk towards Janakpur Junction.	- Drainage designed accordingly to address the issue - Masala tree will not be favored for new plantation - Bridge height maintained for elephant crossings - Will be done accordingly - Park at Dhalkebar Chowk will be protected. At-grade junction with other traffic control mechanism will be adopted at this stage - The Project will coordinate with Ministry of Land Management, Cooperatives and Poverty Alleviation to address this issue - PUP proposed only for 5 sections, at-grade junction with other traffic control mechanism will be adopted at this stage for other junctions - The Project will coordinate with concern Municipality for addressing this
2080/02/08 (22 May, 2023)	Bardibas 1 Bardibas Bazar	24	- Construction work should be done quickly and efficiently in urban areas. - Special attention should be given to quality work while constructing road. - During project construction, trees should be cut down fulfilling legal provisions of Government of Nepal.	Will be done accordingly
2080/02/09 (23 May, 2023)	Lalbandi 8 Lalbandi Bazar	27	- Crossings in hospital and school areas should be added as required and as discussed in previous meetings. - Chautaras and temples should be managed properly by giving appropriate option. - Proper arrangements should be made to facilitate the movement of animals in the forest area between the railway and the East-West highway. - Since information is received late, information flow should be made effective. - Since Lalbandi Bazar is urbanizing rapidly, 6-lane highway should	- PUP proposed only for 5 sections, at-grade junction with other traffic control mechanism will be adopted at this stage for other junctions - Will be managed properly. - This project has considered bridge height to facilitate elephant movement. Will coordinate with Department of Railways - Noted 6-lane highway is proposed at Lalbandi and

Date	Meeting Location and Stakeholders	Attendees	Key Suggestions and Issues Discussed	Response
2080/02/09 (23 May, 2023)	Harion 11 Harion	50	be constructed. - The project should address socio-economic subjects like school reform, market management, trainings related to agriculture etc. Existing carts in the road side should also be managed. - Impact on existing water supply, fibre net and sewerage management should be addressed. - As private structures within ROW of Lalbandi area will be affected, more study should be done. - Crossings should be constructed at three locations between Ishworpur Banke to Fuljor where there is elephant movement and underground should be constructed at junctions (chowks). - In school areas, crossings arrangement should be added as discussed earlier. - Railings should not be placed on the roadside in the market area. - Bridges should be managed in hat bazar areas of Harion and Nawalpur. - Plants that promote greenery should be planted in Harion market area. - Underpass should be constructed in junctions like Sukepokhari Campus Road. - Special attention should be given for water logging and drainage management. - Crossing facility should be provided along Bagmati Municipality and Kamaiya Campus locality - Deed transfer of lands within ROW of road is still pending and the project should address this too. - Affected structures including temples and drinking water should be restored. - Underpass should be constructed at Putali Chowk of Bagmati Municipality as it is the junction for way to Bharat Tal and Road connecting with Kathmandu Fast Track. - Construction work should be done with less damage to the existing road condition.	other similar urban sections - Will be done accordingly and addressed in Resettlement Plan - All the affected utilities will be relocated - Affected private structures are identified and will be compensated - Bridges in areas sensitive to elephant movement have been designed to facilitate their movement - Junction improvement is considered in design itself. - PUP proposed only for 5 sections, at-grade junction with other traffic control mechanism will be adopted at this stage for other junctions - Will be done accordingly - Will be done accordingly - Will be done accordingly - PUP proposed only for 5 sections, at-grade junction with other traffic control mechanism will be adopted at this stage for other junctions - Drainage designed accordingly to address the issue - PUP proposed only for 5 sections, at-grade junction with other traffic control mechanism will be adopted at this stage for other junctions - For deed transfer of lands with ROW, the Project will coordinate with Ministry of Land Management, Cooperatives and Poverty Alleviation to address this issue - Affected structures are identified and will be restored as per resettlement plan - PUP proposed only for 5 sections, at-grade junction with other traffic control mechanism will be adopted at this stage for other junctions - Will be done accordingly

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Date	Meeting Location and Stakeholders	Attendees	Key Suggestions and Issues Discussed	Response
2080/02/10 (24 May, 2023)	Chandrapur Chapur Bazar	6	36 - Alternative route for schools and business should be managed during construction for minimizing the impact. - As there will be more adverse impact of flyover, alternative design should be done with less adverse impact. - Water flow from north to south in areas where there was no Hume pipe previously should be arranged and additional drain should be provided in Chapur Junction. - Sky bridge, one towards left and one towards right of Chapur Junction should be provided. - Special importance should be given to the environmental aspect during the extraction and use of construction materials. - Project should be implemented being under the Forest and Environment Acts and considering experience from other similar projects. - Management of temples and waiting rooms should be done in coordination with the locals. - During the construction of the road, the community forest user committee should be informed and coordinated about the program to minimize the effects of cutting trees (within the road boundary). - For growing trees that take long time to grow like sal trees, stakeholders related with forest should be coordinated. - During project implementation, provision for protection against fire hazards should be kept and forest area should not be disturbed while stockpiling quarry and construction materials. - Since there is no deed transfer of ROW within Chandrapur Municipality, construction works should be commenced after initiating deed transfer. - During the construction stage, 75 percent (of the local residents should be involved in the project. - Initiation should be taken to make electric poles underground in urban areas. - Approach to under construction charging station near Chandri River should be managed.	- Will be done accordingly; Traffic Management Plan has been prepared to address this issue - PUP proposed only for 5 sections, at-grade junction with other traffic control mechanism will be adopted at this stage for other junctions - Cause ways and pipe culverts will be replaced by box culverts. Cross drainage and side drain improved in design to address this issue - PUP proposed only for 5 sections, at-grade junction with other traffic control mechanism will be adopted at this stage for other junctions - Will be done accordingly. Quarry and Burrow Pit Management Plan has been prepared to address this issue - Noted and will be done accordingly - Local level will be coordinated at different stages of construction - Tree cutting will be done as per Forest Act and Forest Rules - Will be done accordingly. - Will be done accordingly - For deed transfer of lands with ROW, the Project will coordinate with Ministry of Land Management, Cooperatives and Poverty Alleviation to address this issue - Priority will be given to local for employment - The project will coordinate with NEA to address this issue. - Will be managed under junction improvement

Date	Meeting Location and Stakeholders	Attendees	Key Suggestions and Issues Discussed	Response
2080/02/11 (25 May, 2023)	Nijgadh 7 Nijgadh	55	- Looking at the land structure and ground condition of Nijgadh market, rainwater/water coming from the north cannot be drained easily from existing causeways so design should be made to drain water of eastern region from central of Nijgadh to Bhamara River and western region to Bakaiya River. As southern section of the road is low relate to northern section, it is suggested to pass water from northern side drain to southern side drain. - Considering the population density of Nijgadh market, service centers, schools, bazaars, etc. sky bridges (overhead bridges) should be provided, accordingly, disabled-friendly, child-friendly, women-friendly structures should be constructed like toilets should be made women-friendly. - In Nijgadh Bazar, water pipelines, telephone, fiber and electricity lines built in the north-south and within ROW of the road should be arranged in a proper manner towards the corner of roadside area. Water supply pipe should be managed prior to construction. - After construction of the road, as speed of the vehicles will increase increasing probability of accidents, so as to solve this problem, speed management, traffic safety, zebra crossings and speed limits should be provided. - For protection of wild animals in big forest areas, animal crossings, under pass etc. should managed properly. Fencing of forest area should be provided. - While implementing road design and drainage design, coordination with local level should be done and implement work accordingly - Since water supply is managed by the drinking water consumer committee, the cost of damage, demolition during road construction should be estimated and cost should be borne by the project. - The project should be implemented in a direct and environment-friendly manner, considering the smoke-dust and traffic movement and public health within market area. - For making highway beautiful and clean, plantation along median should be done develop accordingly - As there is Fast track, railway and proposed international airport within the vicinity of this area, considering construction of all these	- Existing cause ways and pipe culverts will be replaced by box culverts. Cross drainage and side drain improved in design to address this issue - PUP proposed only for 5 sections, at-grade junction with other traffic control mechanism will be adopted at this stage for other junctions - Women, child and disable friendly pubic toilet will be constructed - Design has provisioned of providing utility duct below footpath area to address this issue - Will be constructed accordingly. Adequate Traffic Safety considered in design - Bridges within forest area are designed as under pass for animals and will be constructed facilitating animal movement - Will be done accordingly - All the affected utilities due to project activities will be restored - Will be done accordingly - Considered under design - Will be considered in later stage during operation - Will be provided accordingly

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Date	Meeting Location and Stakeholders	Attendees	Key Suggestions and Issues Discussed	Response
2080/02/11 (25 May, 2023)	Jeetpursimara Pathlaiya	19	infrastructures, charging station, bus park, signature bridge of Bakaiya River and service lane up to Fast Trak should be constructed. - For protection of wildlife in forest areas, adequate speed reducing mechanism and signs should be managed. - Ten shutters of Shri Nepal National Secondary School of Pathalaya are being built close to road and are being used for the income-earning of the school. If possible, it should be protected or if the design occupies a 50-meter ROW area at this location and needs to be removed, reconstruction/rehabilitation cost should be proposed. - This is a commendable and positive program. Proposed box culvert should be used as animal crossings. The proposed structure should be managed at the proper location, wildlife movement should be considered and addressed, some transmission lines are undergrounded that should be coordinated and extended. - The report should be discussed within department and ministry with representatives of Parsa National Park and Buffer zone area and take suggestions - Trucks are parked in this area due to which it is difficult for teaching and studying by students. Therefore, trucks holding in this area should be removed. - As there is three-way junction, refreshment center should be constructed nearby. Historical aspect of the junction should be preserved and reconstructed.	- Compensation cost will be provided to affected structures - Designed accordingly - Done Accordingly - Coordination with Traffic Police will be done for removing truck holding in front of school area. - Junction at Pathlaiya will be Preserved.
2080/09/18 (3 January , 2024)	Parsa National Park, Bara	14	- How can road kill be minimized? Are the proposed animal crossing locations adequate or not? and speeds speed limits at Parsa National Park needs to be limited to 40 km. - For elephant crossings, it is necessary to install guiding fences and pay attention to openness index while constructing animal crossings. - Water holes and grass lands both towards northern and southern side of Kamala-Dhalkebar-Pathlaiya road adjoining to Parsa National Park needs to be developed considering the dietary habits of animals. - For facilitating animal movement, speed control plan needs to be	- Underpasses, rumble strips, guiding fences, speed limit to 40 km have been proposed - Guiding fences are proposed for all elephant crossing locations. Openness index has been considered for elephant crossings - Required water holes will be developed during construction period in coordination with PNP - Coordination will be done accordingly - Animal crossings has been proposed - Speed limit up to 40 km proposed within adjoining section of PNP has been proposed. Further

Date	Meeting Location and Stakeholders	Attendees	Key Suggestions and Issues Discussed	Response
			developed in coordination with road division, traffic police, Parsa National Park and Division Forest Offices. - As the roadkill, mainly small animals, within Parsa National Park is increasing, subject related to be constructed animal crossing infrastructures should be included in detail design. - To facilitate the movement of elephants within and around Parsa National Park, underpasses and overpasses should be constructed, particularly between fast-track point to Pathlaiya Junction. - Elephant underpasses practices within National Park areas of India should also be incorporated into the report. - Implementation of solar fence and its maintenance should be included in the document. - For the easy movement of wildlife, different alternatives such as speed control mechanisms, underpasses/overpasses, and resting vehicular movement during night time need to be implemented to reduce road casualty and wildlife accidents in road. Provisions as provided in Wildlife Friendly Guidelines should be considered. - When constructing bridges of Kamala-Dhalkebar-Pathlaiya Road section within Parsa National Park, the height should be a minimum of 7.5 meters sufficient for elephant crossings. - Suggestions as received in expansion of Pathlaiya-Narayangadh road should also be referred in KDP road section report.	coordination will be done as suggested. - Animal crossing has been included in detailed design - Underpasses for elephant movement have been proposed in this road section - Elephant underpass practices in India has been referred in BMP - Solar fence has been proposed - Different alternatives considering mitigation hierarchy has been proposed - Height of bridges for elephant crossings has been adopted as per National Guideline - Suggestions for Pathlaiya-Narayangadh road section has also been referred.

5.7 Grievance Redress Mechanism

A Grievance Redress Mechanism (GRM) 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 DoR ESMF and WB ESF. The PAPs will be made fully aware of their rights and the procedures for grievances registration verbally or in writing arising during survey and time of compensation. Grievances can be recorded at project level and also addressed at PCU level at DCID office. Grievances can be lodged through contact no. 01 5903753 or email dorfcb@dor.gov.np and <https://grms.dor.gov.np/>.

5.7.1 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.

For KDP, 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 and centrally established grievances redress committee (GRC).

5.7.2 Workers Related Grievance

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).

5.7.3 Gender Based Violence (GBV/CSEAH) Related Grievances

This includes issues of Gender Based Violence in particular Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) 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) and GBV action plan as well as proper documentation of each labour including social sanctions. A parallel SEA/SH GRM will be established in compliance with the World Bank's Good Practice Note. It will primarily uptake and address only SEA/SH related complaints that may result from the activities related to KDP.

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.

The SEA/SH uptake procedure will be established parallelly with the project GRM as detailed out in the SEP.

5.7.4 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 handled 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, CSC office will facilitate a Grievance Redress Committee (GRC) 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 GRC 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. Any anonymous grievances including SEA/SH will also be recorded and addressed.

DCID-DOR will handle received grievances related to works on the road construction. The construction contractor will clarify, if the construction works cause the complaint. The CSC 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, CSC 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 (CSC) 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, CSC; 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 complaints. 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.

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.

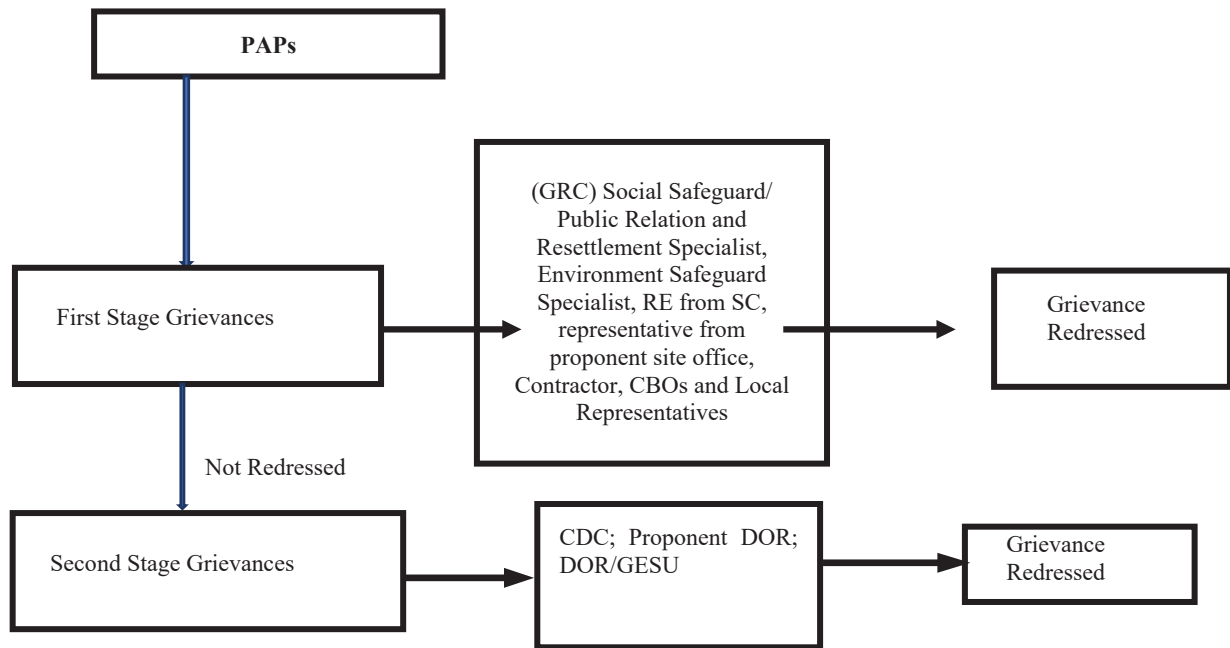


Figure 5.1: Grievance Redress Mechanism Structure in the Project Cycle

CDC= Compensation Determination Committee, PAPs= Project Affected Persons, GRC= Grievance Redress Committee, SC= Project Management and Supervision Consultant, DOR= Department of Roads, GESU= Geo-Environment and Social Unit.

*Aggrieved person may also access the country's legal system at any stage (of the three stages) of the grievance redress mechanism.

CHAPTER-VI: ENVIRONMENT AND SOCIAL RISKS AND IMPACTS

6.1 General

Construction of road will have impact on biophysical and socio- cultural environment. The nature and magnitude of impacts would vary depending on the character of components of construction works and the physical and socio- economic setting in which such project is located. The present KDP project is proposed to be constructed as four lane road.

Although most of the works are planned to be carried out within the existing ROW. Some assets and property will have to be displaced and rehabilitated. As improvement of alignment does not involve permanent land acquisition as widening will be carried out within existing RoW of 50 mts. The bridge and river protection work will also done along riverside. Also, there are some occupiers and encroachers within the existing RoW who have been identified as recipient of compensation, residing within the ROW as investing for housing and other regarding assets, therefore these issues are covered generally in the Resettlement Action Plan (RAP) report. Also, the biological impacts of the project are covered in detail in Biodiversity Management Plan (BMP) prepared separately.

During the field surveys, consultations and site investigations, several environmental issues were identified and discussed through impact matrix. This chapter highlights these environmental and social risks and impacts during the improvement of KDP road. To study the risks and impacts involved with the project, risk screening criteria based on WB ESS was considered as shown in the **Table 6.1** below.

Table 6.1: Environmental& Social Risk Screening Criteria

S. No.	Risk Category	Screening Criteria
1	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.
2	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.
3	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.
4	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.

6.2 Beneficial Impacts of KDP 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 KDP road will facilitate economic development and transport efficiency, providing multiple services to local communities and industries. For identifying and designing appropriate facilities, the design team and ESIA team jointly visited the site, had consultation with stakeholders including local government, traffic police, forest users' groups, division forest offices and Parsa National Park. Suggestions from these stakeholders were analysed and need assessment was done jointly to identify the actual requirement that were then incorporated in design.

There will be provision of Vehicular and Pedestrian underpass, service road, the new road will be developed with more safety provisions, the issue of traffic jams will be lesser, smooth movement of vehicles will lead to use of less fuel because of better efficiency through improved road condition. The likely beneficial impacts, envisaged during construction and operation stages, have been provided in **Table 6.2** below.

Table 6.2: Beneficial Impacts of KDP Road Improvement

Beneficial Impacts	Impact Rating		Rationale
	Construction	Operation	
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 and Women Empowerment	Substantial	Moderate	Opportunities for local labour-force Enhancement of technical skills and know-how The provision of transport related trainings for 250 women and counselling support for job placement for 25 women to archive the objective of gender target.
New income generation (trade, agriculture, businesses, industry)	Low	Moderate	Enhancement of local economy in market area along the stretches Opportunities for women Tourism development Improved living standards Boom industrial development Diversification of local income source
Increase in land and property value	Low	Substantial	Increase of public facilities and public services facilities Increase commercial activities
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

Improved Road Infrastructure

The most significant benefit of road rehabilitation/upgrading is improved road infrastructure from two lanes to four lanes with service road in urban sections. Also, there is provision of Vehicular underpasses, pedestrian underpasses, cross drainage structures that is bridges and culverts, cattle crossing, bus stops, and proper traffic lights (especially in urban sections), etc. Because of improved road infrastructure, the health and safety condition of road users & community along road will be better during operation stage of the project. The upgraded road will provide better access to services and transportation, including social services facilities such as health posts, hospitals, schools, colleges, coaching centers, offices of local authorities, municipalities, district coordination committees, etc. Details of proposed road improvement infrastructure is given in **Table 6.3**.

Table 6.3: Proposed Provisions along the KDP Road

S. No.	Proposed Road Improvement Infrastructures	Details
1.	Bus shelter with or without Bus bays	49 nos. along the road
2.	Truck layby	5 nos. along the road
3.	Service roads	19 nos. in total length of 34,704 m
4.	VUP/PUP	5 nos.
5.	Bridges	60 nos.
6.	Culverts	127 nos.
7.	Elephant Underpasses	Total 8 Nos. (existing bridges), 2 of them to be dismantled and rebuild
8.	Medium size animal crossings	10 Nos. (existing 9 bridges and 1 causeways)
9.	Tractor and Cattle Crossings	18 nos. (existing bridges)
10.	Design speed	100 kmph as per TOR

Source: Detailed Design Report 2023

Chainages for Bus bays and side: 238+200 (Left), 239+600 (Left), 239+900 (Right), 243+300 (Left), 243+350 (Right), 246+350 (Right), 246+200 (Left), 247+550 (Right), 247+750 (Left), 253+800, (Left), 256+900 (Left), 257+900 (Right), 259+750 (Left), 259+950 (Right), 261+050 (Left), 264+900 (Left), 265+100 (Right), 266+850 (Left) 267+400 (Right), 271+350 (Left), 279+300 (Right), 279+950 (Left), 283+200 (Left), 290+000 (Right), 291+200 (Left), 291+450 (Right), 294+800 (Left), 295+050 (Right), 299+450 (Left), 299+700 (Right), 304+100 (Left), 304+300 (Right), 307+000 (Left), 307+200 (Right), 308+000 (Left), 309+300 (Right), 312+800 (Left), 313+600 (Right), 314+600 (Left), 326+500 (Left), 326+700 (Right), 339+100 (Left), 345+500 (Right), 345+700 (Left), 353+150 (Left), 354+000 (Left), 357+800 (Left), 366+500 (Left) and 366+600 (Right)

Chainages for Truck laybys and side: 268+700 (Left), 324+300 (Right), 327+800 (Left), 347+800 (Right) and 366+300 (Right)

Chainages for VUP/PUPs: 243+640 (Birendra Bazar), 294+900 (Lalbandi Bazar), 299+545 (Nawalpur Junction), 304+190 (Hariwan Bazar) and 307+050 (Naya Road Junction)

Chainages for Elephant Underpasses: 329+752 (Amu – 1), 333+733 (Lamaha), 339+342 (Dhansar), 347+272 (Bakeya), 353+628 (Terhakilo), 357+227 (Pasaha), 360+869 (Balganga) and 363+585 (Dudhaura)

Chainages for Medium size animal crossings: 271+514 (Gadhanta), 274+925 (Belgachhi /Dhungre Khola), 275+630 (Tuteshwor-1), 277+266 (Maraha), 278+913 (Dholan), 282+758 (Bankhe), 285+721 (Amuwa), 292+703 (Kalinjor – 2), 317+698 (Paurahi), 322+553 (Causeway)

Chainages for Tractor and Cattle Crossings: 237+022 (Kamala), 241+744 (Charnath), 245+228 (Baluwa), 252+478 (Jalad), 254+663 (Aurahi), 256+186 (Basai), 258+735 (Sukhajor), 260+921 (Badahari), 265+345 (Ratu), 268+310 (Bhapse), 290+215 (Phuljor), 291+868 (Kalinjor – 1), 300+466 (Lakhandei), 307+753 (Rai Bridge), 313+121 (Bagmati), 314+170 (Gairi), 325+067 (Chandi), 343+584 (Bhamara)

Employment Generation

The road improvement activities will provide opportunities for local direct and indirect employment along the settlements in the project area during construction phase. It will be direct employment for construction-related work for the inhabitants all along the existing alignments for construction-related work prioritizing the inhabitants along the existing alignments, or indirect employment on project-support activities such as construction activities, food supply and transport.

Direct employment generation from the proposed project activities will be 1000 labour per day. It is estimated that, out of 1000 workers, about 600 migrant workers will work in this project. Unskilled workers will be hired locally. However, the skilled workers will be brought by the contractor from other parts of Nepal or abroad.

Also, training provision for transport related skills for 250 women during the project period will help the employment support in near future for women group.

It is also likely to increase the commercial agriculture, industrial and trade business activities after road upgrading in major market areas as Dhalkebar, Bardibas, Chandranighapur, Nijgadh etc. The KDP 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, river training works, road embankment and bio-engineering works and other open opportunities.

New Income Generation (trade, agriculture, business, industry)

Trade and business of local products, business of forest products, establishment of small scale and medium industries, agro-businesses, etc., will generate long-term opportunities for local people to be involved into economic activities. New market areas will be developed especially adjoining link roads enhancing more income generation activities and livelihood at local level. The road connects with some pilgrimage sites (such as Janakpur, Gadimai, Nuthar etc.), holding great historical and cultural importance. 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. 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.

Increase in Land and Property Value

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

Carbon Emission Savings/Reduction in GHG emissions in Transportation

It is noticed that during construction phase, 734,413.70 litres of Diesel will be required and this will lead to emission of 1,861.15 Tons of CO₂. Further, considering the material quantities required for the proposed road project (**Table 1.5**), 246,149 Tons of CO₂ equivalent GHGs emission will occur. Though during project construction there will be emission of Green House Gases (GHSs), during operation, the upgraded 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 as shown in **Table 6.4**. The carbon emissions of the project were calculated by following method.

1. Annual Average Daily Traffic data forecasted for years 2026, 2031, 2036, 2041, 2046 AD.

2. Carbon Emission was calculated on the basis of Emission factors provided in “**Guidelines for estimating greenhouse gas emissions of IPCC-guidance for transport projects**”.
3. “With Project” and “without project” scenarios were estimated by pro-rata basis for comparison of the carbon emission.

Table 6.4: Estimate of Carbon Emission (2022 – 2046 AD)

	W'out Project	With Project	W'out Project	With Project	W'out Project	With Project	W'out Project	With Project
Vehicular GHG Emission (TPY)	Jan, 2022		Jan, 2031		Jan, 2041		Jan, 2046	
Total GHG Emission (Tons/Year)	115,292	115,292	181,670	136,263	302,355	229,678	395,401	303,435
% Carbon Saving		0.00		33.32		31.64		30.31

Source: Carbon Emission calculated based on IPCC guidance for Transportation.

Similarly, during construction, though there will be decrease in CO₂ absorption and oxygen production due to loss of trees, in lieu of number of trees to be felled, 1:10 numbers of trees are proposed to be planted. Hence in long run, there will be more sequestration of CO₂. According to the “Arbor Day Foundation”, in one year a mature tree will absorb more than 48 pounds of carbon dioxide from the atmosphere depending on a lot of factors (i.e. the tree's size, species, and the amount of sunlight it receives etc.). Hence, one tree can absorb approximately 25 kg of CO₂ per year¹⁶.

Adverse Impacts

All adverse impacts have been grouped in as per new WB, ESS. Further the general and site-specific impacts were also presented separately. All those impacts were split up between relevant Environmental and Social Standard and evaluated against screening criteria as high, substantial, moderate and low (**Table 6.1**).

General Impacts

All general impacts have been analysed in **Table 6.5**, which provide the summary of all risk and impacts on Physical, Biological and Socio-Economic and Cultural Environment during construction and operation stages. The matrix is organized in order to link observed risk and impacts with WB ESF. The description of specific impacts associated with ESS is given in **Section 6.3**.

¹⁶ (Source: U.S. Department of Agriculture (USDA))

<https://www.usda.gov/media/blog/2015/03/17/power-one-tree-very-air-we-breathe>

Table 6.5: Impact Assessment Matrix along KDP

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
ESS 1: Assessment and Management of E&S Risks and Impacts						
Impact to vulnerable households	Substantial	Low	The project will impact on 40 vulnerable households The preparation of land for widening lot of earth activities will be in place like excavation, cutting, filling, removal of vegetation and trees, opening of borrow sites, plying of vehicles on earthen road. All these activities will lead to soil erosion issues. Therefor Erosion Management Plan will be required during construction stage. The Impact risk category is substantial but limited to Construction phase only as the site clearing and removal of vegetation will occur during construction. Avenue plantation and Slope stabilization work will be carried out, which will further lower the impacts in Operation phase.	Widening of road needs removal of structures of vulnerable households Excavation, cutting, filling, removal of vegetation and trees, opening of borrow sites, plying of vehicles on earthen road in construction phase.	Vulnerable people Construction site, Workers camps site, Nearby Habitation and Borrow areas (mentioned under Table 1.6: Information of Borrow Places)	Loss of residence and livelihood Vegetation clearance and tree cutting will be confined within width formation including embankments and side drains. Erosion due to project activities will also be within this range and further in quarry and borrow pit areas too.
Erosion and bank cutting due to land preparation and tree cutting						
Cumulative Impacts	Moderate	Moderate	The cumulative impacts on physical, ecological and socio-economic environment has been assessed and three VECs has been prioritized in present study. These three VEC are rivers, streams and natural drainage (physical environment), elephants (Ecological	Combined impact due to construction and implementation of different projects within project vicinity	Nearby Habitation, Rivers and Canals along the alignment, Wildlife along the alignment.	For cumulative impacts, surrounding area within 2 km from central line of KDP road alignment is considered in general and further elaborated in annexure 6.1

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
And impacts			Environment), and land resources (Social Environment). The detail CIA report is given in Annexure 6.1 . The risk from the project itself will be reduced during the operation phase by compensatory and avenue tree plantation, better road conditions (Surface & Width), better drainage facilities and underpasses for animal movement. Apart from that, migrant worker and sediments are part of construction phase only. However, the cumulative impacts will be moderate during the operation phase as the residual impacts from other completed projects, potential impacts from the planned projects and prevalent impacts from the current projects will remain.			
ESS 2: Labour and Working Conditions						
Occupational Health and Safety	Substantial	Low	Occupational health and safety of the workforces is one of the risks and impacts to likely occur while upgrading KDP 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 and	Exposure to physical hazards from use of heavy equipment; working at height and electrical equipment; working on water, trip and fall hazards; exposure to dust, noise and vibrations; falling objects; exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery. Workers may be encountered	Construction Workers	Impact related to OHS will be confined within construction sites

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
Working Conditions and Worker Accommodation	Substantial	Low	operation of quarry sites, working at height, etc. and are likely to have impact upon health and safety. The labourers could encounter injuries and accidents (sometimes casualties) in lack of adequate safety measures. Workers may be exposed to chemical and physical hazards like toxic chemicals, extreme heat, light etc. These Occupational health and safety impacts with substantial risk are mainly limited to Construction phase only and there will be no impacts in operation phase.	with health hazard during earthwork cutting, handling of hazardous materials, machinery movement, bitumen works, bridge construction and embankment stabilization etc.	Construction Workers	Impact will be confined to construction areas and camp areas
			There are chances that inaccessible work environment during construction and operation phase of the project will serve as barrier for persons with differently able people. The immigrant workers are likely to face the risk of improper and unmanaged accommodation at the construction sites. Hygiene and sanitation may be of major concern. Also, there would be the high risk of insects, wild animals, snacks etc. The Working Conditions and accommodation impact with substantial risk are limited to Construction phase only, and there will be no impacts in operation phase.	Use of temporary accommodation sites include those relating to poor sanitation (poor latrines conditions and washing facilities) and with no safety arrangements. Diseases, sleeping space issues, Poor quality and quantity of food, personal safety & security issue etc. Endemic diseases such as dysentery, diarrhoea and cholera. Mental stress may increase to the migrant workers due to harassment from the local communities and unfavourable working environment.		

ESF Standard, Environmental and Social risks And impacts	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
Child & Forced Labour	Moderate	Low	There is risk of using children in different phases of the KDP road construction project threatening to the security and rights of the children engaged. The KDP project may also have risks of using forced labour during construction work. The Child & Forced Labour impacts with Moderate risk are limited to Construction phase only, and there will be no impacts in operation phase.	Unethical contractual practices involving Child (as per the national law any individual under the age of 18 is considered a child, minimum working age is 14 years old, however, the minimum age for hazardous work, such as construction related work is 16 years old) & Forced labours (no provisions of working hours, leaves or sick leaves, weekly off etc.)	Construction Workers	Impact will be confined to construction areas, camp areas and further adjoining settlements
Discrimination and less priority on employment opportunities to vulnerable people	Moderate	Low	Chances of discrimination or exclusion to vulnerable peoples. The Discrimination in Employment impacts with Moderate risk are limited to Construction phase only, and there will be no impacts in operation phase.	Chances of discrimination or exclusion to vulnerable peoples by Contractor	Construction Workers	Impact will be confined to all the possible areas from where there can be employment opportunities, more confined to construction areas, camp areas and further adjoining settlements
Gender-based Violence	Substantial	Low	GBV may be prevalent in project 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. Sexual exploitation and harassment especially for girls and women seeking employment or	Migrant and Local Labourers The estimated 1000 labourers will further change community dynamics and potentially abet SE/SH related incidences, in particular, making women and girls of the project areas more vulnerable to GBV/SEA/SH	Girls, Women of the nearby habitation, among the workers	Impact will be confined to construction areas, camp areas and further adjoining settlements

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
And impacts			procurement opportunities. The Gender based Violation impacts are substantially expected in construction phase when working population is living in the project area and/or interacting with local population. None/Low impacts in operation phase are expected in this project.	risks including human trafficking,		
	Substantial	Low	There might be the risk of interaction between the resident population and the construction workforce, including the spreading of communicable diseases including sexually transmitted diseases such as HIV/AIDS. The Spreading of Communicable disease impacts are substantially expected in construction phase when working population is living in the project area and/or interacting with local population. None/Low impacts in operation phase are expected in this project.	Labour influx in the project area, Poor sanitation and solid/liquid waste disposal practices, Lack of awareness towards communicable diseases etc.	Construction Workers, Nearby habitation 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.	Impact will be confined to construction areas, camp areas and further to adjoining settlements
ESS 3: Resource Efficiency and Pollution Prevention Management						
Land use change	Moderate	Moderate	Settlement, agricultural land, forest areas and water bodies/river cover the major land use in the project area. Widening of the existing road will lead change the existing lands to asphalt roads. However, as the widening/construction works will be confined only within ROW, the	Improvement of existing KDP Road, Clearance of vegetation along the road, Labour camp establishment	Forest land, agricultural land with houses, settlement, River and flood plain and scattered vegetation. Improvement of existing KDP	Impact will be confined within ROW, construction areas, borrow pits

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
And impacts			impact will be Moderate. The Worker camp and construction camp sites will be rehabilitated after construction phase. The Land Use change impacts are expected in both Construction and Operation phases. As the proposed KDP Road development is an expansion of Existing Road, the impact risk is Moderate.		comprises forest land (303.44 ha), agricultural land with houses (159.3 ha), settlement (73.90 ha), River and flood plain (22.97 ha) and scattered vegetation (2.2 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.	
	Moderate	Low				Impact will be confined within ROW, mainly areas with site clearance

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
Landscape aesthetic	Substantial	Moderate	The stockpiling of materials, construction excavation for structures and clearance of vegetation are some of the issues related to the aesthetics with substantial impact risk in construction phase. There might be Long-term effect due to vegetation clearing but it will be rehabilitated (1:10 ratio) in 2 years of construction by compensatory replantation and the impacts will be moderate in operation phase.	Improvement of existing KDP Road, Clearance of vegetation along the road, Haphazard management of stockpiling yards, quarry sites, construction sites and camp sites and littering of wastes	Landscape aesthetic along the KDP road	Impact will be confined within construction sites, stockpiling yards, quarry and borrow pits, excavation area etc.
Air pollution	Substantial	Moderate	Air pollution due to operation of machines is likely in the vicinity of the project alignment. There may be influence of dust and noise pollution on settlement areas due to operation of crusher plants, batching and bitumen-mixing plant close to such area 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. The substantial impacts of Air pollution due to the project activities will be seen during construction phase as cited in above para. The impacts will be moderate in the operation phase as road conditions will be smooth and	Dust: Due to site clearance, use of heavy vehicles and machinery, during extraction and transportation of raw materials from quarries, crushers, stockpiling yards to construction sites. Due to Construction activities (mentioned under ESS3 of section 6.3). Exhaust & process Emissions: Apart from the fuel used during the actual pavement placement, energy is required to produce and refine materials, transport materials and equipment, and eventually to dispose of the roadway. Approximately 734,413 liters of Diesel will be required for these activities during	Habitation and plantations in downwind side of the site (confined generally to a band of width ranging from 100m to 150m from the edge of the Right of Way).	Extend of Impacts due to air pollution is expected to be within 300 m from road alignment and other construction sites

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
And impacts			widened.	construction phase. High levels of PM, SO ₂ , HC, CO and NO ₂ are likely from hot mix plant operations. Toxic gases are released through the heating process during bitumen production.		
			Noise and vibration are likely due to operation of large machinery and equipment like excavators, crusher plants, batching and bitumen mixing, concrete-mixing plants and Traffic congestions by Diversions due to widening of existing highway might cause inconvenience to nearby settlements. The substantial impacts of Noise pollution due to the project activities will be seen during construction phase as cited in above para. The impacts will be moderate in the operation phase as road conditions will be improved and there will be less traffic congestions. Better implementation of road safety measures will lead to less requirement of honking for vehicles.	Generation of Noise & Vibrations due to operation of large machinery and equipment like excavators, crusher plants, batching and bitumen mixing, concrete-mixing plants and their activities with the widening of existing highway. Details of different sources of Noise pollution is given in Table 6.7 and Table 6.8 . During operation phase Traffic/vehicles is main source of noise.	Habitations and Animals along the alignment. Details of Receptors of Noise by KDP project is given in Table 6.7 and Table 6.8 . The vibration induced by the construction equipment can have a detrimental effect on structures standing near the road.	Extend of Impacts due to Noise is expected to be within 300 m from road alignment and other construction sites
Chemical hazards (by bitumen and other toxic and hazardous chemicals)	Moderate	Low	The use of chemical hazardous materials for road such as epoxy, additives, admixtures, cements, bitumen, paints, antistripping agents, etc. is inevitable during the time of construction. The storage of	Use, Storage & Disposal of chemical hazardous materials for road such as epoxy, additives, admixtures, cements, bitumen, paints, antistripping agents, etc.	Natural drainages along/across the alignment, Aquatic biota of the natural drainages, Soil, Workers, Habitation	If contaminated, the impact can occur up to 2 km downstream

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
Solid waste	Moderate	Low	such chemical should meet by special precautionary measures. Containers of such chemicals such as bitumen drums often are damaged during transit, leading to a leakage in storage places that often are not or not adequately cleaned up afterwards. The bitumen could remain at the boiling area and decanter sites for many years after the road construction if it is not properly rehabilitated along the existing natural drainages. The Chemical hazards impacts with Moderate risk are limited to Construction phase only (as cited in para above), and there will be none/low impacts in operation phase by oil leakage from road vehicles only.		along the road Exposure to acids and chemicals might bring carcinogenic effect to the labourers and people. Directly mixing of chemicals and lubricants in the water sources can disrupt aquatic species. It leads to pollution of fertile soil as well.	
			Solid wastes will be generated in significant quantities. Bad odour, blockage and obstruction of roadside 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 camps and other allied activities like small enterprises along the highway. In operation phase road side shops only will generate solid waste, which could be managed properly by local municipal authority.	General solid waste will be generated from the construction camps and offices, which include food waste, paper, plastic etc. Total Workers employed-1000, Workers in Camp-600 (250g/day waste), Local workers-400 (150g/day waste). Total 210 kg waste will be generated by 1000 workers per day. Construction & Demolition waste generation by land	Natural drainages along/across the alignment, Aquatic biota of the natural drainages, Soil, Workers, Habitation along the road. Haphazard disposal of Solid waste, spoil and construction materials into the natural drainage will prevent the natural	Impacts will be limited within construction camps, labour camps and other construction sites

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
And impacts Soil Pollution & Erosion			The Solid waste impacts with Moderate risk are limited to Construction phase only (as cited in para above), and there will be low impacts in operation phase.	clearing, excavation, construction, demolition, remodelling and repair of structures, roads and utilities.	flow of the drainage and pollutes the quality of water.	
	Substantial	Moderate	Vegetation clearance, construction work at Riverbanks, drilling for piers, setting up of worker camps can lead to soil erosion along the road alignment and riverbanks respectively. Soil contamination/pollution is expected from stockpiling yard, vehicle parking sites, hot mix plants and worker camps. The Impact risk category is substantial but limited to Construction phase only as soil erosion and soil contamination activities cited above will occur during construction phase. Avenue plantation and Slope stabilization work will be carried out, which will further moderate the impacts in Operation phase.	Soil Erosion: It is expected to be high during site clearance and removal of vegetation, during cutting/excavation for riverbank abutments and drilling for piers and Setting up of workers camp along the project road. Soil Contamination: Soil pollution may take place from stockpiling yards, the sites where construction vehicles are parked and serviced are likely to be contaminated because of leakage or spillage of fuel and lubricants. Pollution of soil can also occur at hot-mix plants from leakage or spillage of asphalt or bitumen. Refuse and solid waste from labour camps can also contaminate the soil.	Top soil, Soil biota, nearby agriculture lands and farmers, natural drainage sources, aquatic biota etc. Contamination of soil during construction might be a major long-term residual negative impact. Setting up of workers camp along the project road may lead to loss of productive soils and impact the soil productivity especially at micro level. River bank cutting can cause flash floods. This contamination is likely to be carried over to water bodies in case of dumping being done near water body locations.	Impact will be limited within excavation and site clearance areas

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
Muck/Spoil Disposal	Moderate	Low	Adjoining local communities, agricultural land, forest and aquatic habitat may be affected by improper storage and transportation muck/spoil. The Solid waste impacts with Moderate risk are limited to Construction phase only, and there will be low impacts in operation phase.	Improper storage and transportation muck/spoil at chainages 237+700, 241+430, 259+200, 290+500, 311+000 and 325+100 nearby camp sites.	Adjoining local communities, agricultural land, forest and aquatic habitat	Impact will be limited within excavation areas and muck/spoil stockpiling area
Pollution of water resources	Substantial	Moderate	Degradation of water quality of existing Rivers (Kamala, Bagmati etc.) is likely, especially during the time of construction due to disposal of soil and chemical wastes from construction works and from camps. Excavation for bridge foundation works can lead to sedimentation of Rivers and streams. Existing Rivers and streams are getting sedimentary, due to local activity like extraction of sand, operation of crusher plants and sand cleaning plants. Table 7.11 depicts the Rivers and possible impacts. Ground Water- Different chemicals used during construction like epoxy, additives, admixtures, cements, bitumen, paints, antistripping agents, fuel, acids etc. can be leaked and seep into ground water and contaminate it. Improperly disposed solid wastes leachate can percolate and contaminate ground water. Domestic waste water soak pits can also	Surface Water - Disposal of soil and chemical wastes from construction works and from camps. Existing Rivers and streams are getting sedimentary, due to local activity like extraction of sand, operation of crusher plants and sand cleaning plants. Table 7.11 depicts the Rivers and possible impacts. Ground Water- Different chemicals used during construction like epoxy, additives, admixtures, cements, bitumen, paints, antistripping agents, fuel, acids etc. can be leaked and seep into ground water and contaminate it. Improperly disposed solid wastes leachate can percolate and contaminate ground water. Domestic waste water soak pits can also	Existing Rivers (Kamala, Bagmati etc.), Canals and 7 nos. of Ponds (Table-4.9). Aquatic biota will also be affected.	If contaminated, the impact can occur up to 2 km downstream

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
And impacts			pollution due to the project activities will be seen during construction phase as cited in above para. The impacts will be moderate in the operation phase due to road side settlements and market areas only.	pollute ground water.		
Impact on fish population	Moderate	Low	Due to pollution of water resources as mentioned above and by fishing/hunting activities by workers may affect the population of fished in nearby water body during construction. The Moderate impacts on Fish population due to the project activities will be seen during construction phase as cited in above point. The impacts will be Low in the operation phase due to road side settlements and market areas only.	Pollution and diversion of water bodies may lead to impacts on fish population	Aquatic biota of Existing Rivers, Canals (Table 6.11) and 7 nos. of Ponds (Table 4.9). Decline in the population of Fishes and other organisms in the water bodies.	If contaminated, the impact can occur up to 2 km downstream
Quarry and extraction of Riverbed materials	Substantial	Low	Quarrying and extraction of riverbed materials as source of change in river morphology, riverbank cutting/erosion and sedimentation. The substantial risk of Quarry and extraction of Riverbed materials are limited to Construction phase only, and there will be no impacts in operation phase.	Quarrying and extraction of riverbed materials as source of construction materials. Probable sources for construction materials are located near the road alignment and detailed in the Table 1.6 .	Quarry material for the project 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	200 m periphery of each quarry sites

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
And impacts					pollutants present in the dredged material in the river water. It can lead to change in river morphology, riverbank cutting/erosion and sedimentation.	
	Stockpiling and handling of Construction Materials	Substantial	Low	Haphazard management of construction materials and their stockpiling along the alignment.	Surrounding Habitation (Dhalkebar, Bardibas, Lalbandi, Nijgadh, Chandrapur and Pathlaiya etc.), Agriculture crop, Vegetation, Water bodies (kamala, Baghmati, Bakaya Rivers and streams as Ratu, Lakhandei etc.) etc. Haphazard management of construction materials and their stockpiles can provide discomfort to local inhabitants, can cause accidents, and littering of materials due to wind and rain. This can further damage surrounding crops, water bodies	100 m periphery of each stockpiling yards

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
And impacts	Construction stage	Operation stage				
					and ground vegetation.	
Water logging and drainage issue.	Substantial	Moderate	Though water logging issue is throughout the alignment during monsoon, major problem is in Mithila, Lalbandi and Nijgadh area. The issue of water logging may occur to some extent because Bhamara river towards east and Bakeya River towards west and bridges constructed over these rivers are high as compared to nearby area. Also, there is unplanned settlements in this area on both side of the existing road and unplanned settlements there are issue of blockage of existing water drainage facilities. The substantial risk of water logging and poor drainage in the project area will be seen in Construction phase due to construction activities and material handling but the risk will be moderate in operation phase due to upgradation in drainage structures.	The Bhamara river towards east and Bakeya River towards west and bridges constructed over these rivers are high as compared to nearby area. Also, there is unplanned settlements in this area on both side of the existing road. Because of that there is issue of blockage of existing water drainage facilities.	Surrounding habitation throughout the alignment during monsoon, major problem is in Mithila, Lalbandi and Nijgarh etc.	Up to 1 km mainly towards northern side
Establishment and Operation of Crusher Plant, Hot mix plant and Batching Plant	Substantial	Low	The project needs to establish Crushing Plant, Hot mix Plant and Batching Plants if not sourced from nearby authorized suppliers. These plants create enormous quantity of dust particles and gaseous pollutants into the atmosphere. Further, the	Crushing Plant, Hot mix Plant and Batching Plants create enormous quantity of dust particles and gaseous pollutants into the atmosphere. Further, the wastewater discharges from the crusher	Local people, construction workers and animals. These plants will have significant impact on public	200 m peripheri from construction camps/sites

ESF Standard, Environmental and Social risks And impacts	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
			wastewater discharges from the crusher plant and batching plants contain high sediments. The substantial risk of Establishment and Operation of Crusher Plant, Hot mix plant and Batching Plant are limited to Construction phase only, and there will be no impacts in operation phase.	plant and batching plants contain high sediments.	health and well-being by emitting air, water and noise pollution.	
Greenhouse Gas (GHG) Emission	Moderate	Low	Green House Gas Emission will be Moderate during construction phase due to deployment of large number of machineries and Vehicles. Also, there will be other construction activities like batching plant operation, hot mix plants and DG sets etc. However, during operation stage there will be vehicular operation only and due to better road conditions, the vehicular emissions will be lower as compared to existing scenario.	Though, during project construction there will be emission of Green House Gases (GHGs), during operation, the upgraded 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 as shown in Table 6.4 of point no. 6.2.5.	Habitation in the project area and overall environment.	The impact of GHG emission will be extended to regional level
Impact of Climate	Substantial	Moderate	Due to climate change, there can be different climate induced disasters like cloud bursts, flash floods, landslides, etc. Rivers and streams along the KDP alignment can receive more discharge and River water during floods can overtop the embankments. The impacts can be found severe in Rivers and streams as Kamala, Jalad,	Due to climate change consequences, Rivers and streams along the KDP alignment can receive more discharge and River water during floods can overtop the embankments. The impacts can be found severe in Rivers and streams as Kamala, Jalad,	Nearby habitations to the Rivers and animals living in the area	Due to climate change, there can be different climate induced disasters like cloud bursts, flash floods, landslides, etc.

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
And impacts			as Kamala, Jalad, Basai, Badahari, Ratu, Bhapsi, Lakhandei, Bagmati, Bakeya etc. The substantial risk of Flash floods and poor drainage in the project area will be seen in Construction phase due to ongoing construction activities and material handling but the risk will be moderate in operation phase due to upgradation in major-minor bridges and other drainage structures.	Basai, Badahari, Ratu, Bhapsi, Lakhandei, Bagmati, Bakeya etc.		
ESS 4: Community Health and Safety						
Traffic Management during construction	High	Moderate	Management of traffic along the existing highway will be a challenging task during the time of widening of road width and excavation. Traffic management plan should be prepared prior to the construction by contractor. The High risk of Traffic Management is limited to Construction phase only, and there will be Moderate impacts in operation phase in the major habitation areas as Dhalkebar, Bardibas, Lalbandi, Nijgadh, Chandrapur and Pathlaiya etc.	Diversion and Blockage of the road for road up-gradation work can also affect traffic and road safety, especially in highly populated sections of the highway like Dhalkebar, Bardibas, Lalbandi, Nijgadh, Chandrapur and Pathlaiya etc.	Habitation (including people) along the alignment	Within ROW of the road alignment
Traffic and Road Safety	Substantial	Moderate	Existing urban areas in construction phase, will be more vulnerable to traffic safety (substantial risk) and there are accident prone areas along the existing KDP with many	Existing urban areas will be more vulnerable to traffic safety in construction stage. In the operation phase, with an improved road, vehicular	Nearby habitation including Accident prone areas (Birendra bazar, Puspalpur, Dhalkebar,	Within ROW of the road alignment, mainly bridge sections and junctions

ESF Standard, Environmental and Social risks And impacts	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
			frequent reported cases of accidents (mainly at Birendra bazar, Puspapur, Dhalkebar, Jamunibas, Bardibas, Lalga, Nawalpur and Chapur). With an improved road in operation phase, 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 KDP road alignment.	traffic will increase and over speeding in busy sections of the road might occur, thereby increasing risks of accidents in overcrowded areas along the KDP road alignment.	Jamunibas, Bardibas, Lalga, Nawalpur and Chapur)	
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. Additional risk might be due to the exposure to different types of wastes and disposal to the community. The workers from diverse culture and places are likely to adversely	Immigration of labours, Impact due to unawareness, open defecation, direct disposal of wastes into the ambient environment and competition for using resources and infrastructures in the project area.	People and communities adjoining to road alignment. If sanitation issue is not addressed properly; there is likely spreading and emergence of disease among the labour. There might be spread of communicable diseases including. Social STDs/AIDS. Social	Nearby habitation and Construction areas.

ESF Standard, Environmental and Social risks And impacts	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
			impact the homogenous society's traditions and way of life. There is risk of inflation of prices of goods and commodities along the roadsides. 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 sales and consumption of beverage drinks like alcohol by the immigrant workers at the construction site and camp sites may cause many social risks. Depletion of the local resources might create scarcity to the nearby communities. The community exposure to health issues and labour influx impacts with substantial risk are limited to Construction phase only, and there will be no impacts in operation phase.		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 sales and consumption of beverage drinks like alcohol by the immigrant workers at the construction site and camp sites may cause many social risks. Depletion of the local resources might create scarcity to the nearby communities	
Human Trafficking	Moderate	Low	The KDP project may have risks of using forced labour and trafficking in person while upgrading and improving the KDP road alignment. The Human Trafficking and forced labour impacts with Moderate risk are limited to Construction phase	The KDP project may have risks of using forced labour and trafficking in person while upgrading and improving the KDP road alignment.	People mainly Girls, women of the nearby habitation, among the workers	Nearby habitation and Construction areas.

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
And impacts			only, and there will be no impacts in operation phase.			
Emergency Preparedness and Response	Substantial	Substantial	Project poses several risks to local communities, including Natural disasters (like floods and cloud bursts, thunder, extreme hot or cold climate, etc.), traffic accidents, fuel spills, riverbank cutting, changes in River flow etc. creating need of establishing emergency preparedness and response along the road alignment. The Risk of Natural calamities is substantial whether it is construction or operation phase. Emergency Preparedness and Response mechanism measures are provided under Environment Management Plan.	Natural disasters (like floods and cloud bursts, thunder, extreme hot or cold climate, etc.), traffic accidents, fuel spills, riverbank cutting, changes in River flow etc.	People and domestic animals within nearby habitation, wildlife within forest sections and Construction areas Loss of lives of nearby habitation, animals and loss of property/structures.	Extent of impact will be local/regional though project is liable within ROW or the road alignment, construction sites, labour camps
Gender Based Violence (GBV)/ Child Sexual Exploitation and Sexual Abuse and Sexual Harassment (CSEA/SH)	Substantial	Low	GBV may be prevalent in project due to unequal gender relations and discrimination towards women in both public and private sphere. The Gender based Violation impacts are substantially expected in construction phase when working population is living in the project area and/or interacting with local population. None/Low impacts in operation phase are expected in this project.	Contractor, Migrant and Local Labours	Girls, Women of the nearby habitation, among the workers. The estimated 1000 labourers will further change community dynamics and potentially abet SEA/SH related incidences, in particular, making women and girls of the project areas more vulnerable to	Nearby habitation and Construction areas.

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
And impacts					GBV/SEA/SH risks including human trafficking.	
ESS 5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement						
Land Acquisition	Low	Low	There is no permanent land acquisition required in the project road.	The East-West (Mahendra) Highway is a National Highway and as declared through publishing notice in Gazette 2034 BS (1977AD) its right of way is defined 50 meter and ownership lies within Department of Roads.	-	-
Economic Displacement	Substantial	Low	Due to KDP road upgradation works, 64HHs and 66 Structures are likely to be economically displaced (loss of private property and assets/housing structures including trade structures), requiring compensation and restoration of livelihoods. Likewise, numbers of small business entrepreneurs including 80 road side vendors along the KDP road alignment are also likely to be economically displaced losing livelihoods through road upgradation works. They need to be relocated at nearby public places. The impacts of Economic displacement will be Moderate in Construction phase as the affected persons will be compensated and rehabilitated as per prevailing world	Displacement of privately established structures and public structures (informal encroachers/inhabitants) located within the ROW due to road widening.	64 HHs whose structures will be impacted, further, 204 other extended housing structures, (Detailed under ESS-5 of Point no. 6.4). Beside this, 80 roadside vendors will be affected due to this project. Details of these project impacts has been illustrated in the Resettlement Action Plan.	Within ROW of the road alignment

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
And impacts			bank guidelines and Nepal Govt. norms.			
Impact on Community Structures-	Substantial	Low	216 Community Structures are going to be affected and these consist of waiting sheds, wells, chautari/trees and other public structures. Construction phase impacts will be substantial because of demolition and rehabilitation/relocation of structures.	Site clearance for road widening	People and communities adjoining to road alignment using/benefited through these structures.	Adjoining habitation/settlements
Impact on Public Utilities	Substantial	Low	2221 electric poles within proposed formation width are to be shifted, 33.16 km of drinking water supply pipelines is to be shifted due to road widening. Construction phase impacts will be substantial because of shifting of public utilities as people will be directly affected.	Site clearance for road widening	People and communities adjoining to road alignment.	Adjoining settlement areas up to 100 m
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources						
Loss of forest area	Moderate	Low	Though the proposed project will not acquire any forest land, while widening the road, trees within RoW needs to be cleared. Trees within ROW are having combined relation with adjoining forest areas too. Removal of trees from ROW can hence lead to loss of forest areas too. The impact will be moderate one during construction phase. Further, if the workforce's energy needs for their meal cooking is met from firewood, may exert pressure	Due to road widening, Due to easy accessibility and influx of people from outside, these people may enter the forest area seeking fire wood and other forest products	Adjoining forest areas and trees to be felled	Within adjoining forest areas up to 100 m

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
And impacts			on the local forests of the surrounding areas. During operation phase, there will be no loss of forest area			
Loss of vegetation	Substantial	Moderate	In total 4,914 saplings (diameter 4.0425 cm to 14.56 cm) and 28,120 trees and poles including 8,954 poles (with dbh 14.56 to 24.26 cm) and 19,166 trees (with dbh >24.26 cm) may need to be felled down due to widening of existing road.	Site clearance for road widening	Trees within ROW	Within ROW of the road alignment
Wildlife movement	Substantial	Moderate	Increase in traffic flow and speeds may cause wildlife population disturbance and decline due to vehicle-wildlife collisions, more likely in Chainages 329+752, 333+733, 339+342, 347+209, 353+628, 357+227, 358+477 for large sized animals (elephants) and chainages 271+514, 274+925, 275+630, 277+266, 278+913, 282+758, 285+721, 292+703, 317+698, 322+553 for medium sized animals (tigers, undulates and others), when fast driving (especially during night time). The Wildlife movement impacts will be substantial during construction phase as there will be barricades, diversions and traffic congestions all over the construction site and wildlife movement areas will be directly affected. In	Increase in traffic flow and speeds may cause wildlife population disturbance and decline due to vehicle-wildlife collisions, more likely in Chainages 329+752, 333+733, 339+342, 347+209, 353+628, 357+227, 358+477 for large sized animals (elephants) and chainages 271+514, 274+925, 275+630, 277+266, 278+913, 282+758, 285+721, 292+703, 317+698, 322+553 for medium sized animals (tigers, undulates and others), when fast driving (especially during night time). Disturbance to Wildlife habitat, defragmentation of wildlife movement, Road kills, decline in population, Increase in Human-Animal conflicts,	Elephant, Tiger and other Wildlife in the project area	The impact on wildlife movement will be extended up to 2 km from road alignment

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
And impacts			operation phase, the impacts will be moderate due to no traffic congestions at wildlife movement areas and upgraded animal passing structures.	poaching etc.		
			Construction works mainly for bridges can affect flows affecting aquatic wildlife too. Disposal of excavated materials in water bodies may increase turbidity of water and result in reduction in dissolved oxygen content. Inappropriate 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 household sources. Continual water pollution will also affect the aquatic biota, with subsequent negative consequences for fisheries and the economic return. The Moderate impacts on Fish population due to the project activities will be seen during construction phase as cited above. The impacts will be Low in the operation phase due to impact from road side settlements and market areas only.	Construction works mainly for bridges can affect flows affecting aquatic wildlife too. Disposal of excavated materials in water bodies may increase turbidity of water and result in reduction in dissolved oxygen content. vehicle washing in streams and Rivers can cause local water pollution by leakage of fuel/oils. Continual water pollution will also affect the aquatic biota, with subsequent negative consequences for fisheries and the economic return.	Aquatic Biota in River, Canals along/across the alignment. People/Animal using stream water for domestic use.	If contaminated, the impact can occur up to 2 km downstream
Threat to Aquatic habitat	Moderate	Low				
Threatened wildlife, hunting and poaching	Substantial	Moderate	A total of 38 species were screened as per the IBAT assessment report which includes Reptiles 12 species,	Illegal hunting and poaching can take place in natural forests by road workers.	A total of 38 species were screened as per the IBAT assessment	Within adjoining forest areas up to 100 m

ESF Standard, Environmental and Social risks And impacts	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
			Birds 16 species and Mammals 10 species. Out of 38 species 2 species namely Asian elephant and Royal Bengal Tiger were reported near the project area. There will be minimum direct effect on them, but construction noise and pollution can affect them indirectly. Illegal hunting and poaching can take place in natural forests by road workers. Where the road stretch is adjoining to forests (Parsa National Park and other Forests) concealing wildlife including game value. The impacts will be substantial in the construction phase due to prevailing construction activities and presence of worker population in and around the Forest areas and Parsa national park. The impacts will be moderate in operation phase due to improved road will help in hunting-poaching activities. However, it will also aid in monitoring and guarding of Forest-wildlife resources.	Where the road stretch is adjoining to forests (Parsa National Park and other 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. The detail of ecological issue of project is given in Biodiversity Management Plan.	report which includes Reptiles 12 species, Birds 16 species and Mammals 10 species. Out of 38 species 2 species namely Asian elephant and Royal Bengal Tiger were reported near the project area.	
Use of forest resources	Moderate	Low	Use of forest resources (mainly firewood). The impacts of use of Forest Resources are substantially Moderate in construction phase when working population is living in the project area. None/Low impacts in operation phase are	Use of Firewood for cooking purpose by Workers from nearby Forest areas may have some impact on Forests.	Adjoining forest areas and trees to be felled	Within adjoining forest areas up to 100 m

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
And impacts			expected in this project.	During construction stage, there might be chance for alien species introduced by any migrant worker or any staff member.		
Spread of invasive alien species	Moderate	Low	There may be Spread of invasive alien species which might put pressure on indigenous plant species. The impacts of spread of invasive alien species are substantially Moderate in construction phase when working population is living in the project area. None/Low impacts in operation phase are expected in this project.	These can cause numerous problems, such as acting as predators, hindering the growth of native species, altering habitats causing physical and chemical changes to the soil, competing for food and space; hybridizing with native species, introducing new parasites and diseases etc.	Adjoining forest areas and trees to be felled	Within adjoining forest areas up to 100 m (if not controlled in time, spreading of invasive species can occur throughout the forest area too)
ESS 7: Indigenous Peoples						
Impact on Indigenous people	Substantial	Low	Among project affected 64 households, 14 are found IPs. Households. RAP and IPDP has compensatory and supportive measures to address these people. The Impact on Indigenous people will be Substantial in Construction phase. It will be low in operation phase as these households will need to be relocated and the affected persons will be compensated and rehabilitated as per prevailing world bank guidelines and Nepal Govt. norms.	The proposed project will affect 14 indigenous households located within the 50-meter right-of-way (ROW). These households will need to be relocated. The indigenous people who are living in heterogeneous societies with scatter way therefore, it is not the subject of indigenous ownership, and there is no indigenous heritage site that will be impacted under the project, the process of obtaining free, prior, and informed consent (FPIC) with	Indigenous People and communities adjoining to road alignment. 14 indigenous households. (Details incorporated in standalone IPDP report)	Within ROW of the road alignment

ESF Standard, Environmental and Social risks	Risk Rating		Rationale & Significance of Impacts	Sources and Cause of Impacts	Receptors	Extent of Impacts
	Construction stage	Operation stage				
And impacts				them for consultation is not required. Hence, KDP project will not significantly impact the indigenous peoples, their traditional culture, land resources and territories.		
ESS 8: Cultural Heritage						
Impact on small temples and shrines	Substantial	Low	It is identified 35 temples will be affected due to widening of proposed road. RAP has rehabilitation measures to address these impacts. The Impact on small temples and shrines will be Substantial in Construction phase when they will be demolished. The impacts will be low in operation phase as the possible numbers of the temples/shrines will be relocated and rehabilitated in nearby area, as the communities and local authorities have agreed upon.	It is recorded during social survey that 35 temples/shrines will be fully affected and needs to be rehabilitated. Similarly, there are 55 nos. of sacred trees (Bar/Pipal Chautara) and needs to be removed during road upgradation works. Some of the temples have some cultural significance, value or importance in locality, but do not constitute cultural heritage under ESS8 of the ESF. All the Bar/pipal Chautara will not be replaced as previous form but waiting sheds will be constructed as in required areas. The communities and local authorities have agreed to relocate and rehabilitate the possible numbers in nearby area.	35 temples/shrines, 55 nos. of sacred trees (Bar/Pipal Chautara) 14 indigenous households. (Details incorporated in standalone IPDP report)	Within ROW of the road alignment

6.3 ESS Assessment for the Project

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).

ESS 1: Assessment and Management of Environmental and Social Risks and Impacts

The environmental and social risk associated with KDP project is divided into three categories that is physical, ecological, and social impacts. The major physical impacts are during construction stage of project. These are basically air pollution, noise & vibration, surface water contamination, construction, and demolition waste, municipal solid waste generation, and oil & chemical spillage etc. The source of these pollution is construction machinery & equipment, vehicles, hot mix plants, crushers plants, borrow & quarry areas, construction material and its transportation etc. The receptors of pollutions are mainly people living in the vicinity of the project area or KDP road, workers, animals, trees & vegetation, and crops. These receptors will be directly and indirectly affected by the said pollution. However, these impacts are only for construction period. The operation phase risks & impacts mainly consist of air pollution, noise generation and oil & chemical spillage. However, provision of water sprinkling, noise barrier during construction and operation phases of their project, waste management, best practices and measures for surface water protection have been considered for environmental management.

Also, it is noticed that around 53.54% of the road alignment passes through forest area all together 30 species were recorded, and Sal (*Shorea robusta*) had the highest number in this section. Total 28,120 trees including poles will be affected during widening of the KDP road. Also, Parsa National Park is a protected area is in the vicinity of KDP road, therefore road development will have impact on park. Near the project road Movement of higher vertebrates is more evident for namely Asian elephant (*Elephas maximus*) and Royal Bengal Tiger (*Panthera tigris*). Total 6-7 Elephant and some Tiger movement was noticed along the project road. The road development will also have impacts on these animals. Total 28,1200 trees will be planted in which a net gain of 253,080 trees will be achieved. Mitigation measures such underpasses/bridge elephant crossings, have been proposed for large, medium size animal and small animals. The details of ecological impacts and mitigation measures is given in BMP.

Total 64 project affected HHs has been identified. Among the 64-project affected HHs, 25 will lose residence structures, 35 will lose business structures, and 4 HHs will lose both residential and business structures whereas 4 oil dispenser of petrol pumps and 204 extended parts of their business set-up need to be relocated during project implementation if needed. Total, 216 public structures, 69 waiting sheds, 35 small temples/shrines, 55 *Bar-pipal Chautara*, 4 police post, extended parts of Mahendra Ma. Bi. (1). and Nepal Rastriya Ma. Bi., High School (1), 2 market sheds, 1 hat bazar shed, army check post, 2 police waiting sheds, 1 traffic building, 3 public toilets, 11 boundary walls 5 gates, 8 wells and 1 wall structure of park) and 16 structures regarding with Army Barrack will be impacted and required relocation and rehabilitation. Also, total of 2221 electric poles (including 140 solar poles) and 33,160 meters of drinking water pipeline will be impacted due to upgrading works. The KDP road project directly affecting the IPs household level, however not affecting in community level. In total, 14 IPs households are going to lose their structures, including business (small tea and snacks shops) and livelihoods due to KDP road development works. These social impacts will be mitigated by providing the financial compensations to the affected families/HH, relocation of community properties and utilities, and by providing livelihood capacity building trainings to the affected communities. The detail of social impacts and mitigation measures are given in RAP and IPDP.

The mitigation hierarchy has been adopted to mitigate the adverse impacts associated with proposed road project, and same has been presented in **Chapter 7**.

The cumulative impacts of KDP along with other projects has been assessed. The VECs of KDP project were identified and prioritized based on site visit observations, stakeholder's consultations, and expert judgement. Based on these, the three VECs, has been finalised and detailed cumulative impact assessment of these VECs has been carried out combining the impact of other projects in influence area. These VECs are river flow, elephants and in-immigration. As the prospective of land use, dense settlements will be established in agriculture and the forest resources will also be more depleted along the KDP road section. Infrastructures intervention like MME Railway, Nijgadh International Airport, HDD 400 KV and Kathmandu-Terai Fast Track that have great implication of land use change and pressure on land resources and environment degradation. Similarly in the perspective of the elephant (animal movement) construction of several linear structures in the project area and lack of coordination between projects that to ensure crossroad facilities (underpasses and overpasses) for further elephant movement within existing corridors. Among others, more sensitive is noticed for Pathlaiya-Hetauda-Narayanghat Road section followed by Kathmandu Terai Fast Track and Mechi-Mahakali Electrified Railway. Along with the KDP road project, other projects within the project vicinity will have impact in natural drainage system including rivers and streams. Major ones are crusher and quarry and borrow pit projects (sand and gravel mining) and Madan Bhandari Highway and Kathmandu-Terai Fast Track.

The construction of those projects will have direct impact on forest, land and water resources. Some of those impacts are residual and irreversible. In addition to this, after the operation of those projects there could be other developmental interventions by which pressure on land degradation will be continue in future. The cumulative impact is a single issue or result of various projects in the specified area with big challenge. So, it is recommended to put forward this topic to policy level for further study indeed. The CIA is given in **Annexure 6.1**.

ESS 2: Labour and Working Conditions

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). It is estimated that for the proposed road upgradation project, approximately total 1000 workers will be deployed for three years for the construction work. Out of them 600 will be migrant workers, which are going to live in labour camps.

The risks include 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.), unmanaged working time, child labour, forced labour, human trafficking, occupational health and safety (OHS) issues including exposure to toxic chemicals, operation of hazardous work, workplace accident and work-related diseases (eg. allergies, respiratory problems, musculoskeletal disorder), communicable diseases including Sexually Transmitted Infections (STIs), grievances related to workers and GBV. The contracted workers are more susceptible to such risks.

Occupational health and Safety

During construction period, workers could be exposed to various health risks and hazards. Occupational Health and Safety risks likely to arise during the construction phase include: exposure to physical hazards from use of heavy equipment; working at height and electrical equipment; working on water, trip and fall hazards; exposure to dust, noise and vibrations; falling objects; exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery. Workers may be encountered with health hazard during earthwork cutting, handling of hazardous materials, machinery movement, bitumen works, bridge construction and embankment stabilization etc. If the personnel protective equipment (PPE) (helmet, gloves, boots, google, ear guard with sponge muffler etc.) are not used or if there is lack of adequate safety measures, workers may suffer from accident, respiration issues and eye irritation due to exposure to dust and emissions.

Worker Accommodations

Potential health issues on workers are associated with the use of temporary accommodation sites include those relating to sanitation, disease, sleeping space, quality and quantity of food, personal safety and security etc. Health risk are also associated with poor labour camp conditions, unsafe drinking water and unhygienic conditions (poor latrines conditions and washing facilities) which could cause endemic diseases such as dysentery, diarrhea and cholera. Mental stress may increase to the migrant workers due to harassment from the local communities and unfavorable working environment.

For the proposed road upgrading project, approximately, 7 ha of land will be acquired temporarily for the establishment of labour camps and construction camp in the vicinity of the project area (**Section 1.7**). 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.

Impacts from Labour Camps

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. Further, toilet waste and waste water from Labour camps can pollute the nearby surface water source or soil, if not handled properly. Basic requirements of the worker in the project are given below:

Water Requirement for workers:

- Water requirement for worker living in Labour camps (600 nos.) will be about 30,000 Liters/day, considering 50 liter water will be used by a worker in a day who are living in workers camps
- Water requirement for worker not living in Labour camps (400 nos.) will be about 10,000 Liters/day. Considering 25 liter water will be used by workers staying day time for work.
- Total water requirement for the workers in the project: 40,000 Liters/day.

Wastewater Generation by workers:

- Wastewater generation by workers in labour camps (600 nos.) will be about 24,000 Liters/day.
- Wastewater generation by workers not living in Labour camps (400 nos.) will be about 8,000 Liters/day.
- Total Wastewater generation by workers in the project: 32,000 Liters/day.

Solid Waste Generation by workers:

- Solid waste generation by workers in labour camps (600 nos.) will be about 150 Kg/day
- Solid waste generation by workers not living in Labour camps (400 nos.) will be about 60 Kg/day
- Total Solid waste generation by workers in the project: 210 Kg/day

The waste water generated will be disposed safely in soak pits/septic tanks up to suitable capacity. No waste water will be left outside the camps, in ground water or in any water body.

Solid waste generated will be disposed to concerned municipal waste collection system nearby.

Camp-site results in change of land use due to setting up of construction camp and waste generation during the construction. Contractor needs to reinstate the site once all the activities are completed and handover to the concerned bringing back to the original state or in a better condition. It 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.

Child Labour, Forced Labour, and Trafficking in Persons (TIP)

The past experience of consultant regarding child labour, forced labour and trafficking in person says that there are chances these risks may be there during construction phase of the project. It has been seen that child labour was engaged in construction work and they have been deployed in construction activities which are unsafe for child labours.

Regarding forced labours, many time contractor does not have proper agreement with labours in which there is no provisions of working hours, leaves or sick leaves, weekly off etc. In this case contractors forced them to work beyond working hours. Also not allowing them to take leaves and neither giving them weekly off.

As the project is located near Indian border there are chances of Trafficking in persons. The trafficking in persons have been observed in many construction projects where these are located at state or international boundaries.

ESS-3: Resource Efficiency and Pollution Prevention Management

Land Use Change

Improvement of existing KDP comprises forest land (303.44 ha), agricultural land with houses (159.3 ha), settlement (73.90 ha), River and flood plain (22.97 ha) and scattered vegetation (2.2 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.

Landscape Aesthetic

Construction of roads and bridges brings change to the landscape. Clearance of vegetation along the road will have an impact on Landscape aesthetics. Haphazard management of stockpiling yards, quarry sites, construction sites and camp sites and littering of wastes can be visually unpleasant during construction.

Air Pollution

Air quality along the project corridor will be impacted during all the stages.

Dust: During pre-construction and construction stage, there will be impact from dust mainly due to site clearance and use of heavy vehicles and machinery. There will also be impacts from dust during extraction and transportation of raw materials from quarries, crushers, stockpiling yards to construction sites. It is likely that impacts due to dust generation are felt downwind of the site rather than on the site itself. Dust is also likely to be generated due to the various construction activities including:

- Stone crushing operations in the crushers;
- Handling and storage of aggregates in the asphalt plants;
- Concrete batching plants;
- Use of air compressor for cleaning of base and during concreting; and
- Asphalt mix plants due to mixing of aggregates with bitumen.

Construction stage impacts will be of short term and have adverse impacts on the construction workers as well as the settlements adjacent to the road, especially those in the downwind direction.

Construction stage impacts will be confined generally to a band of width ranging from 100m to 150m from the edge of the Right of Way.

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 existing road surface.

Exhaust Emissions: Apart from the fuel used during the actual pavement placement, energy is required to produce and refine materials, transport materials and equipment, and eventually to dispose of the roadway. Approximately 734,413 liters of Diesel will be required for these activities during construction phase. Generation of exhaust gases is likely during the construction stage due to movement of heavy machinery for construction. High levels of PM, SO₂, HC, CO and NO₂ are likely from hot mix plant operations. Toxic gases are released through the heating process during bitumen production. Although the impact is much localized, it can spread downwind depending on the wind speeds.

General impacts due to air pollution are mentioned in **Table 6.6**.

Table 6.6: Impacts Associated with Air Pollution

Emission Type	Impacts	
	Human	Vegetation
Hydro carbons	Prolonged exposure to hydrocarbons contributes to asthma, liver disease, lung disease, and cancer. Inhaling formaldehyde can cause irritation. It is a major contributor to eye and respiratory irritation, which is caused by photochemical smog.	Ethylene causes injury to the leaves of sensitive plants. Effects are epinasty, chlorosis, curling, and abscission and growth retardation
CO	Reduces the ability of hemoglobin to carry oxygen to the body tissues.	-
NO ₂	Nitrogen dioxide damages the cell membranes in the lung tissues and constriction of the lung passages. Edema or a filling of the intercellular spaces with fluid. Eye and nasal irritation and pulmonary discomfort are also common.	Nitrogen dioxide causes growth retardation
CO ₂	Asphyxiation, caused by the release of carbon dioxide in a confined or unventilated area. Kidney damage or coma.	Elevated atmospheric carbon dioxide and reduces plant growth
Ozone.	Ozone causes an irritant action in the respiratory tract, cough chest pain, eye irritation, headaches and asthma attacks. Chronic effects include losses in immune system functions, accelerated aging and increased susceptibility to other infections.	Ozone concentrations cause flecks on the upper surfaces, premature aging and suppressed growth, leaf bleaching, necrosis.
SO ₂	The health problems related to the mucous membrane and respiratory tract are due to sulfate aerosols. Chronic effects of SO ₂ include increased probabilities of bronchitis, "colds" of long duration and suppression of immune system.	SO _x produce injury on leaves and plants which is characterized by the killing of marginal or intervention areas of the leaf.
Fugitive Dust	Irritation to the eyes, nose and throat. Respiratory distress, including coughing, difficulty in breathing and chest tightness. Increased severity of bronchitis, asthma and emphysema.	Reduced photosynthesis due to reduced light penetration through the leaves. This can cause reduced growth rates and plant vigor. Increased incidence of plant pests and diseases.

Noise Pollution

Road noise depends on factors such as traffic intensity, the type and condition of the vehicles plying on the road, acceleration/deceleration/gear changes by the vehicles depending on the level of congestion and smoothness of road surface.

Noise levels during the pre - construction stage are mostly expected to be indicative of Prevalent baseline levels apart from localized noise levels at locations where pre construction stage activities are taking place such as establishment of workers camps, stockyards. These increased noise levels will prevail only for a short duration during the pre-construction stage. Moreover, as these activities are not likely to be placed near settlement the increased noise impact is bound to be negligible.

During construction, the major sources for noise pollution will be movement of vehicles transporting the construction material to the construction yard and the noise generating activities at the yard itself. Crushing plants, asphalt production plants, movement of heavy vehicles, loading, transportation and unloading of construction materials produce significant noise during construction stage. The construction equipment with high noise levels, the noise generated during excavation, loading and transportation of material near the areas will affect the construction personnel and other humans in the area.

The typical noise levels associated with the various construction activities and the various construction equipment are presented in **Table 6.7** below.

Table 6.7: Typical Noise Levels of Principal Construction Equipment
(Noise Level in db (A) at 50 Feet)

Clearing		Structure construction	
Bulldozer	80	Crane	75-77
Front end loader	72-84	Welding generator	71-82
Jack hammer	81-98	Concrete mixer	74-88
Crane with ball	75-87	Concrete pump	81-84
		Concrete vibrator	76
Excavation and Earth Moving		Air compressor	74-87
Bulldozer	80	Pneumatic tools	81-98
Backhoe	72-93	Bulldozer	80
Front end loader	72-84	Cement and dump trucks	83-94
Dump truck	83-94	Front end loader	72-84
Jack hammer	81-98	Dump truck	83-94
Scraper	80-93	Paver	86-88
Grading and Compaction		Landscaping and clean-up	
Grader	80-93	Bulldozer	80
Roller	73-75	Backhoe	72-93
		Truck	83-94
Paving		Front and end loader	72-84
Paver	86-88	Dump truck	83-94
Truck	83-94	Paver	86-88
Tamper	74-77	Dump truck	83-94

Source: U.S. Environmental Protection Agency, noise from Construction Equipment and Operations. Building Equipment and Home Appliance. NJID. 300.1. December 31,1971.

Though the noise levels presented for the various construction activities far exceed the permissible standards, it is important to note that the construction noise is generally intermittent and depends on the type of operation, location and function of the equipment.

The source of noise and its impact categorization are presented in **Table 6.8**.

Table 6.8: Sources of Noise Pollution and Impact

S. No.	Phase	Source of Noise pollution	Impact
1	Pre-construction	• Man, material & machinery movements • Establishment of labour camps onsite offices, stock yards and Construction plants	Chronic noise exposure can be a source of annoyance, creating communication problems and leading to elevated stress levels as well as associated behavioural and health effects. It can cause auditory fatigue, temporary and permanent disability of hearing ability, sleep disorders and can even contribute to learning problems in children.
2	Construction Phase	• Plant Site - stone crushing, asphalt production plant and batching plants, diesel generators etc. • Work zones - Community residing near to the work zones	
3	Operation Phase	• Due to increase in traffic	

Source: *The Noise Pollution (Regulation and Control) Rules, 2000*

Noise may prevent many animal species from approaching or crossing road corridors because they are afraid. As a result, road corridors become barriers to regular wildlife travel routes, effectively rendering roadside habitat areas inaccessible to some species.

Noise Impacts during construction Phase: Noise modeling for the proposed road was carried out and presented in **Annexure 6.2**. Keeping overall view of noise impact assessment study for up-grading Kamala-Dhalkebar-Pathlaiya (KDP) section of East West (Mahendra Highway) of length 130 km and width 45 m having uniform ROW 25 m on either side of the highway median along entire study corridor, incremental noise level in dB(A) with respect to three sound level descriptors Daytime (Ld), Nighttime (Ln) and Day-nighttime (Ldn) are shown in **Figure 6.1**, **Figure 6.2** and **Figure 6.3** respectively for the base year 2026 to get an idea how far from the proposed corridor the incremental noise level comply country specific day 55 dB(A) and night 50 dB(A) Ambient Noise Quality Standard (ANQS) for urban residential area without noise barrier and it is expected to meet at approximately 369 m and 1298 m respectively from the median of the highway. With respect to sailent zone landuse, day-standard 50 dB(A) and night-standard 40 dB(A) is expected to meet at 1298 m and 12975 m. It is worthy to mention that compliance distance is estimated under conservative approach considering maximum traffic volume on Bardibas-Nawalpur section and without any noise absorption in the direction of propagation of sound wave. Based on the noise modelling, the noise level at all desired receptors location exceeds the prescribed noise standards (**Table 6.9**) presented with respect to respective land use. To protect from any adverse impact due to noise where noise level exceeds the noise standard it is recommended. However, before installing noise barrier along highway prior site-specific noise monitoring should also be performed.

Table 6.9: Land Use and Noise Standard dB (A)

Receptors	Land use	Day-Noise	Night-Noise
NQ1 (Dhalkebar on Kamal–Dhalkeba)	Mix Residential Area	63.0	55.0
NQ2 Lalbandi on Bardibas-Nawalpur)	Mix Residential Area	63.0	55.0
NQ3 (Paurahi on Nawalpur-Chapur)	Sailent Zone	50.0	40.0
NQ4 (Naijgadh on Chapur-Nijgadh)	Urban Residential	55.0	50.0
NQ5 (Dudhaura on Nijgadh – Pathlaiya)	Sailent Zone	50.0	40.0

Further, predicted noise level at wildlife crossing points along the carriageway due to traffic on respective section of KDP corridor is presented in **Table 6.10**. Predicted noise level exceeds noise

level standard at all sections and in order to protect wildlife from any adverse noise impact due to traffic flow noise barrier is recommended and prior site-specific due diligence study is also suggested.

Table 6.10: Predicted Day (L_D), Night(L_N) & Day-Night (L_{DN}) at Wildlife Crossing Sections

Section	L_D Predicted dB(A)	L_N Predicted dB(A)	L_{DN} Predicted dB(A)
Bardibas-Nawalpur	66.9	67.5	70.2
Nawalpur-Chapur	67.1	67.6	70.4
Chapur-Nijgadh	67.2	67.7	70.5
Nijgadh-Pathlaiaya	69.3	69.8	72.6

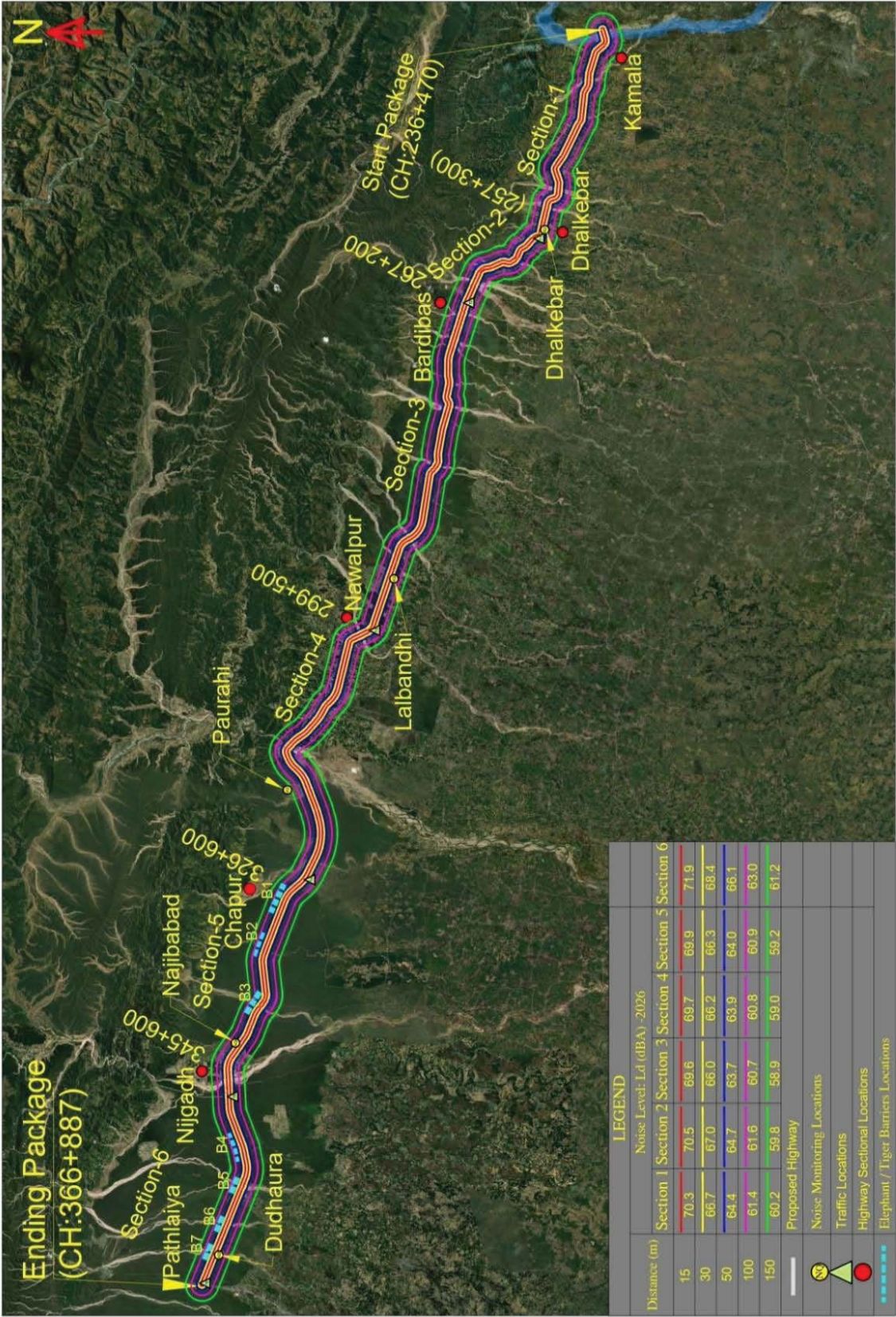


Figure 6.1: Daytime (Ld) Incremental Noise Level Along Entire KDP Study Corridor at 15 m, 30m, 50 m, 100 m & 150m: 2026

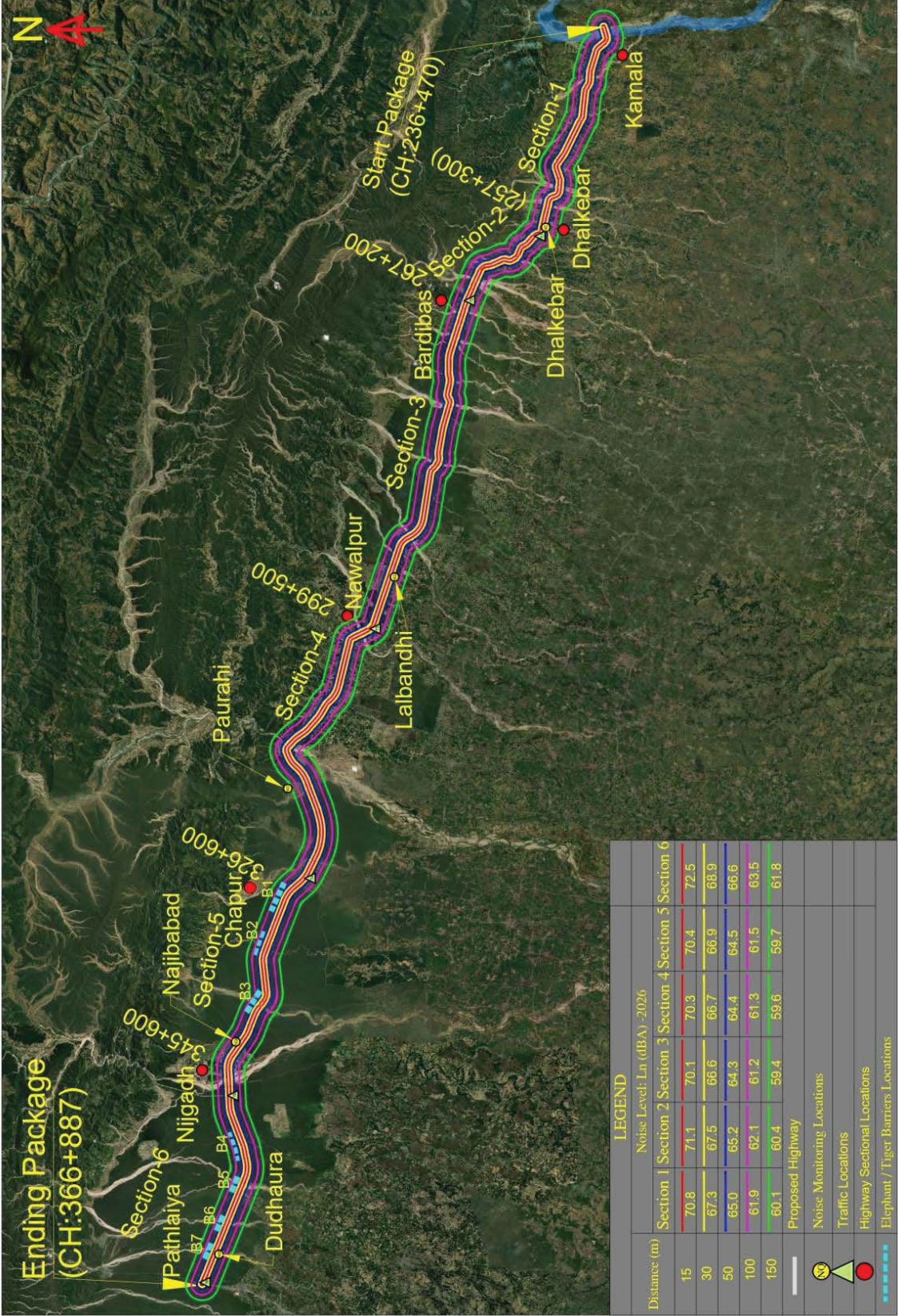


Figure 6.2: Nighttime (LN) Incremental Noise Level along entire KDP Study Corridor at 15 m, 30m, 50 m, 100 m & 150m: 2026

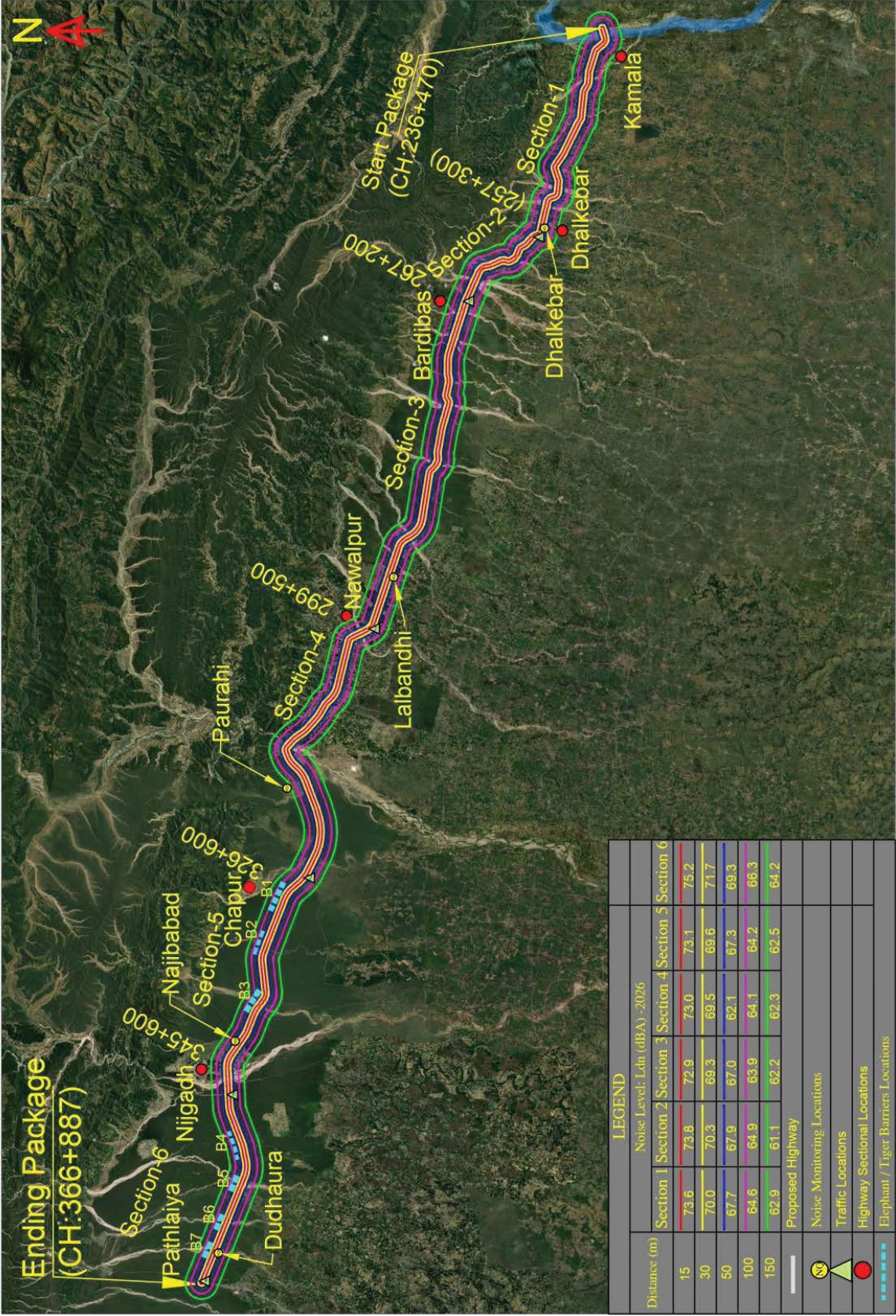


Figure 6.3: Day-Nighttime (L_{DN}) Incremental Noise Level Along KDP Entire Corridor at 15 m, 30m, 50 m, 100 m &150m: 2026

Vibrations

Large machinery and equipment including construction vehicles, generators, compressor and pumps will be used during construction. Such equipment generate vibration, will be experience by the nearby settlement. Also soil compaction work with bulldozers will generate vibration within RoW only.

During operation stage also, movement of heavy vehicles can create vibration and the impact will be high mainly at bridges and nearby locations.

The vibration induced by the construction equipment can have a detrimental effect on structures standing near the road. This is of particular concern in the case of cultural heritage sites, which may have been standing for many centuries, but which were not designed to withstand such vibration. Makeshift or lightly constructed buildings may be the first to succumb to vibration damage. In proposed KDP project, these vibrations will be localized and temporary and will unlikely result in structural damage to buildings or walls of the adjacent private properties.

Though the noise levels presented for the various construction activities far exceed the permissible standards, it is important to note that the construction noise is generally intermittent and depends on the type of operation, location and function of the equipment.

During Operation stage, noise level can be higher due to more flow of traffic.

Potential Hazards Caused by Bitumen and other Toxic Chemicals

Bitumen is used for Asphalt/black topping the road surface. Approximately 30,000 metric ton bitumen will be required during asphalt works. Spillage of bitumen could harm soil and water pollution. Furthermore, during operation of bitumen, it also causes adverse impact to human health including skin burning.

Large number of vehicles, crusher/asphalt/batching plants and heavy equipment will operate during construction of road and bridges. There is possibility of accidental leakage of fossil fuel, lubricants, oils, acids and chemicals from such operations, if all these are not maintained properly. Exposure to acids and chemicals might bring carcinogenic effect to the labourers and land. Directly mixing of chemicals and lubricants in the water sources can disrupt aquatic species.

During Operation stage, there may be accidental leakage of chemicals, mainly fuel and lubricants during accidents.

Solid Waste Management

General Solid Waste: General solid waste will be generated from the construction camps and offices, which include food waste, paper, plastic etc.

There will be approximately 1000 workers employed for this road upgradation work. About 600 workers will live in the construction camps and the average solid waste generation per worker will be 0.250 kg per day (including at camp & construction site). Approximately 150 kg solid waste will be generated from these 600 workers.

The average solid waste generation on construction site per worker will be 0.150 kg per day. Approximately 400 local workers which will not be living in labour camps will generate about 60 kg solid waste per day on construction site only. Hence, in construction phase, total 210 kg solid waste will be generated per day by total 1000 workers.

Construction and Demolition (C&D) Waste: Construction and Demolition (C&D) waste is part of solid waste that results from land clearing, excavation, construction, demolition, remodeling and repair of structures, roads and utilities. C&D waste has the potential to save natural resources (stone, River sand, soil etc.) and energy, its bulk which is carried over long distances for just dumping, its

occupying significant space disposal sites and its presence impedes processing of biodegradable waste as well as recyclable waste. C&D waste generated from road construction has potential use after processing and grading.

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, gulying, 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, gulying 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.

Hazardous Waste: During construction, different types of hazardous materials like epoxy, additives, admixtures, cements, bitumen, paints, anti-stripping agents, etc. will be used. Waste containing such chemicals can be hazardous and needs special attention for disposal. Further, hazardous waste would also arise from the maintenance of equipment which may include used engine oils, hydraulic fluids, waste fuel, spent mineral oil/cleaning fluids from mechanical machinery, scrap batteries or spent acid/alkali, spent solvents etc.

Soil Pollution

Soil Erosion: Soil erosion (mainly topsoil) is expected to be high during site clearance and removal of vegetation. Similarly, there can be significant soil erosion during riverbank cutting/excavation for abutments and drilling for piers. Setting up of workers camp along the project road may lead to loss of productive soils and impact the soil productivity especially at micro level.

Soil Contamination: As per baseline data, the soil along the KDP road is suitable for agriculture purpose except for trace amounts of oil & grease contamination. Contamination of soil during construction stage is primarily due to construction and allied activities.

Soil pollution may take place from stockpiling yards. The sites where construction vehicles are parked and serviced are likely to be contaminated because of leakage or spillage of fuel and lubricants. Pollution of soil can also occur at hot-mix plants from leakage or spillage of asphalt or bitumen. Refuse and solid waste from labour camps can also contaminate the soil. Contamination of soil during construction might be a major long-term residual negative impact. Unwarranted disposal of construction spoil and debris will add to soil contamination. This contamination is likely to be carried over to water bodies in case of dumping being done near water body locations.

Pollution of Water Resources

Surface Water: The project road crosses several Rivers (**Table 6.11**). The river water flow in the project area is predominantly from the north to south. As per baseline data, apart from colour, turbidity and coliforms, other parameters of water quality are within permissible limits of NDWQS. These surface water bodies can be subject to adverse impacts due to the various construction activities as well as during the operation stage of the project. Flowing water can be polluted by stockpiling and construction yards, which could further pollute any stream or ground water through percolation.

Impacts of road construction, which lead to alteration of drainage, are generally due to construction of cross drainage including bridges at locations of crossing. The construction activities will necessitate

diversion of the waterways. This diversion of flow may impact the aquatic habitat, present, if any. Alteration of drainage can lead to soil erosion of adjacent areas and disturb local vegetation. 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.

Kamala and Bagmati rivers are major rivers where aquatic life is of major concern. These rivers are of religious importance and are continuously disturbed due to human activities mainly bathing, cremation, and discharging of idols during performing of the religious rituals in the river. The proposed bridge sites are not primary habitat of protected and threatened species however fish fauna, including globally threatened Indian Mottled Eel, CITES-indexed amphibian species like Indian Bull Frog (*Hoplobatrachus tigerinus*), and Indian Soft-shell Turtle (*Aspideretes gangeticus*) are found mostly during high flood period. Bridge construction works will be halted during high flood period.

Site specific impacts associated with each of the rivers is discussed in **Table 6.11**. Beside these, climate change can have serious impact in these surface water bodies.

Table 6.11: Impacts Associated with Rivers along KDP Road Alignment

S.N	River	Possible Impacts/Issues
1	Kamala	- This is perennial River so construction works can impact on aquatic life. The river is aggrading and hence there can be siltation problem. Disturbance to cattle crossing during construction. - Disturbance during crop harvesting and transportation. - Blockage in access to Riverbank for religious activities (temples, cremation, taking holy bath) - Existing extraction of Riverbed materials may have risk in bridge foundation
2	Kamala Canal	- Deterioration of Irrigation water quality - Open canal can be risk to children
3	Charnath	- Ephemeral River with aggrading nature hence siltation problem - Disturbance to cattle crossing during construction. - Disturbance during crop harvesting and transportation. - Riverbank cutting
4	Baluwa	- Ephemeral River with aggrading nature hence siltation problem - Disturbance to cattle crossing during construction. - Disturbance during crop harvesting and transportation. - Riverbank cutting
5	Jagadav Branch	Ephemeral River with aggrading nature hence siltation problem
6	Jagadav	- Ephemeral River with aggrading nature hence siltation problem - Riverbank cutting
7	Jalad	- Ephemeral River with aggrading nature hence siltation problem - Disturbance to cattle crossing during construction. - Disturbance during crop harvesting and transportation. - Riverbank cutting
8	Aurahi	- Ephemeral River with aggrading nature hence siltation problem - Disturbance to cattle crossing during construction. - Disturbance during crop harvesting and transportation. - Riverbank cutting
9	Basai	- Ephemeral River with aggrading nature hence siltation problem - Disturbance to cattle crossing during construction. - Disturbance during crop harvesting and transportation. - Riverbank cutting
10	Sukhajor	- Ephemeral River with aggrading nature hence siltation problem - Disturbance to cattle crossing during construction. - Disturbance during crop harvesting and transportation
11	Badahari	Ephemeral River with aggrading nature hence siltation problem

S.N	River	Possible Impacts/Issues
		• Disturbance to cattle crossing during construction. • Disturbance during crop harvesting and transportation
12	Ratu	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to cattle crossing during construction • Disturbance during crop harvesting and transportation • Existing extraction of River bed materials may have risk in bridge foundation • River bank cutting
13	Ratu Chahara	• Ephemeral River with aggrading nature hence siltation problem • Existing bridge to be dismantled so issue regarding diversion
14	Bhapsi	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to cattle crossing during construction • Existing extraction of River bed materials may have risk in bridge foundation • Disturbance during crop harvesting and transportation
15	Atabbe	• Ephemeral River with aggrading nature hence siltation problem
16	Janga Pul-1	• This is perennial River so construction works can impact on aquatic life.
17	Janga Pul-2	• Ephemeral River with aggrading nature hence siltation problem
18	Gadhanta	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to wildlife movement • River bank cutting
19	Belgachhi (Dhungre Khola)	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to wildlife movement • Existing bridge to be dismantled so issue regarding diversion
20	Tuteshwar - 1	• Ephemeral River but degrading in nature • Disturbance to wildlife movement
21	Tuteshwar - 2	• Ephemeral River with aggrading nature hence siltation problem
22	Maraha	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to wildlife movement
23	Maraha Kholsi Pul	• Ephemeral River with aggrading nature hence siltation problem
24	Dholan	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to wildlife movement
25	Jarlahi (Kholsi Pul)	• Ephemeral River with aggrading nature hence siltation problem
26	Batuwa	• Ephemeral River with aggrading nature hence siltation problem
27	Bankhe	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to wildlife movement
28	Amuwa	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to wildlife movement
29	Phuljor	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to cattle crossing during construction • Disturbance during crop harvesting and transportation
30	Kalinjor - 1	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to cattle crossing during construction • Disturbance during crop harvesting and transportation
31	Kalinjor - 2	• This is perennial River so construction works can impact on aquatic life. • Disturbance to wildlife movement
32	Betini	• Ephemeral River but degrading in nature • Existing bridge to be dismantled so issue regarding diversion
33	Dumdume	• This is perennial River so construction works can impact on aquatic life
34	Bastipur	• Ephemeral River with aggrading nature hence siltation problem • Existing bridge to be dismantled so issue regarding diversion
35	Lakhandei	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to cattle crossing during construction • Disturbance during crop harvesting and transportation • Existing extraction of River bed materials may have risk in bridge

S.N	River	Possible Impacts/Issues
		foundation • River bank cutting
36	Chapani	• This is perennial River so construction works can impact on aquatic life. Perennial River but aggrading nature hence siltation problem • River bank cutting
37	Bastol	• Ephemeral River with aggrading nature hence siltation problem
38	Sukhapokhari	• Ephemeral River with aggrading nature hence siltation problem • Existing bridge to be dismantled so issue regarding diversion
39	Rai Bridge	• This is perennial River so construction works can impact on aquatic life. • Disturbance to cattle crossing during construction • Disturbance during crop harvesting and transportation
40	Dumajor	• Ephemeral River with aggrading nature hence siltation problem
41	Godari	• Ephemeral River with aggrading nature hence siltation problem • Existing bridge to be dismantled so issue regarding diversion
42	Bagmati East	• Deterioration of Irrigation water quality Open canal can be risk to children
43	Bagmati	• This is perennial River so construction works can impact on aquatic life. Perennial River but aggrading nature hence siltation problem • Blockage in access to River bank for religious activities (temples, cremation, taking holy bath) • Existing extraction of River bed materials may have risk in bridge foundation • Removal of religious trees
44	Bagmati West	• Deterioration of Irrigation water quality Open canal can be risk to children
45	Gairi	• Ephemeral River with aggrading nature hence siltation problem
46	Gairi Khola	• Ephemeral River with aggrading nature hence siltation problem
47	Paurahi	• Ephemeral River but stable in nature • Disturbance to wildlife movement
48	Lachkan	• Ephemeral River with aggrading nature hence siltation problem
49	Katha Ko Pul	• Ephemeral River with aggrading nature hence siltation problem
50	Chandi	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to cattle crossing during construction • Disturbance during crop harvesting and transportation • Existing extraction of River bed materials may have risk in bridge foundation • River bank cutting
51	Dhou	• Ephemeral River with aggrading nature hence siltation problem • Existing bridge to be dismantled so issue regarding diversion
52	Jungle Tole	• Ephemeral River but stable in nature
53	Amu - 1	• Ephemeral River but stable in nature • Disturbance to wildlife movement • Existing bridge to be dismantled so issue regarding diversion
54	Amu - 2	• Ephemeral River but stable in nature • Existing bridge to be dismantled so issue regarding diversion
55	Kathi	• Ephemeral River with aggrading nature hence siltation problem
56	Lamaha	• This is perennial River so construction works can impact on aquatic life. The River is aggrading and hence there can be siltation problem. • Disturbance to wildlife movement
57	Kali Khola	• This is perennial River so construction works can impact on aquatic life.
58	Dhansar	• Ephemeral River with aggrading nature hence siltation problem
59	Lamopul	• Ephemeral River but stable in nature
60	Bhamara	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to cattle crossing during construction • Disturbance during crop harvesting and transportation
61	Rampul	• Ephemeral River with aggrading nature hence siltation problem

S.N	River	Possible Impacts/Issues
		• Disturbance to cattle crossing during construction • Disturbance during crop harvesting and transportation
62	Bakeya	• This is perennial River so construction works can impact on aquatic life. Perennial River but aggrading nature hence siltation problem • Blockage in access to River bank for religious activities (temples, cremation) • Existing extraction of River bed materials may have risk in bridge foundation
63	Unasi	• Ephemeral River, sometimes aggrading and sometimes degrading
64	Terhakilo	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to wildlife movement • Existing bridge to be dismantled so issue regarding diversion
65	Barahakilo	• Ephemeral River but stable in nature
66	Pasaha	• This is perennial River so construction works can impact on aquatic life. Perennial River but aggrading nature hence siltation problem • Disturbance to wildlife movement
67	Pasaha Branch	• Ephemeral River but stable in nature
68	Bangandi	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to wildlife movement
69	Balganga	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to wildlife movement
70	Baijura	• Ephemeral River with aggrading nature hence siltation problem
71	Dudhaura	• Ephemeral River with aggrading nature hence siltation problem • Disturbance to wildlife movement
72	Dhungre - 1	• Ephemeral River with aggrading nature hence siltation problem
73	Dhungre - 2	• Ephemeral River but stable in nature
74	Tin Number	• Ephemeral River but stable in nature
75	Dui Number	• Ephemeral River but stable in nature
76	Ek Number	• Ephemeral River with aggrading nature hence siltation problem

Source: Draft Detailed Design Report 2022 and Field Observation 2022

Further, there are total 7 nos. of Ponds near or within KDP road ROW. These ponds can be affected due to project upgradation work. Details of the same are given in **Table 4.9**. It is noticed that ponds at chainages 255+200 and 295+300 fall within ROW, therefore these ponds will be affected directly, and we have to extent ponds to meet the existing capacity at other location so as to compensate the impacts. Also, there may be impact due to construction like change of land use (some portion to be converted to road structures), pollution, sedimentation, etc. on ponds which are in the vicinity of RoW. Ponds near to ROW may also have impacts from spillage of chemicals and runoff from construction sites.

Ground Water

Most of the sections of project area is rich in ground water and is the main source of drinking water too. The availability of ground water is not an issue in project area. The ground water was tested at 5 locations as stated in Baseline chapter, it is noticed that beside E. coli contamination, all the other measured parameters are within NDWQS 2062. All the drinking water samples except that from Bagmati and Pathlaiya settlements had E. coli contamination.

Like surface water, ground water can also be subjected to adverse impacts due to the various construction activities as well as during the operation stage of the project. Different chemicals used during construction like epoxy, additives, admixtures, cements, bitumen, paints, antistripping agents, fuel, acids etc. can be leaked and seep into ground water and contaminate it. Similarly, if wastes are through haphazardly, leachate can percolate and contaminate ground water. The impact can be increased during rainy season due to infiltration and percolation of contaminated rainwater.

Impact due to operation of pits and quarries

Boulders, gravel and sand are likely to be extracted from the River near to the bridge construction site by the contractors for construction works. It is observed that boulders, gravel and sand is already extracted from River bed for other construction work. The source of boulders, gravel and sand is identified by design team are these rivers. The quantity of construction material required for the project is given in **Table 1.5**). Quarrying from riverbed can lead to change in river morphology, disbalance in riverbed slope and can generate high sediment load impacting the water quality.

Further, sand and gravel extraction from rivers and streams may change river regime and affecting aquatic ecology (mainly in perennial rivers), exposing river side embankment without natural protection causing embankment instability and bank cutting.

The quarries used for obtaining rocks, soil and aggregate materials for road construction can cause direct and indirect adverse impacts on the environment. It is likely that material from quarries could be needed depending on the appropriateness of the material quality. Quarrying and crushing can have a critical impact especially on the air quality of the area especially in the area downwind to the quarry.

A major source of dust during the construction stage is from stone crushing operations from the crusher and the vibrating screen. The dust, in addition to being an eyesore, reduces visibility thereby increasing safety concern. Dust is generated due to procurement and transport of raw materials from quarries to the road construction area. These impacts will persist till the activity ceases.

Quarry material for the project 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 near the road alignment and detailed in the **Table 1.6**.

Impacts regarding reinstatement of quarry sites, camp sites, spoil disposal sites etc. (immediately after construction is over)

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 river side will be washed out affecting River/streams and cultivated lands. Stockpiling along the existing road and near settlement and urban areas will provide discomfort to the local inhabitants with the dust pollution as well. 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 Dhalkebar, Bardibas, Lalbandi, Nijgadh, Chandrapur and Pathlaiya etc. These materials may be washed away by monsoon rain, causing water pollution to existing natural drainages and along the kamala, Baghmati, Bakaya Rivers and streams as Ratu, Lakhandei etc. 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.

Impact from Stone Crushing Plants, Batching Plants and Asphalt Plants

The project needs to establish Crushing Plant, Hot mix Plant and Batching Plants if not sourced from nearby authorized suppliers. The establishment of Crushing Plant/Hot mix Plant/Batching Plants creates enormous quantity of dust particles and gaseous pollutants into the atmosphere, surface water pollution. These plants will impact on public health and well-being emits air, noise pollution to the local people, labour force.

Further, the wastewater discharges from the crusher plant and batching plants contain high sediments. These discharges will pollute the soil and surface water quality and aquatic environment if they are discharged into rivers and streams without any prior treatment.

Impact of Climate Change

Climate change can contribute to the severity of the floods; because it is predicted in climatic scenarios that rainfall amount might be increased within the Terai region, especially in the monsoon season. Meteorological stations in the Terai region show an increasing level of precipitation in July from 1970 to 2009. The frequency and intensity of rainfall are also increased, as well as rainfall causing a rise in flash floods and debris flows. Predicted increase in precipitation may cause the water level higher than usual in Rivers and various streams crossing the project road. Bridge span capacity should be designed considering 15-20% increase of the storm water.

Also, the prevailing river networks may cause drainage problems related to water-logging along the KDP, especially during monsoon season.

ESS4: Community Health and Safety

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.

Traffic Management

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.

Safety of pedestrians including disable people with the plying of vehicles

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

Traffic and Road Safety

As the construction of new bridges are just close to the downstream of existing bridges. Impact upon existing traffic is likely with the construction activities and plying of construction vehicle, storage of construction materials close to the existing highway. These impacts will be direct, high significance, local, and short-term in nature.

Community Exposure to Health Issues and Labour Influx

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.

Emergency Preparedness and Response

Project poses several risks to local communities, including traffic accidents, fuel spills, river bank cutting, changes in River flow etc. creating need of establishing emergency preparedness and response along the road alignment.

Gender Based Violence (GBV)

GBV may be prevalent in project 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 in flux and stress on local villages.

Roadside Facilities for the community

There are provisions of public toilets at three places along the road. Also, marketplaces along the road will be upgraded for the betterment of vendors. Apart from this service roads, animal crossings, pedestrians' underpasses, vehicles underpasses have been considered in design.

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

Land Acquisition

The East West (Mahendra) Highway is a National Highway and as declared through publishing notice in Gazette 2034 BS (1977AD) its right of way is defined 50 meter and ownership lies within Department of Roads.

As said in project description, the proposed road development will be confined within existing RoW. Hence there will be no land acquisition for the development of the project.

Further, some temporary land will be required for the labour camp, stock piling, pit piling, pit site etc. that has been identified approximately 7 ha and finally decided by contractors as per their requirement and agreement with the perspective land owners.

Economic Displacement

Though the project doesn't need acquisition of permanent land, there are other assets like privately established structures and public structures (informal encroachers/inhabitants) located within the ROW and need to be compensated and rehabilitated.

It is noticed that in total there are 66 private structures of 64 HHs within ROW and the project will directly affect these structures. Further, 204 other extended housing structures (Sheds like) with having varied size that made of iron pillar with Zink roof needed removal or shifting from the ROW. Likewise, 48 public structures including 4 police post, 3 public toilets, 11 wall, 5 gates, 5 RCC Structures, other 16 structures of the Dharapani Barack and 4 other structures is noticed to be affected. Similarly, 168 community structures including 69 waiting sheds, 55 Bar/Peepal chautara, 35 small temples/shrines, 8 wells and a structure of a park may be affected due to road widening. Among 64 projects affected HHs, 25 are losing residence, 35 losing business huts, 4 HHs have losing both residential cum business. Beside this, 80 roadside vendors will be affected due to this project. Details of these project impacts has been illustrated in the Resettlement Action Plan which is prepared separately along with this ESIA.

Impact in Public Utilities

Proposed road widening is going to affect 2221 electric poles (including 140 solar poles) that lie within proposed formation width. Similarly, 33.16 km of drinking water supply pipelines is noticed to be affected due to road widening. All these electric poles and water supply pipelines will be shifted by the line department and cost will borne by project proponent.

ESS-6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

Impact in Forest Habitat

Baseline information of trees within ROW is given in section 4.2.4. It is noticed that in total 4,914 saplings (within diameter 4.0425 cm to 14.56 cm) and 28,120 trees and poles including 8,954 poles (with diameter 14.56 to 24.26 cm) and 19,166 trees (with diameter greater than 24.26 cm) may need to be felled down due to widening of existing road. Some of the tree species are under threatened category as per IUCN. Satisal (*Dalbergia latifolia*) tree is under vulnerable category. Similarly, Sal (*Shorea robusta*) and Satisal (*Dalbergia latifolia*) trees are banned by Government of Nepal for commercial felling, transport, or export of timber of these trees.

This vegetation grows in human disturbed environment, and there will be moderate impact from the road improvement to forest habitats. Also, there will be compensatory replantation in 1:10 ratio of Tree cutting.

The compensatory afforestation is proposed to be done mainly in those forest blocks where degraded land and forest blanks are available for planting. During the identification of sites for afforestation, priority will be given to planting in large, continuous habitat areas, with due consideration of areas that might enhance habitat for wildlife. The areas of animal corridors, feeding areas, and other important habitats shall be identified by the DFO/ Forest development fund and planned as high priority planting areas. The indigenous species recommended are *Shorea robusta*; *Mallotus philippensis*; *Anogeissus latifolia*; *Terminalia elliptica*; *Cleistocalyx operculata*; *Albizia odoratissima*; *Tectona grandis*; *Semecarpus anacardium*; *Bombax ceiba*; *Syzygium cumini*; *Senegalia catechu*; *Haldina cordifolia*; *Terminalia bellirica*; *Terminalia chebula*; *Ficus auciculata*; *Butea monosperma*.

List of potential sites for compensatory afforestation as per discussion with DFOs within project area are given in the **Table 6.12**.

Table 6.12: Potential Sites for Compensatory Afforestation

S.No.	Location for Plantation	GPS Location
1.	Lalgadh Community Forest	26°58'23.55"N, 85°56'18.13"E
2.	Near Janakinagar	27° 0'45.46"N, 85°32'18.10"E
3.	Jaitapur Post plantation area 1	27° 9'36.33"N, 85° 4'24.75"E
4.	Jaitapur Post plantation area 2	27° 7'38.87"N, 85° 4'19.22"E
5.	Kakadi plantation area	27° 6'16.23"N, 85° 7'46.77"E
6.	Bodhwan Post plantation area	27° 7'46.16"N, 85° 6'4.73"E

Road construction near reserve forest may impose a heavy burden on the natural resources due to labour labour camps permanent or temporary.

Impact in Aquatic Habitat

Construction works mainly for bridges can affect flows affecting aquatic wildlife too. Disposal of excavated materials in water bodies may increase turbidity of water and result in reduction in dissolved oxygen content. Inappropriate 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 household sources. Continual water pollution will also affect the aquatic biota, with subsequent negative consequences for fisheries and the economic return.

Wildlife and Wildlife Movement

The Asian elephant is distributed across 13 range countries with a population of about 41,000 to 52,000 (Sukumar 2006; Williams et al. 2020). The number of Nepal's resident elephants is estimated in 227 individuals. Number of elephants known to be present near the project road ranges from 4-8

individuals, however during monsoon season it will be increase from 12-18 individuals. Therefore, the area can be considered as a refuge habitat of the Asian elephant. Nevertheless, prior precautionary measures will be taken to avoid any disturbance to the Asian elephant in the project area.

The Tiger is a keystone species, crucial in maintaining the integrity of the ecosystems in which it thrives. Based on the most recent national estimates, the global Tiger population numbers between 3,726 and 5,578 individuals and is restricted to ten countries. Current surveys estimate a population of 235 tigers in Nepal (July 2022). With reference to the project road, as per the recent tiger census, it was noticed that range distribution of two Tigers namely FT-79 & FT-78 were reported part of the project road. These locations were identified between the km 333+100 to 327+700, this section is outside the Parsa National Park.

Major wildlife movement area within KDP road alignment is presented in sections from 329+000 to 342+000 and from 350+000 to 365+000. It is noticed that Increase in traffic flow and speeds may cause wildlife population disturbance and decline due to vehicle-wildlife collisions in these sections when fast driving (especially during night time).

Threatened Wildlife

A total of 38 species were screened as per the IBAT assessment report which includes Reptiles 12 species, Birds 16 species and Mammals 10 species. Out of 38 species 2 species namely Asian elephant and Royal Bengal Tiger were reported near the project area. There will be no direct effect on them, but construction noise and pollution will affect them indirectly.

Disturbance and Poaching of Wildlife

Illegal hunting and poaching can take place in natural forests by road workers. Where the road stretch is adjoining to forests (Parsa National Park and other 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.

The detail of ecological issue of project is given in Biodiversity Management Plan.

ESS-7: Impacts on Indigenous People

The proposed project will affect 14 indigenous households located within the 50-meter right-of-way (ROW). As a result, these households will need to be relocated. The indigenous people who are living in heterogeneous societies with scatter way therefore, it is not the subject of indigenous ownership, and there is no indigenous heritage site that will be impacted under the project, the process of obtaining free, prior, and informed consent (FPIC) with them for consultation is not required. Hence, KDP project will not significantly impact the indigenous peoples, their traditional culture, land resources and territories. It does not require to adopt the FPIC process. Though the specific impacts upon IP groups have not been envisaged however 16 project affected families of them have been found direct affecting by the project intervention likewise, altogether 11 major IPs groups were found residing along the project section as carried out by the baseline survey report which made obligatory for preparing of IPDP in this project section.

The detail of indigenous people along the KDP road has been identified and possible impact due to project on these people have been accessed and incorporated in standalone IPDP report prepared for the project.

ESS-8: Cultural Heritage

Due to a regular influx of people, especially of workers from diverse cultural backgrounds and locations, is likely to adversely impact the homogenous society's traditions and way of life. However, almost roadside settlements and populations are found in heterogenic by nature. The outsider construction workforce, coming from different parts, is envisaged to influence the local cultural and

traditional values with the potential exploitation of the female members during the construction stage. A significant majority of the population is composed of Terai castes, indigenous like Tamang, Magar and Tharu. These social groups of people have their own religions and cultural assets along the road alignment. Likewise, different social groups have their own social groups' specific traits along the road alignment. However, as noted above, there will be no significant impacts on cultural heritage as a result of the KDP road construction.

Some of the temples have great cultural significance, value or importance in locality, but do not constitute cultural heritage under ESS8 of the ESF. The widening of the road did not give space to relocate all affected public utilities within the ROW as before however most of the public utilities will be relocated as appropriate place according to community giving consent. All the *Bar/pipal Chautara* will not be replaced as previous form but waiting sheds will be constructed as in required areas. The communities and local authorities have agreed to relocate and rehabilitate the possible numbers in nearby area

It is recorded during social survey that 35 temples/shrines will be fully affected and needs to be rehabilitated. Similarly, there are 55 nos. of sacred trees (Bar/Pipal Chautara) and needs to be removed during road upgradation works.

Kamala and Bagmati Rivers in the project alignment are sacred Rivers. There are temples and ghats situated on the banks of both Rivers. Worshippers to these sacred places might get affected due to the project upgradation due to disturbance of access (traffic diversion), Air & Noise pollution due to construction works.

CHAPTER-VII: ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

7.1 General

The development of road has impacts on every component of environment e.g., there is significant change in land use, it has impacts on ecology and forest of passing through forest land, also there are impact on air quality, water quality, noise, soil, waste generation, wastewater generation and many impacts on socio-economic environment. The objective of Environmental Impact Assessment is to identify these impacts during planning stage and to examine appropriate, cost-effective mitigation measure for all adverse impacts. These impacts may be either avoided, whatever residual impact is there it is mitigated and if mitigation is not possible than to compensate the impact. The present chapter is describing the mitigation measure for all adverse impact considering the mitigation hierarchy.

7.2 Mitigation Hierarchy

The road improvement work has been proposed within the existing RoW. The mitigation measures include restitution for evaluated risk and impacts based on the mitigation hierarchy (MH) **Table 7.1**.

Table 7.1: Mitigation Hierarchy and its Application Principles (adapted from WB ESF, 2018)

Impacts due to Project			
Avoid	Minimize/Reduce	Mitigate	Offset/ Compensation

7.3 Application of Mitigation Hierarchy in KDP Road

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

Avoidance: Analysis of alternatives, community involvement, no go areas, good construction practices, timing of construction, regular maintenance in the case of KDP, this is avoidance to build 4-lane highway. To avoid forest land acquisition and land and house acquisition, the project has been confined to existing ROW compromising on curve improvement and fulfilling design speed in five different locations as mentioned in **Section 8.4**. Further, bridges that are in more or less working condition will not be dismantled. Other avoidance measures that the project adopts are avoiding spillage of chemicals through proper storage and handling, avoiding storage/disposal of muck in or near water bodies, avoiding pressure horn mainly near school and hospital areas, avoiding washing of vehicles in river and other water bodies, avoiding fishing and hunting of wildlife, avoiding use of fire wood, avoiding accidents, avoiding use of child and forced labour etc.

Minimising: Community involvement, impact identification, project design with incorporated MH, Good construction practices, integration of new improved technologies, Regular monitoring, maintenance practices, compliance of regulatory conditions. So as to minimize the waste generated, the project will adopt the 5R principle- Refuse, Reduce, Reuse, Recycle, and Recover. Impacts due to muck will be minimized by utilizing them in road embankment. Similarly, fuel efficient vehicles and machinery/equipment will be used to minimize fuel consumption. Flood hazard, bank cutting/erosion, water logging will be minimized through adequate river training works, plantation within ROW and proper maintenance of drainage and cross drainage structures. Dust pollution will be minimized through water spraying. For minimizing impact of noise, noise barriers have been proposed.

Mitigation/Rehabilitation: Proposed targeted measures, community involvement, good construction practices and regular monitoring. Upgrading of existing road itself is a mitigation measure for addressing increased traffic volume and smooth and fast transportation. So as to mitigate hinderance

to wildlife movement, underpasses and canopy bridges have been proposed. Avenue tree plantation will be done for mitigating impact to land use. All the project affected public and community structures will be rehabilitated. Just after construction is over, all the quarry and burrow pit sites, stockpiling yards, camp sites etc. will be reinstated to suite the local landscape.

Compensation or Offsets: Compensation Plan, Habitat Management Plan, compensatory afforestation plan, resettlement action plan for affected persons. Residual impacts or offsets in this that cannot be avoided, minimized or mitigated are removal of structures within ROW and cutting of trees. This project has allocated budget for compensatory plantation of cut down of trees in the ratio 1:10 and take care for 5 years. Similarly, all the project affected private structures will be compensated with cash.

7.4 Plan for Beneficial Impact Augmentation Measures

The following matrix presents the positive Environmental and Social impacts of the project and proposed enhancement measures.

Table 7.2: Project Benefits and Augmentation and Enhancement Measures

Activities/Impact/ Issue	Augmentation and enhancement measures
Construction Phase	
Socio-economic and cultural environment	
Employment generation	Preferences to local workers (including opportunity for the people involve in different capacities) for employment and project will generate direct and indirect employment for approximately 2500 people during construction, out of these there 1000 workers which will be engaged in construction work by contractors.
Technical skills and know-how	Awareness and on-job training to workers
New income generation	New job and business opportunities like shops, tea stalls and other kind of vendors near construction camps, construction site and workers camps.
Operation phase	
Physical Environment	
Improved KDP Road and other facilities along the road.	The details of improved road and other facilities are mentioned in Chapter-6, Table 6.3 .
Improved access to services	Rest areas, bus bays, truck bays and Waiting sheds, VUP, PUP, flyovers, Cattle and tractor crossings, and service roads. The details of improved road and other facilities are mentioned in Chapter-6, Table 6.3 .
Saving in Carbon Emission	Periodic maintenance of Pavement and structures Recommendations for fuel efficient machinery Carbon offset by planting trees Prevent activities that increase GHG emissions. The detail of reduction in GHG emission is given in Chapter-6, Table 6.4 .
Biological Environment	
Maintenance greenery along RoW and median.	All along the road.
Socio-economic and Cultural Environment	
Transport and road safety	Maintenance of road furniture, awareness raising campaigns, improved road with better safety measures as there will be improved curves. The detail is given in Safety Management Plan (Annexure-7.1).
Efficient transportation	Better access to social services, enhanced market cooperation opportunities, linkage to other districts.
New income generation opportunities	Enhanced and diversified local economy, benefits for Industries, Educational institutes, Hospitals, tourism and other businesses.
Increase in land value	Enhance in living standards and lifestyle, increase in land and property values.

7.5 Mitigation Measures

The general mitigation measures for road project are given in **Table 7.3**.

Table 7.3: Matrix of General Impacts and Mitigation Measures along KDP road

S. No.	Issues	Impact Category	Impact (Reason)	Mitigation/Enhancement
1.	Fear of uncertainties regarding future	Direct, impact	Land and property owners are subjected to sufferings regarding uncertainties of the extent of loss and the nature of compensation	Public participation sessions were/will be conducted in different stages of project
2.	Inducement of land prices	Direct impact	Danger of unscrupulous speculators moving in to purchase land	Committee will decide the actual cost of land
3.	Inducement of squatter influx	Direct impact	Squatters/occupiers may attempt to occupy adjacent land in the hope of receiving compensation, undue pressure on local resources	The dates of base-line Socio-economic survey have been considered as cut-off date. The cut-off date is a date after which no further enumeration or claims can be made to affected land and/or affected assets. The cut-off date for the KDP road project was established as September, 2022. Further real cut of date will be the date of Section 9 Notice publication in National Daily Newspaper by the Compensation Determination Committee (CDC) Chaired by Chief District Officer (CDO) as per the LAA 1977.
4.	Loss of utilities and amenities	Direct impact	Natural (trees, bushes and Grass lands), and Physical structures (public or private assets and utilities).	Relocation of utilities will be completed prior to start of project work. These have been further discussed in details in RAP
5a.	Public Health and Safety	High direct adverse impact	Impacts associated with Debris generated Risk of accident while demolishing the property. Dust generation and air pollution due to demolition. Noise generation due to demolition work.	Safety measures will be adopted during demolition of properties. Debris, so generated will be disposed to the satisfaction of Engineer in order to avoid any type of pollution or contamination which may pose health risks. Monitoring of air, water, noise and soil during construction and operation phase.
5b.	Labour Camps	Direct Impact	Can have clashes with the local population, Pressure on basic facilities like medical services power, water supply, etc. Transmission of communicable diseases including AIDS. Sanitary conditions in the labour camps	All contractors will be encouraged to recruit the local people as labourer at least for unskilled and semi-skilled jobs. Camp with adequate facility for bed, food, security and other facilities required for efficient camp management. Hygiene and basic facilities will be ensured at labour camp to prevent the spread of disease. Barricading of the labour camp with monitoring of going outside and coming inside of the camp is also required.
5c.	Allied activities	Indirect Impact	Social and economic life of the local population due to quarrying and crushing operations, traffic	Detailed traffic control plans shall be prepared and submitted to the engineer for approval 5 days prior to commencement of work on any section of road

S. No.	Issues	Impact Category	Impact (Reason)	Mitigation/Enhancement
			diversions, etc. traffic jams and congestion, loss of access and other road accident risks, temporary land acquisition	
5d.	Accidents and Safety	Direct Impact	School children, ladies carrying pots full of water, people carrying goods or commodities, vehicle crash during pick drop to the workers/employee	The contractor will provide, erect and maintain barricades, including signs marking flags lights and flagmen as required by the Engineer
6.	Resettlement of People	Indirect impact	Pressure on civil amenities, water sources, grazing lands, fuel wood, medical facilities etc.	A comprehensive resettlement action plan has been prepared in order to rehabilitate affected persons. Also compensation as per entitlement framework will be given to the project affected persons.
7.	Land Use Changes	Indirect impact	Succession of land uses and higher return uses would displace the lower return uses at major intersections and in settlement areas. Urban fringe areas will be subjected to ribbon development.	The ribbon development is anticipated during operation phase of the project.
8.	Removal of encroachments and occupiers	Indirect impact	Loss of shelter, disturbance to family and community life	Impact will be avoided by implementation of phase-wise resettlement action Program. Notice will be served 4 months in advance
9.	Host Community	Indirect Impact	Displaced, resettled families will put pressure on the existing scarce infrastructure and amenities available with the host community	Special provision made in the comprehensive resettlement action plan for the host community

The site-specific mitigation measures for road project are given in **Table 7.4**.

Table 7.4: Site Specific Mitigation Measures

Impacts and risks	Sensitive receptors	Location	Mitigation measures
ESS 1: Assessment and Management of Environmental and Social Risks and Impact			
Vulnerable Households to lose their structures and Livelihood Roadside venders lose their livelihood	40 Vulnerable Households (women headed households, household having disabled member, household having senior citizen, below poverty level and ethnic minorities group) Around 80 Roadside venders	Potaha, Godar, Lachumaniya chowk, Paanityanki chowk, Lalbhitta, Sukhjarepul, Fuljor, Tuteswor chowk, Gaushala, Tinghare lachka and Chiriyadaha	Capacity Building/livelihood restoration training to vulnerable groups Skill and entrepreneurship development training will be provided for project affected Households. Livelihood support to roadside vendors
Cumulative Impacts	Railway Project: Wildlife movement, local people, natural resources – forest, existing quarry and burrow pit sites,	Area between KDP road alignment and Railway Alignment	Coordination with railway project, information dissemination with each other, suggest railway project to design wildlife friendly animal crossings infrastructures aligned with KDP road Project, not to establish quarry and burrow pit together or nearby.
	Fast track: Wildlife movement, natural resources – forest, existing quarry and burrow pit sites, people travelling	Chainage 347+000 to 351+000	Coordination with fast-track project, information dissemination with each other, suggest fasttrack project for wildlife monitoring and plantation activities aligned with KDP road Project, not to establish quarry and burrow pit together or nearby., proper drainage management
	Transmission Line: Wildlife movement, local people, natural resources – forest	Area between KDP road alignment and Transmission Line Alignment	Coordination with transmission line projects, information dissemination with each other, suggest transmission line project for wildlife monitoring and plantation activities aligned with KDP road Project
	Upgrading of Kamala Kanchanpur Road	Adjoining area towards east side associated with Kamala Bridge	Coordination with project for adequate drainage management, pollution prevention (mainly dust) and traffic management during construction
	Pathlaiya Narayanghadh Road	Adjoining area towards west side associated with	Coordination with project for wildlife crossings structures, adequate drainage management and pollution prevention (mainly dust) during construction, wildlife monitoring and plantation activities aligned with KDP road Project

Impacts and risks		Sensitive receptors	Location	Mitigation measures
		Nijagadh International Airport	Pathlaiya Junction Left side section from Nijagadh to Pathlaiya	Coordination with project for wildlife monitoring, adequate drainage management and pollution prevention (mainly dust and noise), and plantation activities aligned with KDP road Project
		Madan Highway	10 to 28 km upstream from KDP	Coordination with project for adequate landslide protection, control in river/stream water sedimentation
		Postal Highway	18 to 35 km downstream from KDP	Coordination with project for adequate drainage management
Disaster Risk from Flood Hazard (bank cutting, erosion etc.)		Road, water bodies, wild life, traveling passengers, adjoining land (forest, agricultural land and settlements)	Disaster prone areas as mentioned in Table 6.11	River training works suggested for reducing hazards from flood, plantation within ROW, proper maintenance of drainage and cross drainage structures
ESS2: Labour and Working Conditions – Construction phase				
Occupational Health and Safety	Local and outside employees, including labours of quarry sites and construction materials Local community	Construction Sites along KDP road		Avoid accidents (fatal or non-fatal) through: - Preparation and implementation of Occupational Health and Safety Plan (given in Annexure 7.2 to be detailed by contractor just after awarding contract). - Provide adequate safety measures to workers like reflective jackets (aprons), boots, gloves, helmet etc. - Include provision in contract requiring Occupational H&S Plan, Operational guideline, appropriate staffing, and reporting requirements. - Enhance capacity of labourers and staffs and stakeholders including local health institutions. Trained managers and responsible personnel - OHS monitoring, inspection and performance audit framework.
Working conditions and Worker accommodations	Labour camp sites Construction Sites	Labour camps (possible locations at Chainages 237+700, 241+430, 259+200, 290+500, 311+000 and 325+100) as mentioned in section 1.7		Avoid adverse working condition through: - Provision of adequate accommodation facilities to workers - Compliance with national and international labour regulations and WB guidance on Worker Accommodation as per ESS 2 - Contractor to provide commitment and implement on proper management of working time, social security, weekday off, worker's capacity building and participants, health assessment and health care facilities, work site OHS policy and work site OHS/safety committee and mechanism to deploy workers for longer period of time. - Labour Management Procedure (LMP) as provided separately. - Adequate accommodation facilities including health and sanitation facilities within camp sites as provided in Annexure 7.3 (to be detailed by contractor just after awarding contract)

Impacts and risks	Sensitive receptors	Location	Mitigation measures
Child and Forced Labour	Children under 14-years old Labourers Construction and labour camp sites Local community	Labour camps and construction camps as mentioned in section 1.7 and construction sites	- Established complaint mechanisms (GRM) - Avoid engaging child and forced labour in project through: - Provision in 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
Gender-based Violence	Labour force, mostly female workers	Labour camps and construction camps as mentioned in section 1.7 and construction sites	- Avoid Gender-based Violence through: - Provision of toilet facilities for women - Provision of lactogen room at work place - Ensure equal wages for women and men. - Transport and construction related skill training for women. - GBV zero tolerance signages around work sites - The Contractor to develop a Worker Code of Conduct to govern the behavior of workers on-site, in camps, and in local communities.
Spreading of Communicable Diseases	Labour force, local community	Labour camps and construction camps as mentioned in section 1.7 and construction sites and adjoining community	- Avoid spreading of communicable diseases through - The awareness campaign to be aimed at the risk of interaction between the resident population and the construction workforce, including the spreading of communicable diseases including sexually transmitted diseases such as HIV/AIDS. - Awareness training of SC, contractor, sub-contractor and service providers staff to sensitize them about Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH), and their responsibilities to prevent. Prepare and implement GBV /SEA/SH/CSEA Risk mitigation action plan.
ESS 3: Resource Efficiency and Pollution Prevention Management– Project Cycle			
Land use change	Flora and fauna and local communities near the road alignment Road users	Along KDP, mostly in forest and agricultural sections as shown in Figure 4.2 .	- Impact on land use change cannot be avoided but can be reduced through confining vegetation clearance only within formation width or only where necessary. - Further, compensatory plantation and maintenance of greenery along road embankment (roadside) and median will be done
Loss of productive topsoil	Agricultural land and forest land within ROW where road is to be widened	Along KDP, mostly in agricultural and forest sections as shown in Figure 4.2	- Impact on topsoil cannot be avoided but can be reduced by collecting and preserving the topsoil that is to be disturbed during site clearance for construction and later reuse it during turfing/bioengineering along road embankment and maintaining greenery along median. - Loss of topsoil can be reduced if vegetation clearance is not done during rainy season.
Landscape aesthetic	Flora and fauna and local communities near the road alignment Road users	Along KDP, disturbed sites	- During construction, landscape aesthetic can be controlled through proper stockpiling of construction materials and management of quarry and burrow pits, construction sites and camp sites - Just after construction is over, all the quarry and burrow pit sites, stockpiling yards, camp sites

Environmental and Social Impact Assessment (ESIA) of Mahendra Highway (Kamala-Dhalkebar-Pathlaiya Section)

Impacts and risks	Sensitive receptors	Location	Mitigation measures
Air pollution	Local Communities and workers	Construction sites, quarry and burrow pits, crusher, batching plant, hot mix plant	- etc. will be reinstated to suite the local landscape. - During operation, landscape aesthetic can be made visually appealing through maintenance of greenery along road side and median. - During construction, air pollution cannot be avoided but can be reduced through - Use of good condition vehicles and equipment for the project, timely servicing of these vehicles, machineries and equipment - Sprinkling of water along the dusty road during construction twice a day. - Transporting construction materials by covering - Avoiding operation of drill machines, excavators, loading and unloading of waste materials during wind. - Dust masks to labour workers,
Noise pollution	Local Communities (mainly school and hospital area) Workers Wildlife	Along KDP For wildlife, road sections mainly mentioned in section 4.2	- Impact due to noise pollution cannot be avoided but can be reduced through - Proper barricade of construction area - Scheduling construction works (mainly near schools and hospital areas) so that noise generating construction works will be done during off office time) - Provided operational schedule to local inhabitants. - Proper lubrication of construction machineries and equipment - Bridges proposed for wildlife crossing to be provisioned with proper noise barriers and vibration controller
Chemical hazards (by bitumen and other toxic and hazardous chemicals)	Flora and Fauna Local communities Workers	Construction camps as mentioned in section 1.7 and construction sites	Use of toxic and hazardous chemicals cannot be avoided but impacts can be avoided or reduced through proper implementation of Standard Operating Procedures for Pollution Spills and Management of Fuels and Hazardous Substances as mentioned in Annexure 7.4 to be detailed by contractor just after awarding contract)
Solid Waste	Local communities Forest and aquatic habitat Road users	Labour camps and construction camps as mentioned in section 1.7 and construction sites	Generation of Solid waste cannot be avoided but impacts can be avoided or reduced through proper solid waste management in place. Solid waste management plan to be adopted is mentioned in Annexure 7.5 (to be detailed by contractor just after awarding contract)
Soil Pollution and Erosion	Adjoining local communities, agricultural land, forest and aquatic habitat	Construction sites, construction camps and Storage yards as mentioned in section 1.7 and quarry and burrow pits as mentioned in section 1.6	Soil pollution and erosion due to project activities cannot be avoided but can be reduced and mitigated through proper soil and erosion control plan as mentioned in Annexure 7.8.
Muck/Spoil	Adjoining local	Construction sites,	So as to avoid impacts from muck/spoil, they will be collected and stored properly in nearby

Impacts and risks	Sensitive receptors	Location	Mitigation measures
Disposal	communities, agricultural land, forest and aquatic habitat	Storage yards, backfilling sites, quarry and burrow pits	agricultural land away from surface water sources with proper boundary (suitable locations near camp site at 237+700, 241+430, 259+200, 290+500, 311+000 and 325+100 s). This spoil/muck will be reused as soon as possible in backfilling purposes. For this, proper scheduling of excavation and backfilling will be made so there will be less muck/spoil to be stored.
Pollution of water resources	Surface and ground water, aquatic habitats	Stockpiling yards, labour camps, construction camps, construction sites, quarry and burrow pits	So as to avoid pollution on water resources, activities associated with pollution of water resources like handling and use of chemicals, solid waste management, waste water management, soil pollution and erosion control and muck/spoil disposal will be done as mentioned above. Further, awareness to local communities and construction workers will be made.
Impact on fish population	Adjoining rivers, commonly <i>Caprinidae</i> (such species as available silver carp)	Perennial Water-bodies as mentioned in Table 1.3 and Table 6.11	Beside controlling pollution of water resources as mentioned above, workers will be prohibited in fishing and washing cloths and vehicles in natural water bodies.
Impact of Quarrying and extraction of River bed materials	Adjoining rivers, aquatic habitat, agricultural land and settlements	Quarry and burrow pits and adjoining area as mentioned in Table 1.5	- Impacts from operation of quarry and burrow pits will be minimized through following - In case contractor is extracting boulders, gravels and sand from river bed, before extracting he will obtain permission from local government/competent authority. - Extraction of sand from seasonal rivers is unavoidable and hence in this case, extraction will be spread over the longest length possible so that no section of riverbed is excessively disturbed. - The equipment for crushing, screening, washing, handling and stockpiling of aggregates will be designed in such a way that the concreting schedule can be kept at any time. - Water spray system will be developed to check the flying of dust from quarrying and crushing activities. - For controlling noise, regular lubrication of moving parts will be done. - Sediments will be covered while transporting. - Sedimentation tanks along with provision of flocculent/coagulant addition will be developed for treating generated wastewater. Wastewater will be brought within recommended tolerance limits for effluents discharged into inland waters before discharging. - Proper storage space at the extraction sites will be established. Storing or piling the sediments nearby the road or paths or any agricultural lands will not be done. - If contractor is procuring sand and aggregates from third party, vendors should comply environmental statutory condition from local/provincial/federal government of Nepal.
Impact of Stockpiling of Construction Materials	Adjoining local communities, forest and aquatic habitat, agriculture fields	Stockpiling yards as mentioned in section 1.7	- Impacts from stockpiling of construction materials will be minimized through following: - Obtain written permission from landowners and local bodies for stockpiling on their land. - Barricade the locations Stockpile will not be located on water courses; will not be within 50m of schools, hospitals or public standpipes; Forest areas and will not affect locals and

Environmental and Social Impact Assessment (ESIA) of Mahendra Highway (Kamala-Dhalkebar-Pathlaiya Section)

Impacts and risks	Sensitive receptors	Location	Mitigation measures
Water logging/Drainage issue	Adjoining local communities, agriculture fields	Bardibas, Lalbandi and Nijgadh settlement areas	their properties; - Stockpiles will be covered with tarpaulins. For large stockpiles, it will be enclosed with side barriers and also covered when not in use. - Hard surface will be prepared for chemical hazard materials store to prevent the contamination/leakage in the soil and water. - Restore the site after use. Water logging problem is in Mithila, Lalbandi and Nijgadh area. The project has proposed sufficient drainage and cross-drainage structures to address the issue of water logging and drainage. All the causeways will be replaced by culverts and size of most of the existing culverts will also be increased. After upgradation of the road, the drainage issues in most of the places will be resolved. However, in Nijgadh area, though size of the side drain will be increased, and existing causeways will be converted to culverts of bigger size. Also DoR has to recommend further studies with line department e.g. department of drinking water and sewerage and urban development etc.
Impacts of Establishment and Operation of Crusher Plant, Hot mix plant and Batching Plant	Adjoining local communities, forest and aquatic habitat, agriculture fields	Suitable location at chainages 237+400, 262+000, 305+500 and 343+600 as mentioned in section 1.7	- Air, noise, soil and water pollution from operation of crusher plant, hot mix plant and batching plant will be minimized through following: - Obtain permission from local stakeholders, Municipality, DCC as appropriate. - Stone crushing equipment / cement batching plants will be fitted with dust control devices and operated as per Manufacturer's Specification. - Locate plant site away from population centers, drinking water sources, cultivated lands and water bodies. Water sprinkle will be done to crusher running materials during operation to minimize dust, make siltation pond to manage waste water, - The plant will be operated during day time only. - Restore the site after use.
Greenhouse Gas (GHG) Emission	Local communities and biodiversity Passengers and other road users	Along the KDP road	- The improved road surface will reduce the wear and tear on vehicles parts thus reducing the general costs for spare parts; increase the fuel efficiency and reduce vehicular emissions. - Further to reduce GHG emission, following measures will be adopted - Recommendations for fuel efficient machinery - Carbon offset by planting trees - Prevent activities that increase GHG emissions
Impact of Climate Change	Local communities Forest and aquatic habitat	Along the KDP road	- For reducing impact of climate change in project, climate resilient structures have been designed and will be constructed accordingly. - For addressing floods due to climate disasters cross drainage structures (including bridges) and road side drain have been designed considering 20% more discharge and precipitation on maximum discharge and precipitation over 100 year return period. - Further, river training works are proposed for most of the rivers.
ESS4: Community Health and Safety– Project Cycle			
Traffic management	Workers and local	Along the KDP road	For avoiding unmanaged traffic situation during construction, traffic management plan as

Impacts and risks	Sensitive receptors	Location	Mitigation measures
during construction	communities		mentioned in Annexure 7.6 • Further to Annexure 7.6, the contractor will develop and implement a comprehensive Traffic Management Plan with adequate measures such as proposing traffic diversion measures, alternate routes for local traffic, considering school hours, following speed limits, hiring licensed drivers, etc. • The plan will be implemented with the aim of preventing unsafe situations, especially near schools, housing areas, construction areas; Road signage will be fixed at construction locations to reduce safety hazards associated with project- related vehicular traffic. Make aware to all vehicle drivers of construction vehicles obtain speed limits on the construction sites. Project will install adequate signage, barriers, and flag persons for traffic control. • So as to avoid accidents and mishaps, proper road safety has been considered in design and road will be constructed accordingly. For this, establishment of traffic signals, speed control mechanisms such as zebra cross, speed breakers, speed limits etc. at crowded places have been proposed. • Beyond designing and constructing road safety measures, following will be addressed: • 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. • Road safety awareness trainings to general public. • Capacity enhancement for traffic police and locals.
Community Exposure to Health Issues and Labour Influx	Local communities, labour force and road users	Along the KDP road, (mainly in critical sections as mentioned in Annexure 7.1). Labour camps, construction camps, construction sites and adjoining settlements	• For avoiding adverse health issues within camps and adjoining communities, following will be adopted: • Construction camps will be built in the designated areas, located away from the local settlements. • Community awareness programs on construction-related hazards, including awareness programs in schools, construction activities such as excavation, bridge foundation particularly and the areas, may pose safety risks to the nearby people. • The awareness campaign with local people and the construction workforce, including the spreading of sexually transmitted diseases such as HIV/AIDS (template on HIV/AIDS has been provided in Annexure-7.9). • Promote health seeking behaviours. • Strengthening and collaboration with the local health facility and onsite primary health care facility or surveillances • 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. • For avoiding cases of trafficking, following measures will be adopted
Human Trafficking	Local communities and	Local communities,	

Impacts and risks	Sensitive receptors	Location	Mitigation measures
	labour force, especially women	labour camps, construction camps, construction sites	- Community awareness and sensitization with emphasis to women and young girls. - Training and awareness regarding trafficking - Coordination with organizations working on anti-trafficking within project area - Vigilance from law enforcement authority and compliance with the labour laws. - Display of hoarding boards about anti trafficking
Disaster and Natural Calamities	Local communities Construction workers	Construction sites, construction camps, labour camps and adjoining communities	- To reduce impacts during disasters, following measures will be adopted - Emergency Preparedness Plan will be prepared for disaster and natural calamities. - Earthquake hazard: All camp sites will be earthquake resistant - Fire hazard: All the camp sites (mainly kitchen area) and stockpiling yards where flammable goods are kept will be equipped with fire extinguishers. Workers will be trained in using fire extinguishers. Date of fire extinguishers will be checked regularly and refilled/replaced immediately if near to date expire. - Flood hazards: Proposed camp site locations are away from flood zones. However, special care is to be taken while working in rivers and nearby area mainly during rainy season. approach road construction. Working in river channels will be halted during rainy season. - Thunder and electric hazards: Proper wiring and earthing within camps - Beside these, project will provide ambulance, medical and rescue facilities at the site for emergency response and will be prepared for extreme hot or cold climatic condition by allocating adequate cooling facilities for extreme hot and heating facilities for extreme cold climatic conditions
Gender Based Violence (GBV/CSEAH)	Female workers, Women (especially young women) of the local community	Construction sites, construction camps, and labour camps	- For avoiding GBV, following measures will be adopted - Community sensitization program on GBV/CSEAH prevention - Awareness and Orientation to labour force on GBV/CSEAH prevention - Code and conduct to guide the workers on how to relate with the community. - Mapping of GBV service providers for prevention and response. - Develop and implement a GBV Action Plan (template has been provided in the Annex 7.10)
ESS 5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement– Project Cycle			
Temporary land requirement	Adjoining land, land owners whose land is taken under lease, crops, trees,	Camp sites, stockpiling yards, workshops, crushers, batching plants etc. are established	- Avoid agricultural land as possible, if cannot avoidance then the land will be used on leased basis, - Damaged/loosed crops, will be compensated as part of construction induced impact, the procedures for construction induced impact is clearly mentioned in RAP - Legal permission and approval process will be carried out and MoU with land owners and concerned parties - Site-Specific Rehabilitation and Reinstatement Plan will be developed by the contractor just after joint survey and MoU with concerned party if require (Annexure 7.7) Rehabilitation and Reinstatement plan will be implemented.

Impacts and risks	Sensitive receptors	Location	Mitigation measures
Economic Displacement	Local communities (64 households with 66 structures and 204 extended housing structures) as mentioned in Table 4.41	Affected households along the road alignment within RoW (mentioned in RAP)	This impact cannot be avoided but compensated. The affected households will receive cash compensation at replacement value against loss of structures and will provide additional cost of assistance for relocation and livelihood restoration.
Community and Public structures (216) as mentioned in Table 4.41	Local communities adjoining to road alignment	Affected locations (mentioned in RAP)	This impact cannot be avoided but compensated. The affected structures will be rehabilitated as per community suggestion.
Impact on Public Utilities (Electric Poles - 2221 and Water Supply Pipelines - 33 km) as mentioned in Table 4.41	Local Communities, NEA and DWSS	Along KDP Road Alignment	Coordination with NEA for shifting of electric poles and DWSS for water supply pipelines and allocating budgeted accordingly
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources– Project Cycle			
Loss of forest area	Adjoining forest area, Flora & Fauna	Forest sections along KDP road alignment (as shown in Table 4.13)	For avoiding forest land acquisition, the project activities are confined within ROW. The design has comprised curve improvement in forest sections (chainage 281+500 to 284+000 and 314+500 to 316+500) to avoid forest land acquisition
Loss of vegetation	Vegetation along road alignment	Throughout KDP road alignment	Loss of vegetation in this project cannot be avoided. For minimizing the impact, vegetation only within formation width will be cleared. Further, compensation of cut down trees by planting new trees in the ratio 1:10 and caring for 5 years will be done. This is in aligned with Forest Rule 2079.
Wildlife movement	Wildlife	Chainages 329+666 Amu – 1, 333+842 Lamaha, 339+381 Dhansar, 347+272 Bakeya 353+612 Terhakilo, 357+337 Pasaha, 361+003 Balganga & 363+687 Dudhaura for large sized animals (elephants) and chainages 271+514, 274+925, 275+630, 277+266,	- For reducing the impact in wildlife movement across KDP road alignment, 8 bridges will be modified as underpasses for elephants and 9 bridges and one culvert (causeway to be upgraded to culvert) will be modified as underpass for medium size animals to meet the statutory requirement and same has been addressed in design. All these underpasses will be assisted with guiding fences and annual maintenance of river/stream bed level and banks for facilitating animal movement. Further, underpasses proposed for elephant crossings will be equipped with noise barriers and vibration reducers. (The under structure of the bridge will modified to improve access of the wildlife for i) Drinking water (access by wild animals to the river course for drinking water), ii) Mobility of the wildlife, flat passage (more than 15 m wide) on both sides of the river, above the normal flood level, underneath the bridge and iii) Baseline vegetation under and around the underpass will be maintained, rather improved with added native fodder species, preferred bamboo and grasses, horticultural species, etc. will be grown not obstructing the visibility in and around the underpass. As far as possible, the basement of the underpass

Impacts and risks	Sensitive receptors	Location	Mitigation measures
		278+913, 282+758, 285+721, 292+703, 317+698, 322+553 for medium sized animals (tigers, undulates and others)	will be maintained naturally with the main focus on mammals using the underpass being tigers, elephants and other ungulates largely.) • Culverts within forest sections will be constructed with shelves, elevated concrete walkways, and docks for facilitating movement of insects, reptiles and amphibians even during rainy season. • Beside these other measures like speed breakers/rumble strips, roadside reflectors and mirrors, signage, variable message sign, installation of arboreal mammal canopy bridges, sound and light barriers etc. will be adopted as per BMP. • Pollution prevention measures for minimizing impact to aquatic habit as mentioned above
Aquatic Fauna	Fishes	Perennial Waterbodies as mentioned in Table 1.3 and Table 4.9	
Threatened wildlife, hunting and poaching	Wildlife	Camp sites and adjoining communities	Threats to wildlife can be avoided by: • Instructions and orientation to workers. • Enforcement and control of Anti-poaching regulations. • Awareness campaigns
Impact due to use of forest resources	Forest resources	Adjoining forest areas	• Use of forest resources (mainly firewood) can be avoided by providing alternative source of energy in labour camps. Workers will be prohibited inside forest area and will be confined only within ROW of KDP road that too during construction time only. • Smoking will be prohibited while working in areas adjoining to forest patches
Spread of invasive alien species	Forest vegetation	Adjoining forest areas	The Ecological Expert/Environmental expert of supervision consultant during construction stage ensure that there should not be any alien species introduced by any worker, labour or any staff. If any alien species identified by Ecological Expert/Environmental expert, he will immediately inform the nearest forest department.
ESS 7: Indigenous Peoples– Project Cycle			
Impact on Indigenous people	Among 64 households, 14 are found to be IPs	Affected IPs along the road alignment (mentioned in RAP)	• Beside normal compensation to affected structures along with additional cost of assistance for relocation and livelihood restoration, no any extra measures are required. • IPDP has address the additional support required for IP settlements within DIA
ESS 8: Cultural Heritage– Project Cycle			
Impact on Cultural Heritage	Impact on 35 temples Local communities worshipping in these temples	Affected temples along the road alignment (mentioned in RAP)	• This impact cannot be avoided but compensated. The affected temples will be rehabilitated as per community suggestion. • It is noticed that none of these temples to be affected are archeologically significant. • Further, during the construction stage, encountering any finding of physical cultural resources at sites, the Contractor will be provided with a Chance Find Protocol by the project/SC before start of works. During the works, if the contractor encounters any findings of archaeological value, the Contractor will follow the Chance Find Protocol instructions

Project intervention plans to map biodiversity data and apply the mitigation hierarchy.

Step 1 – Avoidance

Avoiding realignment section (proposed to meet design speed of 100 km per hr) to avoid forest land acquisition.

Step 2 – Minimization actions

Speed Breakers/ Rumble Strips: Primary set of mitigation which keeps the vehicular speed in control and allows the driver to notice the crossing mammals or foraging birds and basking reptiles on the road. The locations of speed breakers/ rumble strips have been proposed near the prominent wild animal crossings identified based on the survey findings and consultations held with forest officials and the list is given as Annexure VIII.

Speed Limit: Speed limit of 40 km per hour is proposed near the 14 km stretch of Parsa National Park as mandate by Chief Conservation Officer, Parsa National Park. Speed limit is proposed between the Chainage km 350+00 to km 366+420.

Installation of Arboreal Mammal Canopy Bridges: Six canopy bridges are proposed in which four canopy bridges are proposed near the Parsa National Park and other two are proposed near the associated reserve forest which are more than 30 km from the Parsa National Park. Installation of 6 Arboreal Mammal Canopy Bridges are also suggested at the same location near CH:364+200, CH:357+500, CH:349+200, CH:340+900, CH:336+400, CH:330+700.

Underpass for Elephant, Tiger and Undulates: Eight (08) bridges namely 329+666 Amu – 1, 333+842 Lamaha, 339+381 Dhansar, 347+272 Bakeya, 353+612 Terhakilo, 357+337 Pasaha, 361+003 Balganga and 363+687 Dudhaura were proposed for elephant. Ten (10) bridges/culverts at CH 271+514 (Gadhanta), 274+925 (Belgachhi /Dhungre Khola), 275+630 (Tuteshwor-1), 277+266 (Maraha), 278+913 (Dholan), 282+758 (Bankhe), 285+721 (Amuwa), 292+703 (Kalinjor – 2), 317+698 (Paurahi), 322+553 (existing causeway) were proposed for medium size animal crossings like tiger and undulates.

Elephant and Medium animal guiding fences: An electric fence is a psychological barrier, not a physical barrier. Solar electric fencing as guiding fences for elephant crossings are considered at 8 bridges namely 329+666 Amu – 1, 333+842 Lamaha, 339+381 Dhansar, 347+272 Bakeya, 353+612 Terhakilo, 357+337 Pasaha, 361+003 Balganga & 363+687 Dudhaura and guiding fences at 12 locations for medium size animal crossings near the bridges 271+145, 278+358, 294+014, 296+287, 302+777, 305+770, 314+985, 327+240, 330+972, 357+428, 364+437 and 364+693 are considered.

Human Wildlife Conflict Mitigation: The implementation of the Solar Electric Fencing near 3 village Pathlaiya (CH:365+700 to CH:366+800), Piluwa (CH:357+300 to CH:358+400.), Dudhaura bridge settlement CH:363+700 LHS around the settlement is recommended. The electric fences are only effective at preventing crop raiding Banikoi et al. (2017).

Sound & Light Barriers: Total Length of Noise Barrier is total of bridge Length on RHS & LHS and 10 m on either side of the bridge. Noise barriers are recommended at Eight (08) bridges namely 329+666 Amu – 1, 333+842 Lamaha, 339+381 Dhansar, 347+272 Bakeya 353+612 Terhakilo, 357+337 Pasaha, 361+003 Balganga & 363+687 Dudhaura.

Step 3- Restoration actions

Compensatory Afforestation: The compensatory afforestation will require a total area of 290 ha. Net gain of 290 ha is obtained through afforestation program. Afforestation sites will be in the denuded or degraded forest areas near the project area, river side.

The suitable land required for compensatory afforestation has been identified near the degraded Community Forest areas abutting the project road. Beside these sites, eroded and flooded riverbanks

along the road alignment can also be used for compensatory plantation supported with adequate river protection works. List of potential sites for compensatory afforestation are given in **Table 6.12**.

Net Gain: Overall, an offsets strategy in the project road is aimed to achieve a balance between the infrastructure development and the protection of the environment and communities affected by the project. It involves a combination of proactive planning by proposing underpasses, guideline fences, speed restrictions and development implementation of appropriate measures to minimize, offset negative impacts and Net gain of 290 ha additional forest area development through afforestation program.

7.6 Chance Find Procedure

The purpose of the chance find procedure is to outline the necessary actions if previously unknown heritage resources, especially archaeological ones, are encountered during project construction or operation. This procedure applies to all activities conducted by personnel, including contractors that have the potential to uncover a heritage item and site. The roles, responsibilities, and response times required from both project staff and any relevant heritage authority is outlined below.

Steps of chance find procedure in DoR Projects

- i. Stop all works in the vicinity of the find, until a solution is found for the preservation of these artefacts, or advice from the relevant authorities is obtained;
- ii. Immediately notify the technical supervisor who will then notify the Construction Manager and the Environment Officer (EO)/Environmental Manager (EM) of the project;
- iii. The Project Manager will notify to the Department of Archeology immediately;
- iv. Record details in Incident Report and take photos of the find;
- v. Delineate the discovered site or area; secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities take over;
- vi. Preliminary evaluation of the findings by archaeologists deputed from the Department of Archeology. The archaeologist must make a rapid assessment of the site or find to determine its importance. Based on this assessment the appropriate strategy can be implemented. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage such as aesthetic, historic, scientific or research, social and economic values of the find;
- vii. The archaeologist provides the Heritage team with photos, other information as relevant for identification and assessment of the significance of heritage items.
- viii. The Archeologist of the Department of Archeology must investigate the fact within 2 weeks from the date of notification and provide response in writing.
- ix. Department of Archeology shall assess the significance of the site and instruct the project manager for immediate action to be taken based on its significance;
- x. Sites of minor significance such as isolated or unclear features, and isolated finds, should be recorded immediately by the archaeologist, thus causing a minimum disruption to the work schedule of the Contractor.
- xi. In case of major significance of the site, Department of Archeology shall inform the project office immediately in writing to stop the construction work until appropriate protection measure of site is ensured;
- xii. Decisions on how to handle the finding shall be taken by the responsible authorities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage; and
- xiii. Construction works could resume only after permission is granted from the responsible authorities.

7.7 Environment and Social Management Plan

Environment and Social Management Plan developed for the project is given **Table 7.5** in below.

Table 7.5: ESMP of KDP Road

E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
ESS 1: Assessment and Management of Environmental and Social Risks and Impact								
Impact to Vulnerable Households	Impact of 40 vulnerable households and 80 Roadside vendors	Provide rehabilitation assistance (extra allowance as vulnerable allowance)	NRs. 800,000 (as per RAP)	DoR-DCID project office, Construction and Supervision Consultant, contractor	DoR, DCID	Progress reports, training completion report and Consultation with vulnerable households	Capacity built/livelihood restored of Vulnerable HHs	Once after two years
Cumulative Impacts	Combined Impacts from Railway Project, Fast track and Transmission Line Projects	Coordination with other nearby projects (railway, fast track and transmission line projects), information dissemination with each other, suggest other projects to design wildlife friendly animal crossings infrastructures aligned with KDP road Project, not to establish quarry and burrow pit together or nearby, suggest other projects for wildlife monitoring and plantation activities aligned with KDP road Project.	-	DoR-DCID project office	DoR, DCID,	Correspondence letters, observation	Proposed mitigation of other projects in aligned with KDP road project	Monthly
Disaster Risk from Flood Hazard (bank cutting, erosion etc.)	General risk/issue of flood hazard including river bank cutting and erosion as project work lies in Terai region	River training works suggested for reducing hazards from flood, plantation within ROW, proper maintenance of drainage and cross drainage structures	Included in BOQ	DoR-DCID project office, Construction and Supervision Consultant, contractor	DoR, DCID, Construction and Supervision Consultant, GESU	Site visit and observation, Consultation with local people	Reduced disasters	Yearly after completion
ESS 2: Labour and Working Conditions								
Occupational Health and	Construction safety of labourer with	Avoid accidents (fatal or non-fatal) through:	Included in	Construction	DoR, DCID, Construction	Site visit and	Group insurance	Weekly

E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
Safety	man/days	- Preparation and implementation of Occupational Health and Safety Plan. - Provide adequate safety measures to workers like reflective jackets (aprons), boots, gloves, helmet etc. - Include provision in contract requiring Occupational H&S Plan, Operational guideline, appropriate staffing, and reporting requirements. - Enhance capacity of labourers and staffs and stakeholders including local health institutions. Trained managers and responsible personnel OHS monitoring, inspection and performance audit framework.	BOQ	contractor	and Supervision Consultant, GESU	observation	of worker, all time available of PPEs to workers and engineers.	
Working Conditions and Worker Accommodations	Health, Hygiene and safety of labourer. Campsites (possible locations at Chainages 237+700, 241+430, 259+200, 290+500, 311+000 and 325+100)	Avoid adverse working condition through: - Provision of adequate accommodation facilities to workers - Compliance with national and international labour regulations and WB guidance on Worker Accommodation as per ESS 2 - Labour Management Procedure (LMP) as provided separately. - Adequate accommodation facilities including health and sanitation facilities within camp sites	Included in BOQ	Construction contractor	DoR, DCID, Construction and Supervision Consultant, GESU	Site visit and observation	Group insurance of worker, Good Hygiene and safety to workers and engineers	Weekly

E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
Child and Forced Labour	Child and Forced Labour for Children under 14-years old Labourers	Established mechanisms (dedicated labour GRM) Avoid engaging child and forced labour in project through: - Provision in 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	Included in BOQ	DoR-DCID project office, Construction and Supervision Consultant, contractor	DoR-DCID, GESU	Field visits, interview and verification	Status of working population's age	During construction
Gender-based Violence	GBV threat to Labour force, mostly female workers	Avoid Gender-based Violence through: - Targeted employment of women, poor and the excluded Gender specific facilities for labour workers. - Ensure equal wages for women and men The Contractor to develop a Worker Code of Conduct to govern the behaviour of workers on-site, in camps, and in local communities.	Included in BOQ	DoR-DCID project office, Construction and Supervision Consultant, contractor	DoR-DCID, GESU	Field visits, interview and verification	Living status of women workers community due to implementation of project	During construction
Spreading of Communicable Diseases	Health, Hygiene and safety of labourer	Avoid spreading of communicable diseases through The awareness campaign to be aimed at the risk of interaction between the resident population and the construction workforce,	500,000	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

E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
		including the spreading of communicable diseases including sexually transmitted diseases such as HIV/AIDS. Awareness training of SC, contractor, sub-contractor and service providers staff to sensitize them about Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH), and their responsibilities to prevent. Prepare and implement GBV /SEA/SH/CSEA Risk mitigation action plan.						
ESS 3: Resource Efficiency and Pollution Prevention Management								
Land use change	Change in different kind of Land Use like Plantation, Agriculture, water body etc. along the alignment	- Impact on land use change cannot be avoided but can be reduced through confining vegetation clearance only within formation width or only where necessary. - Maintaining greenery within median and road side where possible Further, compensatory plantation and maintenance of greenery along road embankment (road side) and median will be done	Cost of Maintaining greenery within median and road side where possible is part of project cost. Plantation cost Included in Biological section (ESS 6)	Construction contractor	DoR- DCID Construction and Supervision Consultant, GESU	Site visit and observation	Excavation Methodology in place	Monthly
Loss of productive topsoil	-Impact on agro-production, loss of vegetation and forest	Impact on topsoil cannot be avoided but can be reduced by collecting and preserving the topsoil that is to be disturbed during site clearance for construction and later reuse it during turfing/bioengineering	NRs. 1,000,000 for stockpiling and re-using of top soil	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

E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
		along road embankment and maintaining greenery along median. Loss of top soil can be reduced if vegetation clearance is not done during rainy season.						
Landscape aesthetic	General aesthetics due to vegetation clearing and stockpiling of materials	- During construction, landscape aesthetic can be controlled through proper stockpiling of construction materials and management of quarry and burrow pits, construction sites and camp sites - Just after construction is over, all the quarry and burrow pit sites, stockpiling yards, camp sites etc. will be reinstated to suite the local landscape. During operation, landscape aesthetic can be made visually appealing through maintenance of greenery along road side and median.	The cost is part of Project cost.	Construction contractor	DoR- DCID Construction and Supervision Consultant, GESU	Site visit and observation	felling of marked trees only; Excavation Methodology in place	Monthly
Air pollution	Air pollution at Construction sites, quarry and burrow pits, crusher, batching plant, hot mix plant etc.	During construction, air pollution cannot be avoided but can be reduced through - Use of good condition vehicles and equipment for the project, timely servicing of these vehicles, machineries and equipment - Sprinkling of water along the dusty road during construction twice a day. - Transporting construction	The air pollution cost is part of Project cost.	Construction contractor	DoR, DCID, Construction and Supervision Consultant, GESU	Site visit and observation	As per prevailing Air quality parameters.	Quarterly during Road width excavation.

E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
		materials by covering Avoiding operation of drill machines, excavators, loading and unloading of waste materials during wind. Dust masks to labour workers,						
Noise Pollution		Impact due to noise pollution cannot be avoided but can be reduced through - Proper barricade of construction area - Scheduling construction works (mainly near schools and hospital areas) so that noise generating construction works will be done during off office time) - Provided operational schedule to local inhabitants. - Proper lubrication of construction machineries and equipment Bridges proposed for wildlife crossing to be provisioned with proper noise barriers and vibration controller	The Noise pollution cost is part of Project cost.	Construction contractor	DoR, DCID, Construction and Supervision Consultant, GESU	Site visit and observation	As per prevailing Noise Level guidelines	Quarterly during Road width excavation.
Chemical hazards (by bitumen and other toxic and hazardous chemicals)	Potential Chemical hazard to Local communities, Forest, and aquatic habitats, Road users	Use of toxic and hazardous chemicals cannot be avoided but impacts can be avoided or reduced through proper implementation of Standard Operating Procedures for Pollution Spills and Management of Fuels and Hazardous Substances as mentioned in Annexure 7.4 to be detailed by contractor just after awarding	The cost is part of Project cost.	Construction contractor	DoR, DCID, Construction and Supervision Consultant, GESU	Site visit and observation, water quality of Trishuli River and tributaries lab test	Storage, and handling practice. Accident records; spillage of chemicals and surface and ground water contamination	Monthly

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E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
Solidwaste	Waste, health and hygiene to locals and road users.	contract) Generation of Solid waste cannot be avoided but impacts can be avoided or reduced through proper solid waste management in place. Solid waste management plan to be adopted is mentioned in Annexure 7.5 (to be detailed by contractor just after awarding contract)	The cost is part of Project cost.	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
Soil Pollution & Erosion	Soil Pollution and erosion due to poor drainage, vegetation clearing and spillage	Soil pollution and erosion due to project activities cannot be avoided but can be reduced and mitigated through proper soil and erosion control plan as mentioned in Annexure 7.8	The cost is part of Project cost.	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
Muck/Spoil Disposal	Dust pollution, contamination of Natural drainages	So as to avoid impacts from muck/spoil, they will be collected and stored properly in nearby agricultural land away from surface water sources with proper boundary (suitable locations at 237+700, 241+430, 259+200, 290+500, 311+000 and 325+100 nearby camp sites within stockpiling yards). This spoil/muck will be reused as soon as possible in backfilling purposes. For this, proper scheduling of excavation and backfilling will be made so there will be less muck/spoil to be stored.	NRs. 1,000,000 for stockpiling of spoil/muck and re-using it in backfilling	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
Pollution of water resources	Disposal chemical, sedimentary and solid wastes, etc. into water bodies.	So as to avoid pollution on water resources, activities associated with pollution of water resources like handling and use of	The cost is part of Project cost.	Construction contractor	DoR-DCID, Construction and Supervision Consultant,	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

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E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
		chemicals, solid waste management, wastewater management, soil pollution and erosion control and muck/spoil disposal will be done as mentioned above. Further, awareness to local communities and construction workers will be made.			GESU			months.
Impact on fish population	Loss of species; impoverishment of aquatic habitats	Besides controlling pollution of water resources as mentioned above, workers will be prohibited in fishing and washing cloths and vehicles in natural water bodies.	The cost is part of Project cost.	Construction contractor	DoR, DCID, Construction and Supervision Consultant	Observation and interaction with locals	Grievances received from locals.	Before and after construction
Quarry and extraction of Riverbed materials	Increase of sedimentation level etc.	Impacts from operation of quarry and burrow pits will be minimized through following- - The equipment for crushing, screening, washing, handling and stockpiling of aggregates will be designed in such a way that the concreting schedule can be kept at any time. - Water spray system will be developed to check the flying of dust from quarrying and crushing activities. - For controlling noise, regular lubrication of moving parts will be done. - Sediments will be covered while transporting. - Sedimentation tanks along with provision of flocculent/coagulant addition will be developed for	The cost is part of Project cost.	Construction contractor	DoR-DCID, Construction and Supervision Consultant, GESU	Site visit, observation and interview with locals	pits and quarry site operational plan in place; approval from engineers.	Weekly

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E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
		treating generated wastewater. Wastewater will be brought within recommended tolerance limits for effluents discharged into inland waters before discharging. Proper storage space at the extraction sites will be established. Storing or piling the sediments nearby the road or paths or any agricultural lands will not be done.						
Stockpiling and of Constructio n Materials	Dust emission, washout affect to the natural drainages & cultivated areas, and discomfort to locals. Stockpiling yards, suitable locations at Chainages 237+700, 241+430, 259+200, 290+500, 311+000 and 325+100) along with camp sites	Impacts from stockpiling of construction materials will be minimized through following: - Obtain written permission from landowners and local bodies for stockpiling on their land. Barricade the locations Stockpile will not be located on water courses; will not be within 50m of schools, hospitals or public standpipes; Forest areas and will not affect locals and their properties; - Stockpiles will be covered with tarpaulins. For large stockpiles, it will be enclosed with side barriers and also covered when not in use. - Hard surface will be prepared for chemical hazard materials store to prevent the contamination/leakage in the soil and water. Restore the site after use.	The cost is part of Project cost.	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
Water	Water logging and	For avoiding water logging near	The cost is part	Construction	DoR-DCID,	Site visit and	Roadside drainage	Monthly

E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
logging	Blocked drainage due to insufficient drainage capacity and improper waste disposal	the road alignment, proper cross drainage and road drainage structures have been designed and will be constructed accordingly.	of Project cost.	contractor during DLP, DOR-DCID, DOR project office and DOR-GESU	Construction and Supervision Consultant, GESU	observation	discharge locations, water-pounding area during rain.	
Establishment and Operation of Crusher Plant, Hot mix plant and Batching Plant	Air and Noise pollution at Crusher plant, batching plant sites, urban and settlement areas	Impacts from operation of crusher plant, hot mix plant and batching plant will be minimized through following: - Obtain permission from local stakeholders, Municipality, DCC as appropriate. - Stone crushing equipment / cement batching plants will be fitted with dust control devices and operated as per Manufacturer's Specification. - Locate plant site away from population centers, drinking water sources, cultivated lands and water bodies. - Water sprinkle will be done to crusher running materials during operation to minimize dust, make siltation pond to manage waste water, - The plant will be operated during day time only. Restore the site after use.	The cost is part of Project cost.	Construction contractor	DoR, DCID, Construction and Supervision Consultant, GESU	Site visit and observation	As per prevailing Air quality parameters.	Quarterly during Road width excavation.
Greenhouse Gas (GHG) Emission	Quantification of GHG emission from existing and post construction scenario affecting Local communities and biodiversity	The improved road surface will reduce the wear and tear on vehicles parts thus reducing the general costs for spare parts; increase the fuel efficiency and reduce vehicular emissions.	Plantation cost included in biological section (ESS 6) Others The cost is part of Project	Construction contractor	DoR, DCID, Construction and Supervision Consultant, GESU	Site visit and observation	As per prevailing Air quality parameters.	Quarterly during Road width excavation.

E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
		- Further to reduce GHG emission, following measures will be adopted - Recommendations for fuel efficient machinery - Carbon offset by planting trees - Prevent activities that increase GHG emissions	cost.					
Impact of Climate Change	Natural disasters with impacts of climate change affecting Local communities Forest and aquatic habitat	- For reducing impact of climate change in project, climate resilient structures have been designed and will be constructed accordingly. - For addressing floods due to climate disasters cross drainage structures (including bridges) and roadside drain have been designed considering 20% more discharge and precipitation on maximum discharge and precipitation over 100 year return period. Further, river training works are proposed for rivers where there is problem of bank cutting and flood as mentioned in Table 6.11.	The cost is part of Project cost.	Construction contractor	DoR, DCID, Construction and Supervision Consultant, GESU	Site visit and observation	Record of past Natural disasters	Quarterly during Road width excavation.
ESS 4: Community Health and Safety								
Traffic management during construction	Accidents, Traffic jam, noise, air and dust pollution etc.	- For avoiding unmanaged traffic situation during construction, traffic management plan as mentioned in Annexure 7.6 - Further to Annexure 7.6, the contractor will develop and implement a comprehensive Traffic Management Plan with	The cost is part of Project cost.	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

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E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
		adequate measures such as proposing traffic diversion measures, alternate routes for local traffic, considering school hours, following speed limits, hiring licensed drivers, etc. The plan will be implemented with the aim of preventing unsafe situations, especially near schools, housing areas, construction areas; Road signage will be fixed at construction locations to reduce safety hazards associated with project- related vehicular traffic. Make aware to all vehicle drivers of construction vehicles obtain speed limits on the construction sites. Project will install adequate signage, barriers, and flag persons for traffic control.						
Traffic and Road Safety	Operation of construction vehicles, excavation etc.	- So as to avoid accidents and mishaps, proper road safety has been considered in design and road will be constructed accordingly. For this, establishment of traffic signals, speed control mechanisms such as zebra cross, speed breakers, speed limits etc. at crowded places have been proposed. - Beyond designing and constructing road safety measures, following will be addressed: - GPS tracking and CC cameras	Traffic safety structures included in BOQ NRs. 500000 for awareness in road safety and capacity enhancement	Construction contractor	DoR- DCID, Construction and Supervision Consultant, GESU	Site visit and observation	Accident records, safety application and facilities maintained.	Weekly

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E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
		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. - Road safety awareness trainings to general public. Capacity enhancement for traffic police and locals.						
Community Exposure to Health Issues and Labour Influx	Impacts of Labour Influx including health issue and conflicts	- For avoiding adverse health issues within camps and adjoining communities, following will be adopted: - Construction camps will be built in the designated areas, located away from the local settlements. - Community awareness programs on construction-related hazards, including awareness programs in schools, construction activities such as excavation, bridge foundation particularly and the areas, may pose safety risks to the nearby people. - The awareness campaign with local people and the construction workforce, including the spreading of sexually transmitted diseases such as HIV/AIDS. - Promote health seeking behaviors. - Strengthening and collaboration with the local health facility and	NRs. 500000 for awareness	DoR-DCID project office and construction contractor	DoR-DCID, GESU	Number of awareness programs and events	Regular health checkup records of workers and engineers. Records at Health Institutions. Inflow of population within and close to highway.	Once in every Six month.

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E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
		onsite primary health care facility or surveillances 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.						
Human Trafficking	Trafficking threat to mostly female workers of local and outside	- For avoiding cases of trafficking, following measures will be adopted - Community awareness and sensitization with emphasis to women and young girls. - Training and awareness regarding trafficking - Coordination with organizations working on anti-trafficking within project area - Vigilance from law enforcement authority and compliance with the labour laws. Display of hoarding boards about anti trafficking.	NRs. 500000 for awareness. All kind Hoarding and signages will be covered in civil cost and part of BOQ.	DoR-DCID project office, Construction and Supervision Consultant, contractor	DoR-DCID, GESU	Field visits, interview and verification	Living status of women workers community due to implementation of project	During construction
Emergency Preparedness and Response	Impacts related to natural and other accidental emergency	- To reduce impacts during disasters, following measures will be adopted - Earthquake hazard: All camp sites will be earthquake resistant - Fire hazard: All the camp sites (mainly kitchen area) and stockpiling yards where flammable goods are kept will be equipped with fire extinguishers.	Included in BOQ	Construction contractor	DoR- DCID, Construction and Supervision Consultant, GESU	Site visit and observation	Accident records, safety application and facilities maintained.	Weekly

Environmental and Social Impact Assessment (ESIA) of Mahendra Highway (Kamala-Dhalkebar-Pathlaiya Section)

E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
		Workers will be trained in using fire extinguishers. Date of fire extinguishers will be checked regularly and refilled/replaced immediately if near to date expire. Flood hazards: Proposed camp site locations are away from flood zones. However, special care is to be taken while working in rivers and nearby area mainly during bridge and approach road construction. Working in river channels will be halted during rainy season. Beside these, project will provide ambulance, medical and rescue facilities at the site for emergency response.						
Gender Based Violence (GBV)/SEA /SH risks	GBV and SEA/SH risks from labour force, lack of survivor centric services, lack of coordination and insufficient experts	For avoiding GBV, following measures will be adopted - 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 local GBV service providers for prevention and response. - Develop and implement a	NRs. 500000 for community sensitization and orientation workshops to labour	DoR-DCID project office, Construction and Supervision Consultant, contractor	DoR-DCID, GESU	Field visits, interview and verification	Living status of women workers community due to implementation of project	During construction

E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
		SEA/SH Prevention and Response Action Plan. Hiring of GBV Service Providers						
ESS 5: Land Acquisition Restrictions on Land Use and Involuntary Resettlement								
Land Acquisition	LA impacts to Adjoining agricultural land, land owners whose land is taken under lease	- There is no permanent land acquisition require in the project road beside temporary land acquisition for labour camp, stockpiling yards, operation of crusher, batching plant and hot mix plant etc. - For temporary land use, agricultural land will be leased. To minimize the impact on these land, Rehabilitation and Reinstatement Management Plan as mentioned in Annexure 7.7 (to be detailed by contractor just after awarding contract) will be implemented	The cost is part of Project cost.	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, Infrastructures inventory.	Before construction and implementation of project
Impacts on structures and Economic Displacement	Cash Compensation for affected structures and restoration of livelihood Impacts of relocation of affected people	These impacts cannot be avoided but compensated. The affected structures will be compensated. Further, livelihood support trainings will be provided to project affected vulnerable households, affected business households and non-residential business disrupted people	NRS 32,964,628 for RAP	Construction contractor, DoR-DCID project office	DoR-DCID, GESU	Progress report, Field visits and assessment	Livelihood of affected people and living standard preparation of RAP, Relocation status and condition	During construction
Community Structures	Impacts on affected community structures	This impact cannot be avoided but mitigated. The affected structures will be rehabilitated as per community suggestion.	NRs. 100,056,054.40 for dismantling and rehabilitation	Construction contractor, DoR-DCID project office	DoR-DCID, GESU	progress report Field visits and assessment	Procedures regarding compensation have been properly set out and followed; preparation of	During construction

E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
Utilities	Impacts on electric poles and water supply pipelines	Coordination with NEA for shifting of electric poles and DWSS for shifting water supply pipelines	Cost for shifting electric poles is included in BOQ and NRs. 82,226,180 for water supply pipelines	Construction contractor, DoR-DCID project office, NEA and DWSS	DoR-DCID, GESU, NEA	Progress report Field visits and assessment	RAP, Relocation status and condition Procedures regarding relocation have been properly set out and followed; Relocation status and condition	 During construction
Project affected people and communities	Dispute about R&R compensation	Efficient implementation of Resettlement Plan will be done through information dissemination campaign, organizing CDC meetings, public consultation meetings and establishing Grievance Redress Mechanism and external monitoring	R&R Cost mentioned above. 1,100,000 for R&R implementation and 1,500,000 for external monitoring	Construction contractor, DoR-DCID project office	DoR-DCID, GESU	Progress report Field visits and assessment	Procedures regarding compensation have been properly set out and followed; preparation of RAP, Relocation status and condition	During construction
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources								
Loss of forest area	Impact on Adjoining forest area land into non-forest land	For avoiding forest land acquisition, the project activities are confined within ROW. The design has comprised curve improvement in forest sections (chainage 281+500 to 284+000 and 314+500 to 316+500) to avoid forest land acquisition	No cost required	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 (if required);	During and after construction (quarterly)
Loss of vegetation	Loss of trees and vegetation, disturbance	Loss of vegetation in this project cannot be avoided. For minimizing the impact, vegetation only within formation width will be cleared. Further, compensation of cut down	NRs. 389,510,482 for compensatory plantation and	Construction contractor in coordination with CFUG, DFOs and	DoR, DCID, Construction & Supervision Consultant (CSC),	Site visits and observation	Forest clearance certificate acquired (if required); felling	During and after construction (quarterly)

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E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
		trees by planting new trees in the ration 1:10 and maintenance for 5 years will be done. This is in aligned with Forest Rule 2079.	NRs. 18,205,646 for Avenue Plantation, maintaining greenery along the road	DoR-DCID project office	GESU-DoR		of marked trees only.	
Wildlife movement	Impact on Wildlife movement at Chainages 329+752, 333+733, 339+342, 347+209, 353+628, 357+227, 358+477 for large sized animals (elephants) and chainages 271+514, 274+925, 275+630, 277+266, 278+913, 282+758, 285+721, 292+703, 317+698, 322+553 for medium sized animals (tigers, undulates and others)	- For reducing the impact in wildlife movement across KDP road alignment, 8 bridges will be modified as underpasses for elephants and 9 bridges and one culvert (causeway to be upgraded to culvert) will be modified as underpass for medium size animals to meet the statutory requirement and same has been addressed in design. All these underpasses will be assisted with guiding fences and annual maintenance of river/stream bed level and banks for facilitating animal movement. Further, underpasses proposed for elephant crossings will be equipped with noise barriers and vibration reducers. - Culverts will be constructed with shelves, elevated concrete walkways, and docks for facilitating movement of insects, reptiles and amphibians even during rainy season. Beside these other measures like speed breakers/rumble strips,	NRs. 900,000 for canopy bridges (6 no.), Other cost including underpasses included in BOQ,	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

E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
		roadside reflectors and mirrors, signage, variable message sign, installation of arboreal mammal canopy bridges, sound and light barriers etc. will be adopted as per BMP.						
Threat to Aquatic habitat	Impacts on aquatic biodiversity at Perennial Water-bodies as mentioned in Table 4.13 and Table 6.10	Pollution prevention measures for minimizing impact to aquatic habit as mentioned above	Included in BOQ	Construction contractor	DoR, DCID, Construction and Supervision Consultant	Observation and interaction with locals	Grievances received from locals.	Before and after construction
Threatened wildlife, hunting and poaching	Impacts and threats to wildlife along KDP road	Threats to wildlife can be avoided by: • Setting up a wildlife management unit • Instructions and orientation to workers through BMP advisor • Enforcement and control of Anti-poaching regulations through BMP advisor; • Wildlife monitoring Awareness campaigns/Training and capacity building	NRs. 5,400,000 for recruiting BMP Advisor, 4,158,000 for wild life monitoring through camera trapping, and 300,000 for training and Capacity Building	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
Use of forest resources	Use of forest products by construction workers	• Use of forest resources (mainly fire wood) can be avoided by providing alternative source of energy in labour camps. • Workers will be prohibited inside forest area and will be confined only within ROW of KDP road that too during construction time only. • Smoking will be prohibited	Most will be covered from above 390,000 for anti fire strategies	Construction contractor	DoR-DCID, Construction and Supervision Consultant	Observation and interaction with locals	Grievances received from locals; use of fuel wood in campsites and in other construction activities.	Weekly

E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
Spread of invasive alien species	Ecological pressure on native species due to invasive alien species	while working in areas adjoining to forest patches Implement effective anti-fire strategies The Expert/Environmental expert of supervision consultant during construction stage ensure that there should not be any alien species introduced by any worker, labour or any staff. If any alien species identified by Ecological Expert/Environmental expert, he will immediately inform the nearest forest department.	No extra cost required, will be covered from above	Construction contractor, DoR-DCID project office	CSC; DFO, DoR- DCID	Field visits, Review of grievances recorded,	Grievances received from locals	One time a week
ESS 7: Indigenous People								
Impact on Indigenous people	Among 64 households, 14 are found to be Indigenous people	Beside normal compensation to affected structures along with additional cost of assistance for relocation and livelihood restoration, no extra measures is required. IPDP has address the additional support required for IP settlements within DIA	IPDP cost 2185000	DoR-DCID	DoR-DCID, GESU	Proper planning	IP development plan	After construction
ESS 8: Cultural Heritage								
Impact on Cultural Heritage	Impact on 35 temples Local communities worshipping in these temples	- This impact cannot be avoided but compensated. The affected temples will be rehabilitated as per community suggestion. - It is noticed that none of these temples to be affected are archeologically significant. Further, during the construction stage, encountering any finding of	Cost required for dismantling and rehabilitation of temples included in section ESS 5 above under community	Construction contractor, DoR-DCID project office	DoR-DCID, GESU	Field visits and assessment	Relocation status and condition	During construction

E & S Risks and Impacts	Activity/ Issue	Mitigation measures	Cost	Responsible agency for		Verification Methods	Verifiable Indicators	Frequency
				Implementation	Monitoring			
		physical cultural resources at sites, the Contractor will be provided with a Chance Find Protocol by the project/SC before start of works. During the works, if the contractor encounters any findings of archaeological value, the Contractor will follow the Chance Find Protocol instructions	structures					

7.8 Summary of Environmental and Social Mitigation Cost

Cost associated for implementing environmental and social mitigation measures as per ESMP above is summarized in **Table 7.6**. This cost does not include cost allocated in project cost.

Table 7.6: Environmental and Social Mitigation Cost

Item No	Particulars (Environment Mitigation/Management Cost)				Remarks
Physical Environment					
1	Stockpiling and re-using of topsoil	Agricultural and forest sections of Road Alignment	During Site Clearance	1,000,000	Lump-Sum Cost for transportation, storage and re-utilization
2	Stockpiling and re-using of muck/spoil	Excavated areas	Cutting/Excavation for embankment and bridges	1,000,000	Lump-Sum Cost for transportation, storage and re-utilization
3	Waste Management (solid and liquid)	Labour Camps and Construction Camps	During construction	Included in BOQ, to be managed by contractor	It will be finalized by the contractor before construction and it goes under contractor responsibility
4	Management of Quarry and Borrow Sites, Construction Camps (crusher plant, batching plant, asphalt plant, workshops, stockpiling yards etc.)	Quarry and Borrow Sites, Construction Camps	During construction	Included in BOQ, to be managed by contractor	It will be finalized by the contractor before construction and it goes under contractor responsibility
	Subtotal 1			2,000,000	

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Item No	Particulars (Environment Mitigation/Management Cost)				Remarks
Biological Environment					
5	Compensatory Plantation of Trees (with cost of caring for five years)	Location to be finalized in coordination with DFOs/Forest Development Fund	During construction	389,510,482	Cost estimated as per DOR Norms for rate analysis of Road and Bridge works Rate analysis done for plantation of 281,200 trees and care for 5 years
6	Avenue Plantation, maintaining greenery along the road (favor to flowering plants as per thematic concept consultation with local people)	Along median and ROW	During construction	18,205,646	Cost Estimated as per DOR Norms for rate analysis of Road and Bridge works Cost of maintain greenery in median throughout the section (excluding the junction, bridge and approach areas)
6	Underpasses for wildlife including natural guiding fences and construction of water holes	Forest sections	During construction	Included in BOQ, to be managed by contractor	Cost for 18 bridges modified for large and medium sized animal crossing has been estimated and included in design and BOQ
7	Installation of Canopy Bridges for arboreal mammals	Forest Sections	During Construction	900,000	For canopy bridges at 6 places. It is estimated that for installation of one canopy bridge it cost 150,000
8	Wildlife monitoring from wildlife experts	Parsa NP, DFOs, Project office	Before and during construction	5,400,000	Expert cost for 3 years@ 1,800,000 per year
9	Implement effective anti-fire strategies (Forest Fire Management)	CFUG team	During Construction	390,000	Cleaning road side by removing leaves and twigs during dry season
10	Wildlife monitoring through camera trapping	Forest sections of Elephant crossing locations	During Construction	4,158,000	Installation of camera traps and monitoring in forest section focusing in proposed 8 elephant underpass areas
	Subtotal 2			418,564,128	
Social Environment					
11	RAP Cost	Project Implementation		32,964,628	Included in RAP
12	IPDP Cost	Project Implementation		2,185,000	As per IPDP of Project
13	Stakeholder	Project Office/	During Construction	250,000	Cost for Stakeholder Consultation

Item No	Particulars (Environment Mitigation/Management Cost)				Remarks
	Engagement Plan Implementation-Stakeholder Consultations	Municipal/ward office			
	Subtotal 3			35,399,628	
Training and Capacity Building					
14	Training and Capacity Building for Forest and Biodiversity Management	DFOs, CFUG groups	During Construction	300,000	Lump-Sum Cost
15	Awareness to Labours on communicable diseases (including HIV/AIDs)	Labour Camp Sites	During Construction	500,000	Lump-Sum Cost
16	Awareness to workers on material handling, waste management	Construction Camp Sites	During Construction	500,000	Lump-Sum Cost
17	Awareness/ capacity building to workers, local communities and traffic police on road and traffic safety	Project Office	During Construction	500,000	Lump-Sum Cost
18	Awareness to local communities and workers on Occupational Health and Safety	Project Office/ Municipal/ward office	During Construction	500,000	Lump-Sum Cost
19	Awareness to local communities on trafficking, coordination with anti-trafficking organizations	Project Office/ Municipal/ward office	During Construction	500,000	Lump-Sum Cost
20	Community sensitization and orientation on GBV/CSEA/SH	Project Office/ Municipal/ward office	During Construction	500,000	Lump-Sum Cost

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Item No	Particulars (Environment Mitigation/Management Cost)			Remarks
	Subtotal 4			3,300,000
Environmental Monitoring and Auditing				
21	Environmental and Social Monitoring	Along Road Alignment, Labour camps, construction camps and other construction sites	Just before construction, during construction and just after construction	Cost as per Monitoring Plan
22	Environmental Auditing	Along Road Alignment	After two years of Project Completion	Cost as per Auditing Plan
	Subtotal 5			4,860,000
	Total ESMP Cost			464,123,756

7.9 Environmental and Social Monitoring and Evaluation Framework

Environmental and Social safeguards monitoring provide an essential tool to ensure smooth progress of all project interventions and activities in accordance with the plans. Monitoring also provides the necessary feedback for programme management to ascertain whether activities are going according to the plan and take remedial measures if required. The key objectives of monitoring are:

- To see what impacts have occurred;
- To evaluate the performance of mitigation measures;
- To ensure that the conditions of approval are adhered to;
- To suggest improvements in management plan, if required;
- To see that benefits expected from the implementation of safeguard measures are achieved as the project proceeds; and
- To satisfy the legal and community obligations

Monitoring and evaluation is primarily required to ensure proper and timely implementation of environmental and social mitigation measures. Monitoring at regular intervals during implementation and for a specified period in the post implementation stages is necessary to identify and implement any change / improvement needed in the execution of the activity or in the mitigation measures. A monitoring and evaluation cell may be created at Project Level under Supervision Consultant (SC) with officials familiar with environmental and social issues of the project. In specific situations, external agencies may be considered to carry out the monitoring and evaluation activities and report to the supervising official.

Environmental and Social Monitoring for the project is given in **Table 7.7** below

Table 7.7: Environmental and Social Monitoring Plan

Parameters	Indicators	Method	Monitoring Location	Monitoring Time	Cost	Monitoring Agency
Baseline Monitoring						
Water Quality	Appearance, Colour, pH, turbidity, Electrical Conductivity, Iron, Nitrate, Alkalinity, Hardness, Calcium, Magnesium, Sulphate, E.coli etc..	Sample collection and lab analysis	Locations as per baseline and as per site condition to be decided by SC	Just before construction works	100,000	DCID/ Contractor
Air Quality	PM _{2.5} , PM ₁₀ , SO _x , NO _x , CO	Measurement through portable devices or High-volume air samplers	Locations as per baseline and as per site condition to be decided by SC	Just before construction works	250,000	DCID/ Contractor
Noise Level	Day time and Night time noise level (max, min and Leq levels)	Measurement through Noise level meter	Locations as per baseline and as per site condition to be decided by SC	Just before construction works	100,000	DCID/ Contractor
Waste Management	Waste Management scenario within project locality	Observation/Consultation with local people	Near proposed labour camps and construction camps	Just before construction works	No extra cost required	DCID/ Contractor
Rain/stormwater outflow and Water Logging	Outflow of rain water/storm water and water logging scenario	Observation during heavy rain /Consultation with local people	Within existing causeway and culverts and Dhalkebar, Lalbandi, Nijgadh and other water logging areas	Just before construction works	No extra cost required	DCID/ Contractor
River Cutting and Erosion Prone areas	Risk of river cutting, erosion	Observation /Consultation with local people	River banks	Just before construction works	No extra cost required	DCID/ Contractor
Structures within RoW and Formation Width	Structures and utilities to be damaged due to road upgradation	Observation /Consultation with local people	Within RoW	Just before construction works	No extra cost required	DCID/ Contractor
Vegetation within ROW and Formation Width	Vegetation status, Number of Trees to be felled	Observation, counting and measuring	Within RoW	Just before construction works	500,000	DCID/DFO/ SC/Contractor
Socio-economic activities along the road alignment	Number of tea stalls, shops, business activities	Observation /Consultation with local people	Along the Road alignment, mainly	Just before construction	No extra cost required	DCID/ Contractor

Parameters	Indicators	Method	Monitoring Location	Monitoring Time	Cost	Monitoring Agency
			near proposed labour camps	works		
Compliance Monitoring						
EIA proposed measures in project document	Contract documents/BOQs	Review/cross checking of tender and design documents	Project Office	During/after the project design stage completion of tender documents	No extra cost required	DCID/ SC/ Contractor
Contractor's commitment in Environment and Social Safeguarding	Revised Plans by Contractor (e.g. ESMP, LMP, Quarry and Borrow Pit Management Plan, Camp Management Plan, Traffic Management Plan, GESI Plan, OHS Plan, Site Restoration Plan, Monthly Progress Report etc. Number of labourers from road affected municipality employed as skilled/ unskilled Labour in the road construction, Percent/ number of socially and economically vulnerable people (Janajati, Dalit, Women etc.)	Review of Document	Project Office	Within 1 month of awarding contract	No extra cost required	DCID/ SC/ Contractor
Employment opportunity to local people		Employment records / observation of labour camp and construction sites/ Consultation with Local Government/Local people	Labour camps, construction sites	Periodically during construction phase	No extra cost required	DCID/Local Government/ SC/ Contractor
Awareness and Trainings as proposed in EIA	Number of trainings provided and awareness program conducted	Training and awareness records	Project Office, Camps sites, Construction sites, ward, municipal offices, etc.	Beginning of construction and during construction	No extra cost required	DCID/ Local Government/ SC/ Contractor
Compensation to loss of Private Structures	Price fixation for loss structure by CDC/ Compensation amount/ acquired properties, Allowances and support provided to affected HHs	Records of CDC and FGD with families which have lost properties	As decided by CDC	After settlement of the prices by CDC	Included in Resettlement Plan	DCID/ SC/ Contractor
Relocation of damaged community structures	Timely relocation of community/ public structures	Observation, consultation with affected communities	Relocated areas	During construction	Included in Resettlement Plan	DCID/ SC/ Contractor
Relocation of utilities:	Timely relocation of utilities	Observation, consultation with	Relocated areas	During	Included in	DCID/ SC/

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Parameters	Indicators	Method	Monitoring Location	Monitoring Time	Cost	Monitoring Agency
water supply pipelines and electric poles		affected households		construction	Resettlement Plan	Contractor
Health and Sanitation at Labour Camps	Health and Sanitation Facilities at Labour camps, Health and sanitation condition of workers,	Observation, Consultation with workers	Labour camps	Periodically during construction phase	No extra cost required	DCID/Local Government/ SC/ Contractor
Occupational Health and Safety	Mandatory use of safety features during construction by the labourers, Availability first aid material at the site for primary treatment/ Medical facility in the camps,	Observation of construction sites and Camps	Construction sites and camps	Periodically during construction phase	To be done of OHS Expert, no extra cost required	DCID/DFO/ SC/Contractor
	Fire extinguisher at the camp site,	Records of Supervision consultant reports				
	Cases of withholding of payment to the contractor for non-compliance on occupational Health and safety	Review of contractor's document and insurance paper				
Ensure Life Insurance of the Labours	Insurance paper of the Labours	Consultation with labours	Labour camps and Construction Camps	Before commencement of construction work or recruiting new worker	No extra cost required	DCID/SC/ Contractor
Monthly wage paid to labours	Wage Paid to Labours not less than wage fixed by concerned district to both male and female	Consultation with labours	Project site	Monthly during construction	No extra cost required	DCID/SC/ Contractor
Application of road safety measure	Number of road safety signs in accident prone segments of the alignment, Implementation of traffic management plan	Observation, Consultation with local people and Local Government	Construction Sites	Periodically during construction phase	No extra cost required	DCID/ SC/ Contractor
Vegetation Clearance	Felling of trees in accordance with Forest Rules	Observation	Forest areas along Road Alignment	Just before construction	No extra cost required	DCID/DFO/ CFUGs/ SC/ Contractor
Plantation	Status of planted trees (compensatory as well as avenue), Greenery in Median, Care for planted vegetation	Observation	Plantation areas	Periodically during construction	No extra cost required	DCID/DFO/ SC/ Contractor

Parameters	Indicators	Method	Monitoring Location	Monitoring Time	Cost	Monitoring Agency
Wildlife Movement	Construction of animal underpasses as proposed	Observation	Proposed underpass area	and operation phase Near project completion	No extra cost required	DCID/DFO/ SC/ Contractor
Grievances	Grievances Redress Mechanism in place as proposed	Observing Grievance recording register	Project Office and Site Office	Periodically during construction phase	No extra cost required	DCID/ SC/ Contractor
Spoil Generation	Storage and use of Spoil in embankment filling	Observation	Road Embankment	Periodically during construction phase	No extra cost required	DCID/ SC/ Contractor
Stockpiling of Construction materials	Proper storage and transportation of construction materials including hazardous and toxic materials	Observation	Stockpiling yards	Periodically during construction phase	No extra cost required	DCID/ SC/ Contractor
Rehabilitation of Labour camps and construction camps	Rehabilitation of sites as per restoration plan	Observing, consultation with land owners	Labour camp and Construction camps	Just after completion of construction works	No extra cost required	DCID/ SC/ Contractor
River Protection	Adoption of River Protection Works with bioengineering	Observation	River banks	Just after completion of construction works	No extra cost required	DCID/ SC/ Contractor
Stability of Road Embankment	Bioengineering/Turfing along Road Embankment	Observation	Road Embankments	Just after completion of construction works	No extra cost required	DCID/ SC/ Contractor
Impact Monitoring						
Impact on Air Quality	Emission of dust and smoke (PM _{2.5} , PM ₁₀ , SO _x , NO _x , CO)	Measurement through portable air monitoring device or high-volume air sampler	5 locations, as per baseline and additional 5 to be determined by SC as per site condition	Monthly during construction	900,000	DCID/ SC/ Contractor

Parameters	Indicators	Method	Monitoring Location	Monitoring Time	Cost	Monitoring Agency
Impact on Surface Water Quality, Downstream Sedimentation	pH, DO, TDS, TSS, Turbidity, Ammonia, BOD, Chloride, Iron, Nitrate, Alkalinity, Hardness, Calcium, Phosphate, Manganese, Chromium, Fluoride, Total coliform etc.	Water sampling and lab analysis	10 locations, 6 as per baseline and additional 4 to be determined by SC as per site condition	Quarterly during construction	600,000	DCID/ SC/ Contractor
Impact on Ground Water Quality	pH, TDS, TSS, Turbidity, Ammonia, Arsenic, Chloride, Iron, Nitrate, Alkalinity, Hardness, Calcium, Magnesium, Sulphate, Manganese, Chromium, Fluoride, E.coli etc.	Water sampling and lab analysis	10 locations, 7 as per baseline and additional 3 to be determined by SC as per site condition	Quarterly during construction	600,000	DCID/ SC/ Contractor
Impact on Soil Quality	Soil parameters viz. pH, moisture, organic matter, total nitrogen, total phosphorus, total potassium, sodium, oil and grease etc.	Soil sampling and lab analysis	5 locations, as per baseline and additional 5 to be determined by SC as per site condition	Quarterly during construction	600,000	DCID/ SC/ Contractor
Skill Enhancement	Number of trained graduates from project affected area working as a skilled labourer	Observation, Consultation	Construction Sites	Periodically during construction phase	No extra cost required	DCID/ SC/ Contractor
Occupational Health and Safety	Number of accident/incidents during construction	Observation, Accident Records	Construction Sites	Periodically during construction phase	No extra cost required	DCID/ SC/ Contractor
Impact due to utility shifting	Disruption in water supply and electricity	Observation, Consultation with Local Community	Construction Sites	Periodically during construction phase	No extra cost required	DCID/ SC/ Contractor
Impact in Traffic flow	Traffic Disturbance	Observation, Consultation with Local Community	Construction Sites	Periodically during construction phase	No extra cost required	DCID/ SC/ Contractor
Drainage outflow	Adequate drainage outflow or not, Water Logging issues	Observation, Consultation with Local Community	Construction Sites	Periodically during	No extra cost required	DCID/ SC/ Contractor

Parameters	Indicators	Method	Monitoring Location	Monitoring Time	Cost	Monitoring Agency
Solid waste Management	Cleanliness within labour camp and construction camps	Observation	Labour Camps and Construction Camps	construction and operation phase Periodically during construction phase	No extra cost required	DCID/ SC/ Contractor
Waste Management	Cleanliness within labour camp and construction camps	Observation	Labour Camps and Construction Camps	Periodically during construction phase	No extra cost required	DCID/ SC/ Contractor
Status of Forest	Cases of hunting and poaching, use of forest resources, forest land encroachment	Observation, Consultation with Local Community	Forest and nearby areas along road alignment	Periodically during construction phase	No extra cost required	DCID/DFO SC/ Contractor
Economic Activities	Development of new business	Observation, consultation	Settlement areas along road alignment	Periodically during construction phase	No extra cost required	DCID/Local Government SC/ Contractor
Cultural Activities	Inflow of migrant workers in project area, affect cultural activities, conflicts and quarrels	Observation, consultation	Settlement areas along road alignment	Periodically during construction phase	No extra cost required	DCID/Local Government SC/ Contractor
GBV, SH, Child Labour, Forced Labour	Cases of GBV, SH, Child Labour, Forced Labour within project	Observation, consultation with workers and local people Age verification of workers through ID check and regular maintenance of workers' log at work site	Along road alignment, labour and construction camps, construction sites	Periodically during construction phase	No extra cost required	DCID/Local Government SC/ Contractor
Health Condition of workers	Occurrence of communicable diseases	Observation, consultation with workers and local people	Along road alignment, labour and construction camps, construction sites	Periodically during construction phase	No extra cost required	DCID/Local Government SC/ Contractor

CHAPTER-VIII: ANALYSIS OF ALTERNATIVES

8.1 Introduction

The Project Road Kamala – Dhalkebar - Pathlaiya is a part of East West (Mahendra) Highway. This Road has a total length of 130 Km. There are 76 bridges and 127 other cross drainage structures, and 25 Causeways provided on the Project Road. The Road Carriageway width in Project Road section in average is about 7 m ~8 m and shoulder width is about 1 to 2m on both sides. In selected settlement/urban areas, width more than 7m has been provided for the pavement.

The design for the up-gradation project mainly consists of widening the existing 2-lane highway into 4-lane highway and design of bridges accordingly. In urban areas, the design includes the provision for service roads either on the one side or on both sides depending up on nature of the settlement.

The alternatives analysis for the proposed widening/upgradations of this corridor based on the mitigation hierarchy for management of environmental and social risks and impact have been considered. The aspects considered for the analysis of alternatives include Road safety, Hydrology, Impact on forest and trees, bridges, causeway, impact on built up area, wildlife habitat, wildlife & wildlife movement, indigenous people, cultural & community resources, land acquisition, marketplaces and urban area, and public acceptance for social & cultural aspects etc.

8.2 Basis of Selection of Road alignment

The environmental and social screening and initial analysis of alternatives sections of the design report was reviewed for independent assessment of the adequacy of consideration of environmental & social aspects in the selection of preferred road alignment, bridges, causeway improvement alternatives were done. Public consultations were carried out at different locations along the alignment to understand the improving the road sections with due considerations to all alternatives. The data of existing physical structures and infrastructures, existing ecological features, social aspects, and other environmental aspects were collected and studied. The alternative studied for various sections of existing alignment, bridges, and causeways.

8.3 Design

The design of the proposed road section will adopt Asian Highway Design Standards (AHDS) to meet Class I standards and NRS 2070 to meet Class II standards. The road will be 4-lane (6 lane in urban sections with service lane roads). Accordingly, adequate drainage and cross drainage system have been designed for addressing water logging issues. All the causeways will be modified as box culverts. Bridges, within the forest, where wildlife movement is found to be high, will be modified as underpasses to meet Wildlife Friendly Infrastructure Construction Guidelines 2078. The design also complies for providing universal access.

8.4 Realignment Sections

The design consultant had carried out preliminary alignment for the proposed 4 lane as part of concept study after inception report submissions. Based on the site inspection and alignment, the design consultant had found that the alignment could not be designed for 100 Kmph at 5 locations. These are Dhalkebar (Km 257.400), Badhari Bazar (Km 261.200), Banke Bridge approach (Km 283.200), Harion (Km 301.700) and Bagmati River approach (Km 311.500). The consultant had

presented the realignment options at 5 locations during the review meeting at Client's office on 22/12/2021. The client had reviewed the Nepal Road Standard 2070¹⁷ in case of unavoidable circumstance to avoid / minimize land acquisition. Accordingly, the consultant has revised the alignment design at Dhalkebar considering design speed of 75 Km/h.

Part plans of alignment at above mentioned 5 locations are given from **Figure 8.1** to **Figure 8.5**.



Figure 8.1: Proposed Realignment at Dhalkebar

Table 8.1: Comparison of Existing and Proposed alignment

S. No.	Description	Existing Alignment	Proposed alignment
1	Length	1+555 Km	1+400 Km
2	Land use	Built-up area	Agricultural area
3	Terrain	Plain/Rolling	Plain/Rolling
4	Geometries	This alignment is not having good geometrics	Geometric Improvement in proposed alignment
5	Total Additional land required (Ha)	Nil	
6	Social Impact	Alignment is passing through number of built-up areas which leads to significant amount of demolition of existing structures	Not significant issue
7	Environment	People living near road will be affected by air and noise pollution during construction phase	There will be no impact as land is agriculture land.
8	Recommendations		Recommended

¹⁷ Letter ref no DCID:6/2078-79/362 dated 13/02/2022 to adopt guiding principles given in clause 7(b) of NRS 2070



Figure 8.2: Alignment at Badahari Bazar for 75 Km/h

There is minor modification in Badahri alignment therefore there is no major difference in existing and proposed alignment.



Figure 8.3: Alignment at Approaches of Bankhe Bridge

There is minor modification in Bankhe alignment therefore there is no major difference in existing and proposed alignment.



Figure 8.4: Minor Realignment at Hariyon

There is minor modification in Hariyon alignment therefore there is no major difference in existing and proposed alignment.



Figure 8.5: Alignment along Bagmati River Bridge and Approaches

There is minor modification in Bagmati Bridge alignment therefore there is no major difference in existing and proposed alignment.

The alignment at approach to Dhanusar bridge cannot be accommodated within right of way of 50m if the new bridge is proposed on the southern side of existing bridge. It is learnt that the existing bridge is actually eccentric with respect to right of way. The extent of land acquisition is appr. 8256 Sqm of forest area (ref Figure 8.6). In order to avoid the land acquisition, the new bridge is proposed on the northern side of the existing bridge with design speed of 75 Km/h (ref Figure 8.7).

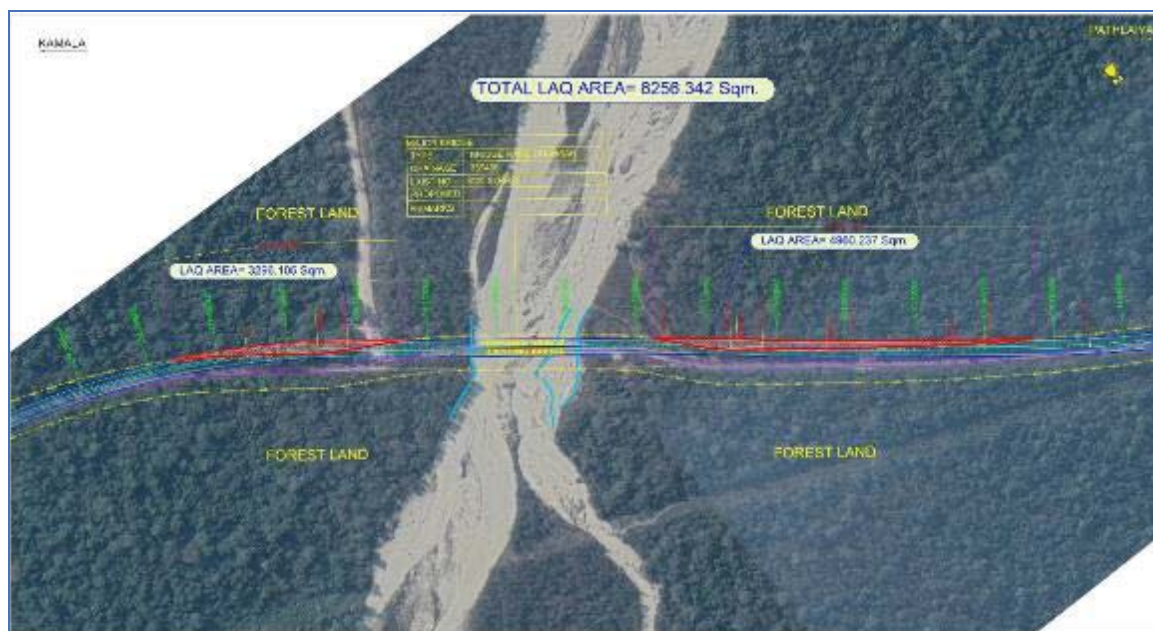


Figure 8.6: Alignment with New Bridge on Southern Side (with LA)



Figure 8.7: Alignment with New Bridge on Northern Side (without LA)

Table 8.2: Comparison of Existing and Proposed alignment

Sr. No	Description	Southern Side of Existing Bridge	Northern Side of Existing Bridge
1	Land acquisition	8256 sq m	Nil
2	Environment	8256 sq m Forest land	Nil
3	Terrain	Plain/Rolling	Plain/Rolling
4	Social	Nil	Nil
5	Recommendations		Recommended

8.5 Alternatives for Construction Technology

Cold Mix Technology involves cold asphalt which is a high-quality, polymer-modified cold mix asphalt available in batch orders. Hot Mix Technology involves Hot Mix Asphalt (HMA) which is a combination of approximately 95% stone, sand, or gravel bound together by asphalt cement, a product

of crude oil. Asphalt cement is heated aggregate, combined, and mixed with the aggregate at an HMA facility. The comparison between the two is given in **Table 8.3**.

Table 8.3: Analysis of Cold & Hot Mix Technology

S. No.	Parameter	Cold Mix	Hot Mix
1	Description	Street Cold Asphalt is a relatively new product developed in 1995 through the introduction of new polymer technology and research into the manipulation of viscosity and material design, of the various components of an asphalt mix - Street Cold Asphalt is soft and sticky out of the bag, but it quickly hardens after application and the end result is a pavement patch with better strength but similar properties to hot asphalt.	Hot mix asphalt is used primarily as paving material and consists of a mixture of aggregate and liquid asphalt cement, which are heated and mixed in measured quantities. Hot mix asphalt facilities can be broadly classified as either drum mix plants or batch mix plants, according to the process by which the raw materials are mixed. In a batch mix plant, the aggregate is dried first, then transferred to a mixer where it is mixed with the liquid asphalt. In a drum mix plant, a rotary dryer serves to dry the aggregate and mix it with the liquid asphalt cement.
2	Requirements	Cold patch, also known as cold mix or cold asphalt, was first recognized as a way to make road repairs quickly because it can be applied right from the container without heating. Cold asphalt also doesn't require any special heavy rolling machines or special applicators as it can be shovelled or poured into a pothole or utility cut and tamped down with a hand tool.	Hot mix asphalt concrete (commonly abbreviated as HMAC or HMA) is produced by heating the asphalt binder to decrease its viscosity, and drying the aggregate to remove moisture from it prior to mixing. Mixing is generally performed with the aggregate at about 300 °F (roughly 150 °C) for virgin asphalt and 330 °F (166 °C) for polymer modified asphalt, and the asphalt cement at 302 °F (150 °C). Paving and compaction must be performed while the asphalt is sufficiently hot
3	Use	Cold mix asphalt concrete is produced by emulsifying the asphalt in water with (essentially) soap prior to mixing with the aggregate. While in its emulsified state the asphalt is less viscous and the mixture is easy to work and compact The emulsion will break after enough water evaporates and the cold mix will, ideally, take on the properties of cold HMAC Cold mix is commonly used as a patching material and on lesser trafficked service roads	HMAC is the form of asphalt concrete most commonly used on high traffic pavements such as those on major highways, racetracks and airfields Asphalt concrete has different performance characteristics in terms of surface durability, tire wear, braking efficiency and roadway noise.
4	Merits	Actually, less expensive to use over the life of a road repair. Completely seals and patches potholes, utility cuts, edge repairs, and even overlays.	Less expensive for new road construction
5	Demerits	Less resilient and more vulnerable to cracking	Expensive

Cold Mix technology is more suitable for repair of potholes and cracks on roads, bridges, overlays, parking lots and other asphalt and concrete surfaces. Cold Mix is fast, permanent, easy to use and environmentally preferable cold asphalt product. However, for constructing of new roads hot mix technology is better suited so the contractor shall utilise the same wherever suitable.

8.6 Alternatives for Wildlife Movement

Based on the experience and site visits and the mitigation hierarchy as per ESS, two alternatives for wildlife movement facilitation were identified.

1st Alternative: The best option as per the ESIA Consultant's view taking into the present and proposed traffic figures, animal movement and road kills as reported and noticed during the site visits is

- Elevated corridor / flyovers in two areas for approximately 15 km:
 - In between Dhansar bridge to Lamaha bridge for approximately 5.5 km and
 - In between Bakyea and Pasaha rivers for approximately 10 km
 - The areas are reported to have the most WL crossings and habitats.
- Other engineering option like underpasses & / or overpasses (land bridges or ecoducts) as per site suitability at the remaining wildlife crossing locations besides keeping the guiding principle of Wildlife Institute of India (WII), which the consultants have been guided to apply besides other Good International Industry Practices (GIIP).
 - WII (2016) Eco Friendly Measures to Mitigate Impacts of Linear Infrastructures on Wildlife, funded by GoI & WB suggests that 300m underpass at every 1 Km for connectivity across 3km corridors divided due to upgradation of the road. Thus, there shall be approximately 28 underpasses in the project corridor – vertical curves shall be more and may lead to traffic snarls and speed reductions.
- Provision of minimum 6-8 feet height mesh fences along with guiding channels to prevent WL crossings other than at designated areas for approximately 56.6 km (28.3 km on both sides) – regular maintenance shall be required and cost to be budgeted.
- Provision of the canopy bridges for primates – these are reported to be most impacted in road kills.
- Provision of traffic calming measures like tabletop speed breakers at regular intervals, traffic awareness signages, traffic camera and other paraphernalia
- Design speed to be restricted to no more than 60 km per hour in the WL crossing areas to reduce chances of road kills.

2nd Alternative: As the above option is not accepted due to design, cost and other constraints the second option has been explored:

- Engineering option like underpasses & / or overpasses (land bridges or ecoducts) as per site suitability. Here bridges to be modified as underpasses is proposed.
- Provision of minimum 6-8 feet height mesh fences along with guiding channels to prevent WL crossings other than at designated areas along the entire forest sections on both side for approximately 86.6 km (43.3 km on both sides) – fencing has been suggested as an option by locals & forest officials & regular maintenance shall be required and cost to be budgeted
- Provision of the canopy bridges for primates
- Provision of traffic calming measures like tabletop speed breakers at regular intervals, traffic awareness signages, traffic camera and other paraphernalia

Design speed to be restricted to no more than 40 km per hour in the 14 km section adjoining PNP to reduce chances of road kills.

Alternative for Underpass Height

Different alternatives on openness index were compared as observed in different countries.

- An underpass constructed in Kenya, which was readily used by African elephants and has since received sustained elephant use (Weeks, 2015), has an openness index of 2.25.
- Arch underpasses (average openness index = 5.5) in southern Bhutan were readily used by Asian elephants soon after construction (Chogyel et al. 2017).
- In India the recommended underpass openness index is 2.010
- It is noticed that in proposed underpasses, openness index ranges from 5.30 to 20.25 which exhibits a high degree of openness for the target species

Similarly, height of the underpass proposed by different agencies in different countries were compared.

- Asian Wild Elephant maximum height was 2.75 m, double the height of elephant space is available for elephant crossing.
- Most of the agencies/countries are recommending a minimum height of 6.5 m including in Nepal
- Recently ADB has approved Upgrading Kakarbhitta-Laukahi Road (120KM) in Jhapa District was also recommending a minimum height of 6.5 m.
- WII, India recommended a minimum height of 6 to 8 m subjected to site specific conditions.

For KDP road, 8 bridges are proposed for elephant crossings. If the minimum height of the bridge is increased above 7 m, all the 7 existing bridges need to be dismantled which would not be an economically feasible and environmentally friendly option. In case the national standard is adopted and bridge height is kept within 6.5 m, only 2 bridges needs to be dismantled. Hence, national standard for wildlife crossings is adopted and 6.5 m bridge height (vertical clearance) is maintained. Apart from providing bridge height of 6.5 m, other best practices such as providing Noise barriers, Light barriers, guiding fences, annual maintenance of river depth, other improvement proposals required to facilitate wildlife to walk along the banks and avoid crossing through the road have been proposed.

CHAPTER- IX: 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.

9.1 Regulatory Institutions

Institutions responsible for addressing environmental and social issues in the project are mentioned in Table 9.1 below.

Table 9.1: Institutions and their Roles in Addressing Environmental and Social Issues in KDP Project

Institutions	Roles and Responsibilities in KDP Project
Ministry of Physical Infrastructure and Transport (MoPIT)	MoPIT is the mother agency of the DoR and is mandated by the EP Act to review and approve IEEs for projects in public works and transport sector. It also reviews and endorses EIA reports for review and approval of the MoFE. The Ministry will also be the one to authorize the Project Management Office (PCU) to initiate preliminary action for land acquisition. This function is handled by the Environment and Social section under the Planning, Monitoring and Evaluation Division. EIA of KDP is to be first approved from MoPIT before implementation
Department of Roads (DoR)/DCID	DOR/DCID is the proponent of this KDP road project. The DoR-DCID prepares and implements the ESIA/ESMP, which has to be reviewed and approved by the World Bank as the financing agency of the project. DoR-DCID is directly responsible for managing the E&S risks of individual projects under the program, i.e., from assessment, mitigation planning, implementation to monitoring.
Geo-Environment and Social Unit (GESU)	The focal point for the E&S risk management at of DoR is GESU. GESU provides advisory services to units of DoR on geological, environmental and social safeguards matters. Its main role is to prepare IEEs and EIAs for the DoR projects and have the map proved by the MoPIT in the case of IEEs and by the MoFE in the case of EIAs. Because of this role, GESU interacts with the Environment Unit of MoPIT as well as that of MoFE. EIA report of KDP road project is reviewed by GESU also before forwarding to MoFE through MoPIT for approval. GESU also undertakes compliance monitoring and auditing of projects within DOR including KDP.
EIA Unit under Ministry of Forests and Environment (MoFE)	This unit is tasks to undertake review and approve EIAs. It is reporting directly to the Ministry and not part of the Department of Environment. This unit convenes and engages multidisciplinary team to constitute the EIA Review Committee for each EIA submitted from approval. The EIA approvals typically include conditions which the project must comply or implement in addition to the EMP/ESMP
Department of Forestry and Soil Conservation (DoFSC)	DoFSC under the MoFE reviews and approves applications for RoW of road sections falling within areas classified as public forest. The DoFSC imposes conditions on the acquisition of right of way on forest lands, such as replacement of cut trees.
Department of National Parks and Wildlife Conservation (DNPWC)	DNPWC under MoFE reviews and approves sections of roads within Parks and protected areas. As some sections of KDP road alignment is adjoining to Parsa National Park, development activities in this section needs consensus from DNPWC.
Divisional Forest Offices (DFOs)	The Forest department will verify and grant permission for tree cutting as significant number of trees will be felled down due to proposed widening.
Department of Labour and Occupational Safety	DoLOS under the Ministry of Labour and Social Security is currently not involved in the E&S risk management (i.e. it has no role in the EIA process) of

Institutions	Roles and Responsibilities in KDP Project
(DoLOS)	development projects. Its role is mainly on the regulatory side. It can formulate and issue policies, rules and standards for OHS consistent with the law. As such, it can occasionally conduct monitoring and audit of workplaces, construction sites and offices of contractors and project management.
Department 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. The role of this department in KDP road project will activate in case if any monuments are found during excavation.
District Coordination Committees (DCC)	DCCs can regulate soil and water conservation activities. DCCs are also responsible for reviewing applications of eminent domain land acquisitions and confirming public use. It will be responsible for the issuance of land acquisition notice; the formation of Compensation Fixing Committee which would determine fair compensation; finalize the list of land owners to receive compensation; and receives grievances for submission to the Ministry of Home Affairs
Municipalities and Rural Municipalities	The municipalities are responsible to conduct public hearings of the EIA results and based on it endorse the project. The MoFE will not approve EIAs without the endorsement of municipalities. It will be responsible for approval of quarry area and establishment of labour camps and construction camps too.

9.2 Implementation Arrangement of ESMP

The environmental management framework during construction is based on and integral with the overall project management framework for the project. The project will be implemented by the Department of Roads (DOR) as the Executing Agency. The Development Cooperation Implementation Divisions (DCID) of Department of Road (DOR) is the Implementing Agency (IA) for KDP Road Project. Upon completion of upgradation of the KDP, Development Cooperation Implementation Divisions (DCID)-DOR, will carry out the operation, management, and maintenance.

The implementation of the ESMP will be the responsibility of DoR/DCID with support 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 KDP Road 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.

The SC will be responsible to monitor and supervise road construction works and its associated safeguard works including camp establishment, stock piling, quarry sites, crusher plant, batching plant, hot mix plant etc. established, generation and disposal of spoil, 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 monitoring and supervising all the environmental concerns of the project, the SC will engage a full-time environmental specialist along with necessary assistants. The SC environment specialist will support the environmental specialist of the DCID and GESU team 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. Besides, the SC environmentalist will

support in monitoring, evaluation, and reporting to senior level staffs. Along with environmental specialist, for addressing social and resettlement concerns of the project, the SC will also engage a full-time Social Safeguard Specialist. The SC social safeguard specialist will support the social safeguard specialist of the DCID and GESU team in implementing the ESMP. Social safeguard specialist will also be liaising with the local communities and municipalities and organizing trainings and awareness on GBV, trafficking, communicable diseases including SEA, SH within project (labours) and adjoining communities.

Separate ministry, Ministry of Forests and Environment (MOFE) is responsible for approval of Environmental Impact Assessment Report and monitoring of environmental and social aspects of the project. Department of Environment (DOE) under MOFE is mainly concern with monitoring of environmental and social aspects whereas Department of Forests and Soil Conservation (DoFSC) is responsible for verification and permission of tree cutting adjoining to community and Collaborative forests. There are Division Forest Offices (DFO) in each districts and sub-divisions under DoFSC for supporting verification and removal of trees adjoining to community and Collaborative forests and other national forests. Parsa National Park (PNP) under Department of National Park and Wildlife Conservation (DNPWC) is responsible for verification, approval and removal of trees adjoining to Parsa National Park. These departments, divisions and subdivisions are also responsible for monitoring mainly biodiversity (floral and faunal) associated issues within project area.

District Administration Office (DAO) under Ministry of Home Affairs (MOHA) is responsible for assisting project in implementation of RAP. They are responsible for formation of compensation fixation committee (CFC), determination of compensation and relocation costs and also responsible for maintenance of the security of the project development sites.

Department of Survey (DOS) and Department of Land Management and Archive (DoLMA) under Ministry of Land Management, Cooperatives and Poverty Alleviation (MoLMCPA) needs to be referred in case of disputes and issues related with land ownership and acquisition (if required).

As the project will affect public utilities like electric poles, water supply pipelines, sewerage system, communication and cable net etc., other departments, divisional and sub-divisional offices also need to be coordinated during construction phase. Organizational chart showing different organizations associated with project activities and providing an overview of the institutional setup related to the implementation of the ESMP is shown in Figure 9.1.

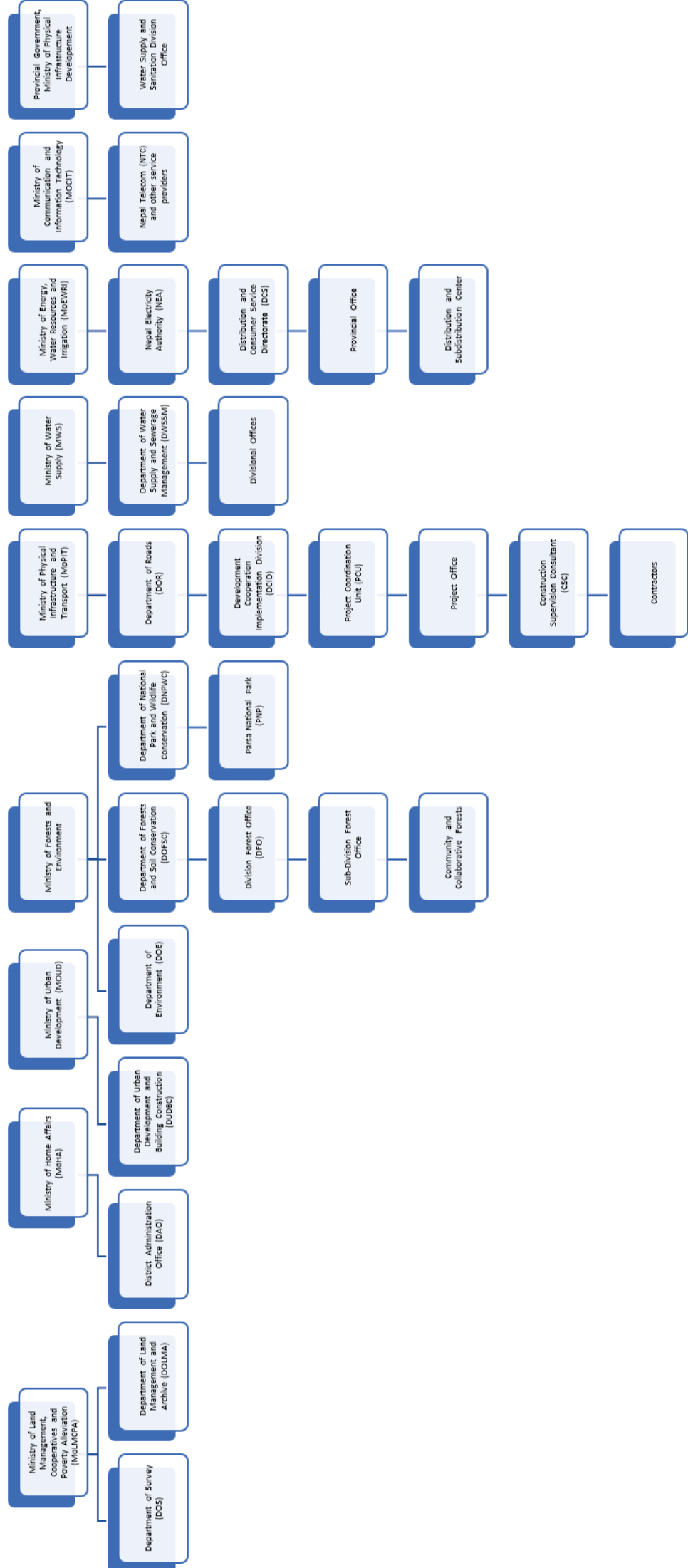


Figure 9.1: Implementation Arrangements for ESMP

Existing and proposed human resource for ESMP and BMP implementation is presented below.

Table 9.2: Existing and Proposed Human Resource for ESMP Implementation

Institution	Personnels /Expert	Number
PIU (DoR -DCID) (Existing)	1. Environment Specialist	1
	2. Social Development Specialist	1
	3. Occupational Health and Safety Specialist	1
	4. Gender and GBV Specialist	1
CSC	1. Environment Specialist	1
	2. Social Development Specialist	1
	3. Occupational Health and Safety Specialist	1
	4. Gender and GBV Specialist	1
	5. Biodiversity Specialist	1
	6. Traffic Management and Road Safety Specialist	1
	7. E&S Inspectors	as required
Contractor	1. Environment Officer	1
	2. Social Development Officer	1
	3. Occupational Health and Safety Officer	1
	4. Gender and GBV Officer	1

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