



GOVERNMENT OF NEPAL

Ministry of Physical Infrastructure and Transport

Department of Roads (DoR)

Development Cooperation Implementation Division (DCID)

**ACCELERATING TRANSPORT AND TRADE CONNECTIVITY IN EASTERN SOUTH
ASIA - NEPAL PHASE 1**

Environment and Social Baseline Report of Gorusinghe-Chandrauta Road

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ABBREVIATIONS

°C	Degree Celsius
MoPIT	Ministry of Physical Infrastructure and Transport
ACCESS	Accelerating Transport and Trade Connectivity in Eastern South Asia
CBS	Central Bureau of Statistics
DCID	Development Cooperation Implementation Division
DOR	Department of Road
DPR	Detailed Project Report
EIA	Environmental Impact Assessment
EPA	Environment Protection Act
EPR	Environment Protection Rules
ESMF	Environment and Social Management Framework
ESF	Environment and Social Framework
GBV	Gender Based Violence
GC	Goringhe Chandrauta
GoN	Government of Nepal
IBA	Important Bird and Biodiversity Area
IDA	International Development Association
IEE	Initial Environmental Examination
IP	Indigenous People
IUCN	International Union for Conservation of Nature
Km	Kilometer
Kmph	Kilometre Per Hour
M	Meter
msl	Mean Sea Level
M/RM	Municipality/Rural Municipality
OFC	Optical Fiber Cable
PSA	Poverty and Social Analysis
PUP	Pedestrian Underpass
RAP	Resettlement Action Plan
RoW	Right of Way
ToR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
viz	Namely
VUP	Vehicular Underpass
WB	World Bank

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CHAPTER 1: Project Description

1.1. Project Background

The Government of Nepal (GoN) has received financing for the Accelerating Transport and Trade Connectivity in Eastern South Asia (ACCESS) project from the World Bank to be implemented jointly by the Department of Road (DoR), Development Cooperation Implementation Division (DCID), the Ministry of Industry, Commerce and Supplies (MoICS), Ministry of Physical Infrastructure of Transport (MoPIT) and the Department of Forests and Soil Conservation (DoFSC) of the Ministry of Forest and Environment (MoFE). The aim of this project is to support the cost-efficient and resilient movement of goods and people within and across the borders of Nepal along the East-West Highway on the western side which is key to accessing India's western seaports and thus for economic growth. The ACCESS project comprises four components among them "construction of green and resilient transport and trade infrastructure" is one covered in Butwal-Gorusinghe-Chandrauta (BGC) road.

Component 1: Digital Systems for trade: This component will support the adoption and Implementation of Digital and Automated Systems for improvement of Nepal's cross-border clearances: (a) Development of electronic Automated Border Management including electronic cargo tracking system, (b) Business Intelligence and Data Analytics Package and Risk Engine (c) Development of web-based supply MIS for automation of registration processes and permits.

Component 2: Green and Resilient Transport and Trade Infrastructure: This component will support (a) Upgrading of Butwal-Gorusinghe Road section and Gorusinghe-Chandrauta Road section of East-West Highway from 2 to 4 lanes, (b) Construction of a green resilient urban bridge (including detailed design/urban design and construction), and (c) Support for development and implementation of green resilient highway concept, integrating transportation functionality and ecological sustainability.

Component 3: Institutional and Policy Strengthening for Transport and Trade: This component will provide support in streamlining the policy environment for regional trade and cross-border movement of goods through (a) Bangladesh-India-Nepal Motor Vehicle Agreement related reforms, (b) Customs reforms, (c) Private sector support initiatives, (d) Capacity Strengthening, and (e) Project preparation studies.

Component 4: Contingency Emergency Response: This component will support unforeseen emergency needs. In case of a major natural or human made disaster, the Government of Nepal (GoN) may request the World Bank to re-allocate project funds to this component to support its quick response and reconstruction.

1.2. GC Road General Characteristics

The proposed Goringhe -Chandrauta road upgradation project is part of the ACCESS - Nepal Phase 1 which covers the highway upgradation from Butwal to Chandrauta in Rupandehi and Kapilbastu Districts of Lumbini province. GC road section has been proposed as lot-3 in-terms of construction packages where lot 1 and lot 2 are part of Butwal Goringhe (BG) section (50 km). The GC Road section starts from near Belwagurdawa Nadi Bridge (CH 640+000) i.e., continuation of BG section and ends at Umari/Shivpur Chowk (659+200) about 6 km west from Krishnagar chowk (Chandrauta Chowk). The road passes through section of Buddhabhumi and Shivraj Municipality crossing through two major settlements viz Goringhe and Chandrauta via small built-up area such as Imiliya, Champapur, Kharendrapur and Shivpur etc. The road section passes entirely through plain terrain (generally varies from 100-150 masl). This road section passes through the community forests and collaborative forest in the major part. At Chandrauta and urban area existing road is 15 m wide. All existing bridges in the section are of double lane configurations. In an average, the finished road level rises 0.5-1 m above the natural ground level, except at embankment for bridge approaches where it reaches above 6 meters. The existing RoW is 25 m each side (total of 50 m RoW) from central line. As such there will be no need to acquire additional land for the project except in case of improving of reverse curves.

Goringhe- Chandrauta road upgrading works involves the upgrading and widening of the existing 2 lane road into 4 lanes, with intermittent service lanes on sides, additional roadside structures, geometry improvements, pavement construction with asphalt concrete drainage improvement, retaining structures, slope protection/stabilization, and bridge construction works on traffic management and road safety. The 19.2 km GC road will be an express highway with green resilient road in Asian Highway standard traversing the Kapilbastu district. The road covers ward number 9 of Buddhabhumi municipality and ward number 1, 3, 4 & 5 of Shivraj municipality.

This Baseline Report has been prepared to take the baseline information considering RoW as direct impact zone, 300 meters (either side) from edge of the RoW as indirect impact zone of the road and affected wards as zone of influence of the project.

1.3. Project Location and Accessibility

The project is extended from Goringhe to Umari/Shivapur Chowk about 6 km west from Chandrauta (Junction of Krishnagar road). It connects western Nepal with the capital Kathmandu through the highway and air links (via the Gautam Buddha International Airport). The proposed section is located in Kapilbastu district of Lumbini Province. Project road start at near Belwagurdawa Nadi at 640+000 (Major Bridge) having GPS 27°39'27.50" N, 82°59'47.15" E and extends 19 km westward that ends at Umari/Shivapur

Chowk at chainage 659+200 having GPS 27°41'24.59" N, 82°50'22.45" E. The chainage continues with the EWH starting from eastern border of Nepal i.e. Kakarvitta. It is connected with end part of the Butwal-Gorusinghe road upgradation project towards east where construction works has already been initiated. The location of proposed road alignment is shown in Figure 1-1.

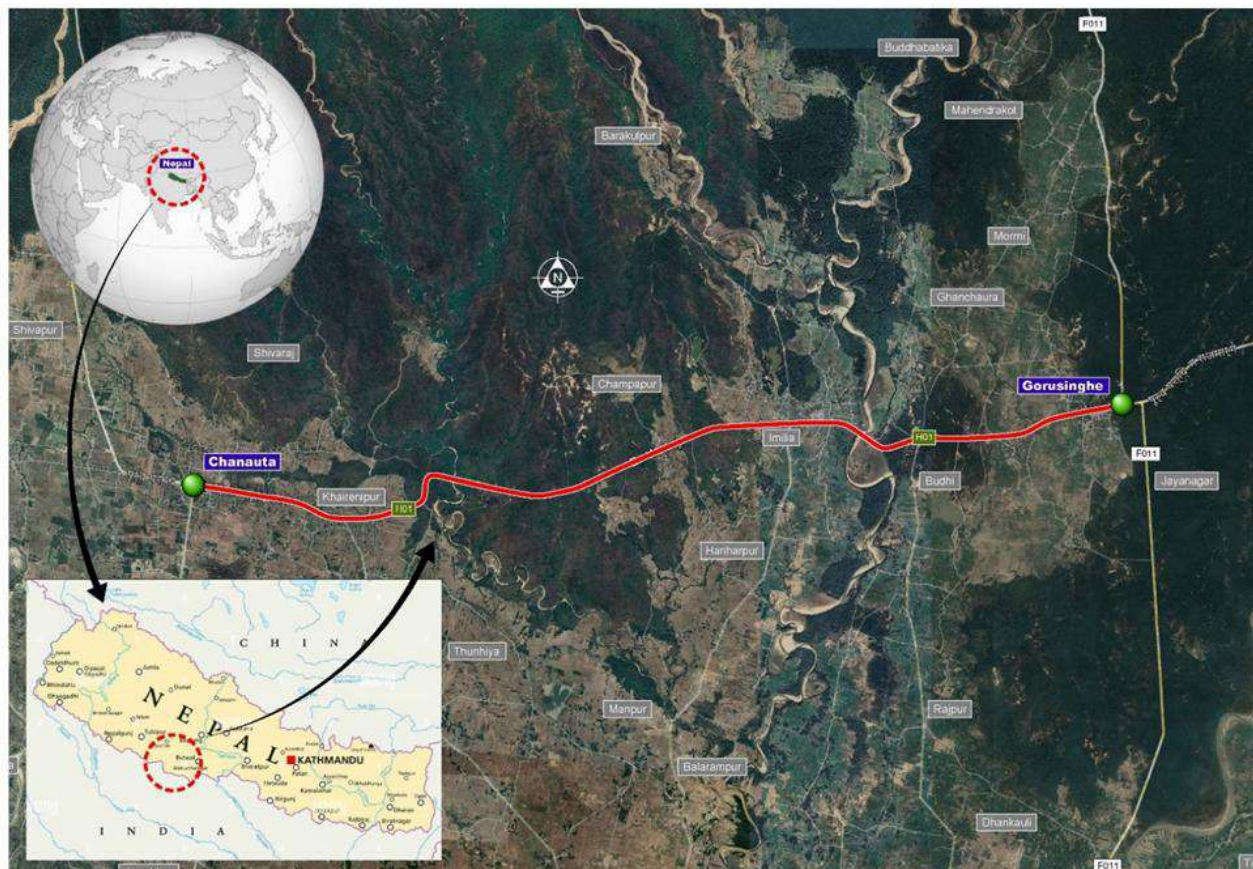


Figure 1-1: Google Earth map of project area (Source: Google earth, 2024)

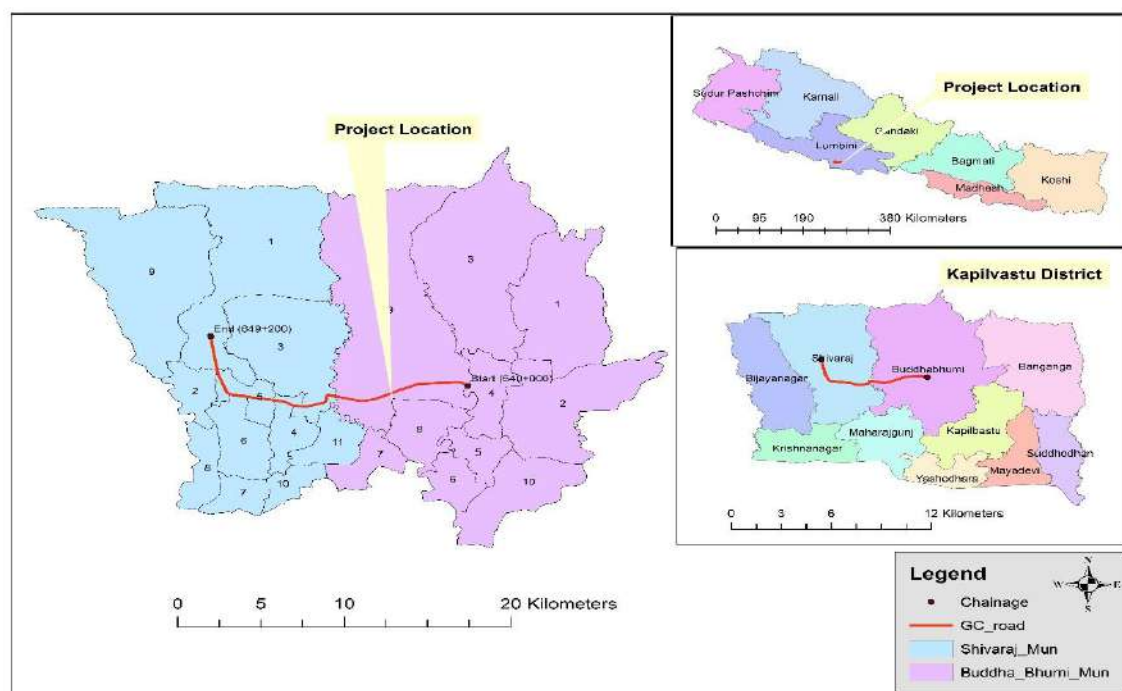


Figure 1-2: Location map of project area (Source: Department of Survey, 2076)

1.4. Salient Features of the Project and Components

The proposal is to upgrade of Gorusinghe-Chandrauta road (19.2 km) section of EWH to four lane standards. In case of dense settlements, extra service lanes on each side will also be constructed. Salient features of the Project are given in **Table 1- 1**:

Gorusinghe-Chandrauta road section does not pass through any protected areas of the country but covered the diverse habitat including settlements, farmlands, river crossing and forests (community forest and collaborative). The project area lies within Terai Arc Landscape (TAL) and its eastern half section lies within the area of global significant Kapilbastu Important Bird and Biodiversity Area (IBA). This area was declared as IBA because of breeding habitat of critically endangered White-rumped Vulture, other threatened birds and important biodiversity hotspot. The project site is an important reservoir for groundwater as there are several small wetlands and connected forest that facilitate for the wildlife dispersal.

Table 1- 1: Salient Features of the Project

Description	Features
Name of the project	Upgrading of Gorusinghe-Chandrauta road (19.2 km) section of EWH to four lane standards.
Province	Lumbini
District	Kapilbastu
Affected municipality	Buddhabhumi Municipality and Shivraj Municipality
Geographical features	Terai
Geology	Plain/ Rolling
Climate	Tropical /Sub-tropical
Altitude	100 m-150 m msl
Total length	19.2 km
Starting point	Belwagurdawa Nadi (CH 640+000)
End point	Umari/Shivpur Chowk (CH 659+200)
Road standard	National highway
Right of Way	25 m each side from central line (50 m RoW)
Existing Carriage way width, Shoulder	Two-lane facility (7 m carriage way) without paved shoulders and earthen shoulders
Design speed	100 Kmph in plain terrain and 80 Kmph in rolling terrain
Design period for operation	20 years
Surface type	Bituminous
Type of work	Upgrading
Total bridge	2 Major bridges and 6 minor bridges, 1 VUP & 2 PUPs
Culverts	64 box culverts and 7 pipe culverts
Total width of cross drain structure	24 m for culverts 20 m for bridges
Carriage way width of structure	Rural and forest area - 24.0 m, Urban area- 50 m including Utility duct
Width of Footpath	1.0 m (Both Side)
Estimated Grand total Project Cost	NRs. 5,68,45,10,641.00 (with VAT)
Cost Per Km	NRs. 296,068,262.55

Source: Design Report of GC road section, 2025

1.5. Drawing Key Features of the Proposed Road

There are three categories of road namely rural/forest, semi urban and urban types will be constructed in GC section. Altogether, following three types of cross-sections are proposed to upgrade the existing road (Figure 1-3, 1.4 and 1-5).

- **Urban area:** It is the area where entire right of way will be covered and construction works will be done from 46-50 meter. It includes four dedicated highway lanes (two in either direction) having median of 3m at the center. Similarly, it will have standard service lane, footpath, side drain as well as street light in three rows facility. Sketch of the highway section has shown in figure 1-3 (TCS -02).
- **Semi urban areas with drain and footpath:** It includes dedicated four lane highway including side drain for the road catchment and footpath along the edge of the road. It covers at least 28 m width of the road. There will be street light at the median of the highway. Sketch of the highway section has shown in figure 1-4 (TCS -03).
- **Forest and Rural area without drain and footpath:** There will be only dedicated 4 lane highway including its median and instead of footpath there will be only paved shoulder. There will be no street light in the forest section. Sketch of the highway section has shown in figure 1-5 (TCS-01 and TCS-01A).

Environment and Social Baseline Report of the Goringhale-Chandrauta Section of East-West Highway including Bridges, 2025

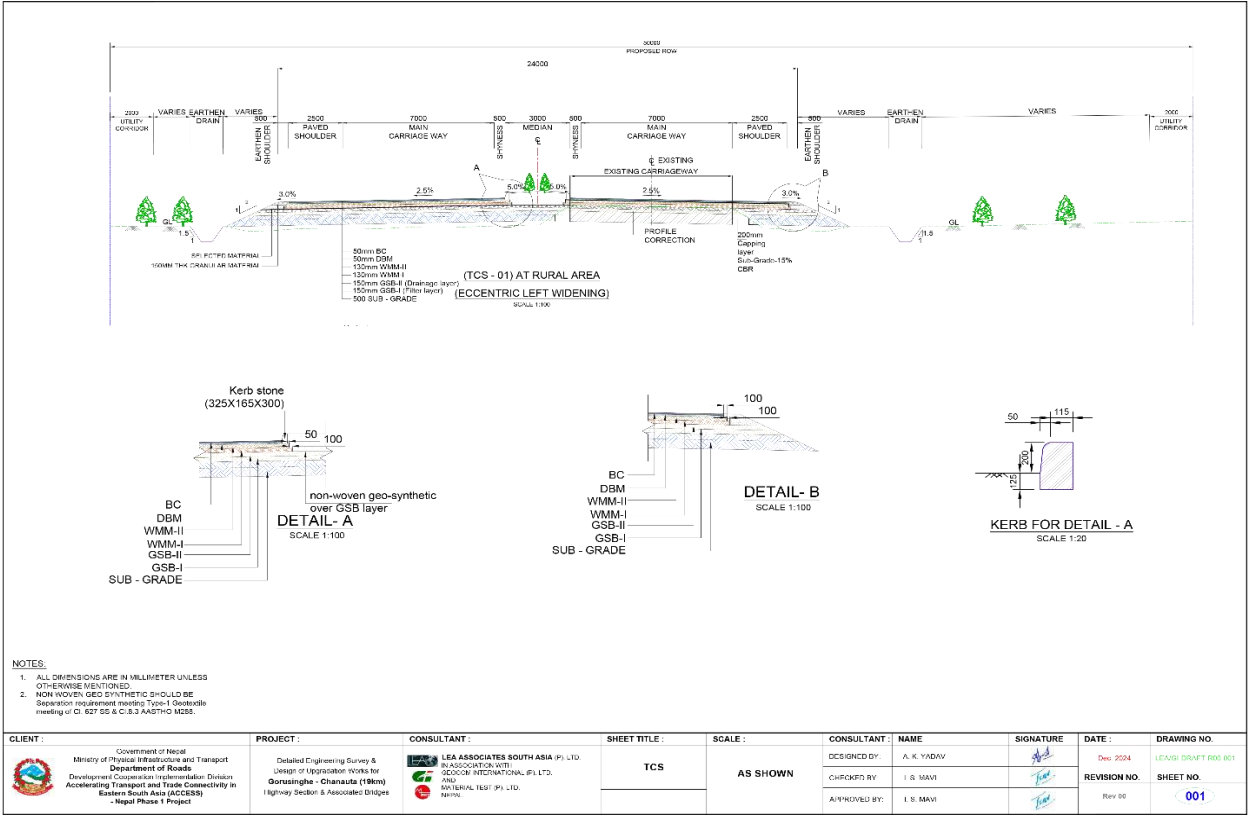
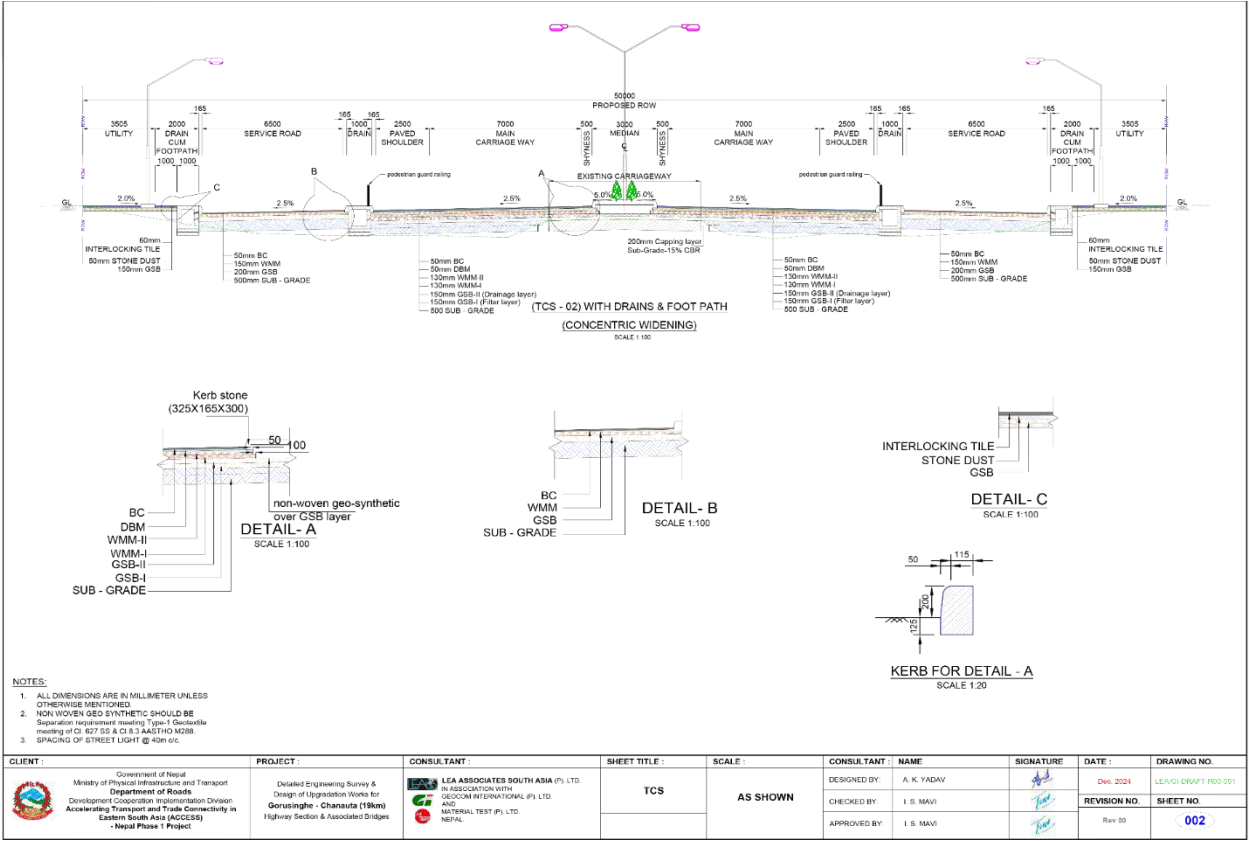


Figure 1-3: TS of the road at Rural Area

Environment and Social Baseline Report of the Goringhe-Chandrauta Section of East-West Highway including Bridges, 2025



Environment and Social Baseline Report of the Gorusinghe-Chandrauta Section of East-West Highway including Bridges, 2025

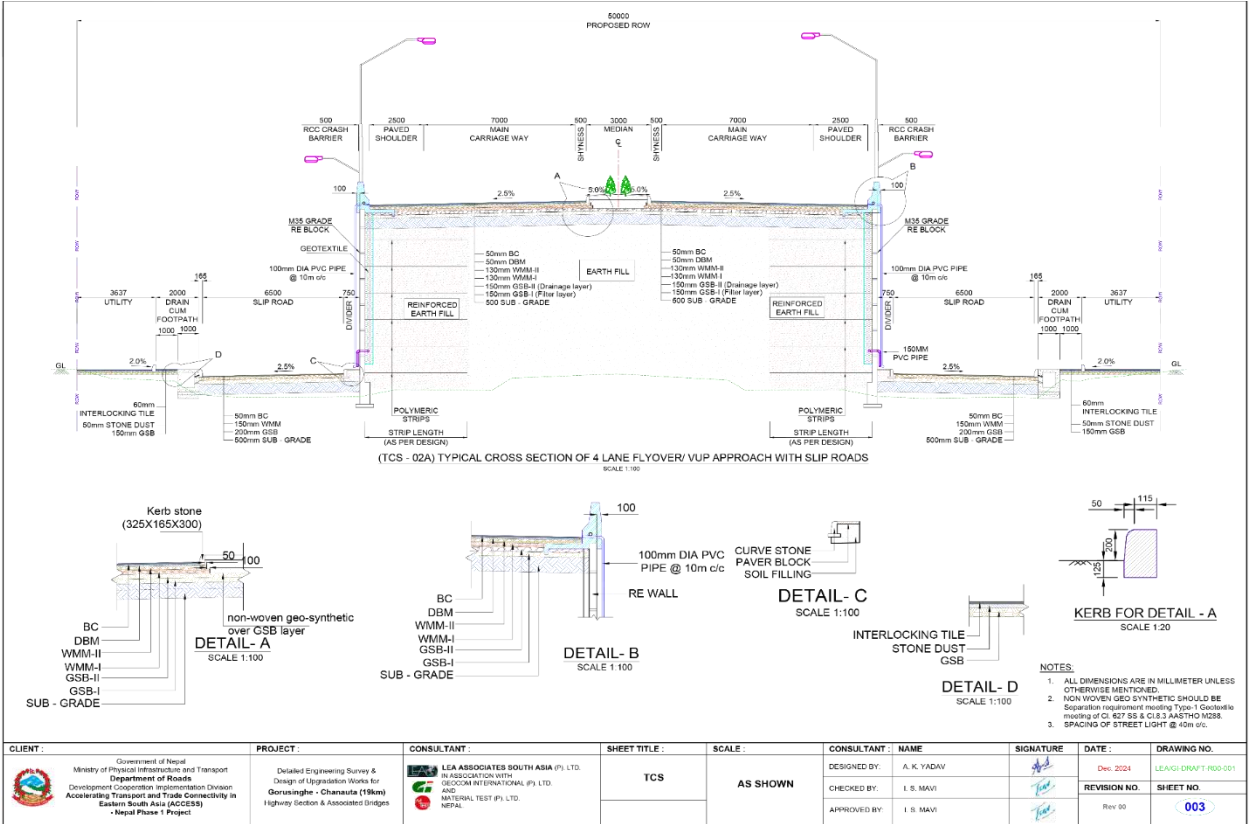


Figure 1-5: TSC of 4 Lane Flyover/VUP Approach with Slip Roads

There will be median of 3 m at the center which will be followed by 0.5 m Kerb shy each side. There will be 7 m dedicated formation either side for movement of vehicles in either side representing two lane each. In the similar manner there will be 2.5 m of paved shoulder either-sides and 0.5 m.

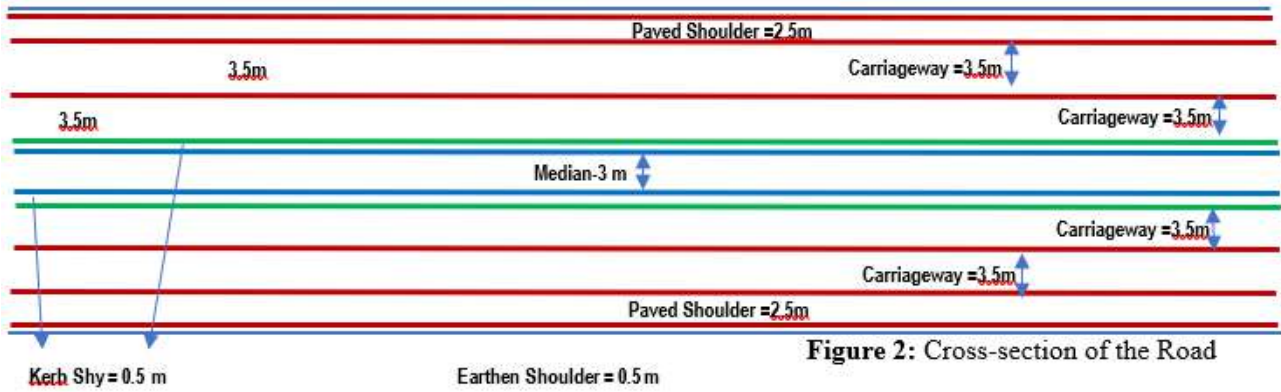


Figure 2: Cross-section of the Road

Figure 1-1a: Cross section of the Road at Rural Area

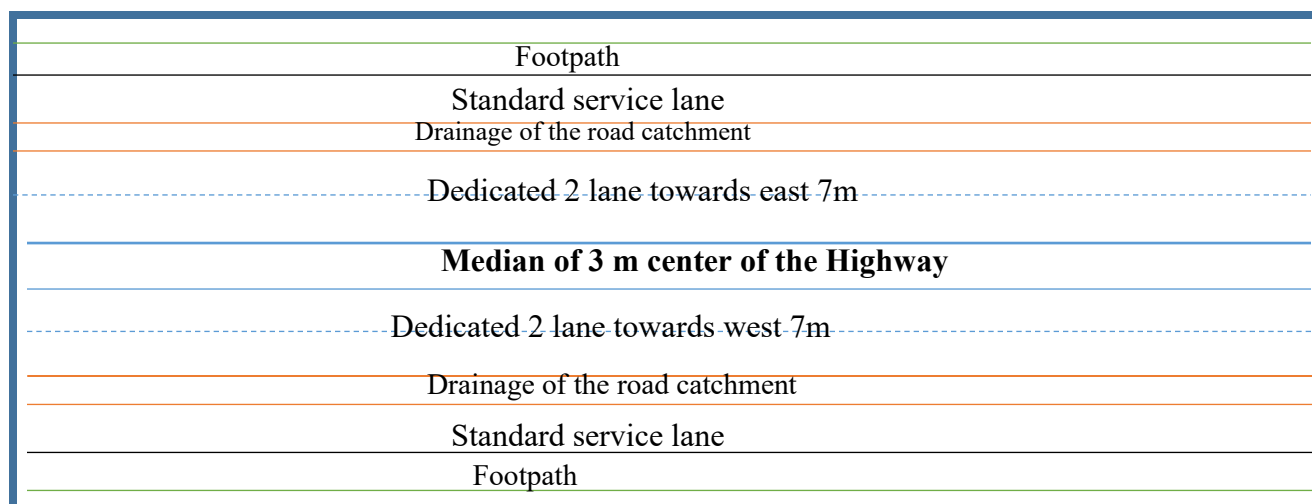


Figure 1- 2b: Cross section of the Urban Area

1.5.1. Geometric Design

Regarding geometric design criteria, the Nepal Road Standards, 2070 (2013) and other relevant standards was considered while upgrading the road. The following basic standards has proposed for the project road (**Table 1- 2**):

Table 1- 2: Geometric design of the road

S. N.	Design Specification	Unit	Proposed Design Standards	
1	Terrain Classification		Plain and rolling	Mountainous and Steep
	Cross Slope of the Ground	%	Up to 25 Percent	More than 25 Percent
2	Design Speed	km/hr	Plain and Rolling Terrain	Mountainous and Steep Terrain
	Desirable		100	60
	Minimum		80	40
4	Carriageway Width	M	7 m	
5	Median Width	M	Plain and rolling for 4 lanes	
	Open Country with isolated Built-Up Area		2.5	
	Built up Area		1.63 Jersey crash barrier	
	Approaches to Grade Separated Structures		2.5 m	
6	Paved Shoulder width	M	Plain/Rolling	
			2.5	
7	Camber	%		
	Carriageway (Flexible/Rigid)		2.5/2.0	

S. N.	Design Specification	Unit	Proposed Design Standards	
	Paved Shoulders (Flexible/Rigid)		2.5/2.0	
	Earthen Shoulders		3	
8	Gradients	%	Ruling	Limiting
	a) Plain and rolling		2.5	3.3
	b) Mountainous/Steep		5.0/6.0	6.0/7.0
9	Super elevation	%	5.0 when the Curve radius is more than desirable minimum 7.0 when the curve radius is less than desirable	
	Maximum in normal situation			
10	Minimum Horizontal Curve Radius	M		
	(Plain and Rolling) for 100 kmph			
	Desirable		400	
	Absolute		360	
11	Minimum Horizontal Curve Radius (Mountainous and Steep)	M		
	Desirable			
	Absolute		80	
			50	
12	Sight Distance	M	100 km /hr	80 km / hr
	Stopping Sight Distance			
	Intermediate Sight Distance		180	130
	Overtaking Sight Distance			
			360	260
			640	470
13	Minimum Vertical Curve Length (SSD case)	M		
	Crest		73.6	
	Sag		41.5	
14	Minimum Vertical Curve Length (ISD case)	M		
	Crest		135	
	Sag		41.5	

S. N.	Design Specification	Unit	Proposed Design Standards
15	Design Service Volume	PCUs/	10000-40000
	For 4 Lane Road in Plain Terrain maintaining LOS B	Day	
16	Widening at curve locations	M	
	Up to 40 m		1.5
	41-60 m		1.2
	61-100 m		0.9
	101-300 m		0.6

Source: Design Report of GC road section 2025

Pavement Design

Pavement has been designed to withstand the traffic volume and axle load for 20 years period. Adequate drainage will be provided below the pavement layers and sub-grade level. Pavement layers in general will consist of granular sub-base, crushed stone base and asphalt concrete. Capping layer of suitable material will also be provided in those areas, where deemed necessary. Pavement will be designed as per Pavement Design Guidelines (Flexible Pavement)-2014 (Second Edition 2021), published by Department of Roads, Overseas Road Note 31 published by Transport Research Laboratory of UK and IRC-37-2018 as well as suggestions of DoR. The bituminous surface pavement (Asphalt) will be designed to meet the expected traffic level and sub-grade strength. The design of the intersections for access to approach for other connecting roads will to be provided to ensure the safety of vehicles diverging from or merging into high-speed road. Intersection will be considered for major feeder roads, minor feeder roads, district roads. Road furniture will be provided in the form of road signs, crash barriers, road markings, delineators, foot paths, covered side drains. The pavement design for the project road will be carried out adopting various parameters. The parameters that can adopted considering provisions/stipulations made in NRS 2070 and IRC-37-2018 as well as suggestions of DoR. The following parameters has been proposed for the pavement design.

This project being WB funded project, it will be sensible for the safeguard issues. Hence the project will perform environmental and social assessment in accordance with the World Bank's Environmental and Social Framework (ESF) requirements. Similarly, ESMF as well as Baseline Report of this project for WB will also be considered so that the IEE will also align with the WB report so that both the reports have consistency. Furthermore,

other prepared documents like RAP as well as Poverty and Social Analysis report will be accessed for IEE especially in social aspect

Table 1-3: Pavement design for the project

Proposed Pavement Type	Flexible Pavement
Design Period	20 years
Design Subgrade	Based on outcome of field survey
Axle Load Distribution	50%/50%
Vehicle for axle load consideration	All commercial vehicles
Design Codes	NRS 2070 IRC 37-2018 (verification by IIT Pave Software)

Source: Design Report of GC Road, 2025

1.5.2. Bridges

There are two major bridges and eight minor bridges in the project where additional double lane bridges will be constructed Upstream/Downstream (US/DS) of the existing bridge. All the bridges have been designed based on the guideline provided by Nepal Bridge Standards - 2067 of DoR & Wildlife Friendly Infrastructure Construction, 2022. The bridge in the chainage 648+561 & 649+257 (Bel and Jawai) has been considered as major wildlife crossing.

The designed discharge of 100 yrs. return period of the river has been considered for bridges. Similarly, all bridges are designed as per IRC loadings. Details of the bridges and constriction status/modality has presented in **Table 1-4**.

Table 1-4: Details of the bridges and construction status

S. N	Chainage	Name of the Bridge	Length	Type of construction	Remarks
1	640+262	Belwagurdawa	63	<i>Additional two lane will be constructed</i>	
2	641+637	Agaiya Nala	7	Dismantled and complete 4 lane will be constructed	
3	642+199	Kushma Nala	7	Dismantled and complete 4 lane will be constructed	
4	648+157	Dry Nala	14.3	Additional two lane will be constructed	
5	648+561	Bel Nadi	63	<i>Additional two lane will be constructed</i>	<i>Proposed for large and medium sized animal crossing</i>
6	649+257	Jawai	17	Additional two lane will be constructed	<i>Proposed for medium sized animal crossing</i>

7	650+768	Dry Nala/Nahar Bridge	7	Dismantled and complete 4 will be constructed lane	
8	651+614	Bantiya Nala	7.5	Dismantled and complete 4 lane will be constructed	

Source: Design Report of GC Road, 2025

1.5.3. Culverts

All existing culverts will be tested for capacity adequacy and accordingly inferior culverts will be modified. New culverts have been designed for 50 years return period of flood. All together there are 64 slab culverts and 7 pipe culverts in existing road which are proposed to be 60 box and 11 pipe culverts in the final design for cross drain of the discharge.

1.5.4. Side Drain

Two type of side drain exists along the road. Drainage at Imilia and Chandrauta bazar are closed type whereas open drain exists at Dumara, Kharendrapur and west of Chandrauta to Umari chowk. Both drains are observed clogged with the wastes and earthen materials. Closed rectangular box type of side drain has provisioned along the road side. Size of side drain have been selected on the basis of 25 years return period of flood. In the major settlement there are side drains for longitudinal discharge management. In Chandrauta west section large size of earthen side drains exists that drains its discharge into nearby cross drains. The hydraulic capacity of road side drainage has been calculated with 10% safety coefficient and 25-year flood return period. In many sections like Imilia settlement large size of closed drains (1.5m*2m) with RCC walls has also constructed to drain the discharge into Belwagurdawa river.

Existing side drains in different section of the road					
S.N.	Drain Start	Drain End	Side	Length (LHS)	Length (RHS)
1	640+300	640+380	LHS	0.08	
2	640+300	640+600	RHS		0.3
3	640+880	641+440	RHS		0.56
4	640+880	641+800	LHS	0.92	
5	641+650	641+800	RHS		0.15
6	642+440	642+730	RHS		0.29
7	644+850	645+200	RHS		0.35
8	647+920	648+080	RHS		0.16
9	651+180	651+780	LHS	0.6	
10	653+460	654+460	RHS		1
11	653+460	654+440	LHS	0.98	
12	654+950	655+070	LHS	0.12	
13	655+500	655+580	LHS	0.08	
14	657+650	657+800	LHS	0.15	

1.5.5. Protection Works

Protection works will be provided especially in the embankments area as well as upstream and downstream of culverts, bridges, road sides etc. All protection structures have been designed for design life of 50 years.

1.6. Project Related Activities

Pre- Construction Phase: The Contractors will prepare and get approval of CESMPs, Site-specific safeguard plans along with workers code of conduct before the commencement of construction activities. The details of plans will be determined during ESIA study and listed in the ESIA report. The project activities identified during this phase are: Finalization of design, bidding and selection of the construction contractor and deployment of the supervision consultant, compensation of land (if any), relocation of public utilities, tree felling process including identification and numbering of trees to be felled, identification of land for setting up of temporary contractor camp, labor camps, quarry site and borrow pit identification, material storage yard, preparedness, awareness to contractor's staff, location of storage yards and others etc. As RoW of the proposed road section is already under DOR and all the construction activities will be done within Right of Way (RoW), no extra permanent land is required for the project.

Construction phase: The project activities during this phase are:

- Cutting of trees and site clearance,
- Setting up of all construction and labor camps and plants including batching plants, hot mix plants, crushers etc.,
- Commencement of quarrying, and crushing activities, The proposed aggregate sources (Sand, gravel and boulder) are Belwagurdawa Khola, Agewa Nala, Surahi Khola, Rapti River and Banganga River. Approval of environmental assessment of the quarry site will be obtained for the extraction of riverbed materials from the local authorities. The proposed Crusher plant is at Ch. 640+000. The land lease agreement paper and approval from local authorities will be taken for operation of Crusher Plant. Site-specific quarry site operation plan & Crusher Plant operation plan will be prepared by the Contractor, approved by supervision consultant and shared with the WB.
- Civil works such as earth works, foundation excavation, structure construction, material storage and handling, construction yards and worker's yards construction, grading, pavement, drainage and cross drainage, road embankment, movement of vehicles and equipment, operation of Diesel Generator (DG) sets, crushers etc.
- Road furniture (Jersey Barriers) will be installed during the construction operation phase. It is practiced in the road upgrading works in Nepal. The interim traffic management measures will be considered and incorporated in the ESIA report

- Construction of structures related to animal pass, water holes (water ponds as water sources for wild animals), social structures etc.
- Road side plantation, Greenery, etc. (within and beyond RoW)
- Examine the construction induced impacts
- Implementation of Environmental and Social Management Plan (ESMP)

Operation Phase: The activities to be performed during operation phase of proposed road are as follows:

- Reinstatement of environment camps, quarry sites, borrow pits, labor camp, material storage yards etc.
- Management of water holes, animal crossings
- Pavement maintenance and rehabilitation work.
- Road furniture.
- Maintain the green area along the road alignment.
- Implementation of ESMP

CHAPTER 2: METHODOLOGY FOR BASELINE STUDY

2.1. Delineation of the Project Area

The survey was done using sampling method by stratifying the HHs with homogeneous character and used random sampling method for each stratified group. The project affected municipalities are considered to be within the Project Influence Area or Zone of Influence (ZOI). For GC road project, it is noticed that two municipalities of Kapilbastu district viz. Buddha bhumi municipality and Shivaraj Municipality lie within ZOI. The impact area has been further categorized into following as per ToR.

Individual HHs survey was conducted by using structured questionnaire. Qualified and trained enumerators were oriented and mobilized for the HHs survey and concurrently check the filled-up questionnaire by the supervisor to rectify any errors during the survey so as to avoid the second visit for same HHs.

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 involved consultations with stakeholders, including local communities, project affected HHs, interested parties and civil society organizations, to ensure that their concerns and perspectives are taken into account in the assessment and decision-making process. The stakeholder mapping has been conducted and identified the project-affected parties (covers directly project affected households, indigenous HHs/vulnerable HHs, marginalized groups), other interested parties (media, business person, transport workers, local NGOs/CBOs, IP/labor related organizations, local women groups, GoN offices etc.)

a. Right of Way (ROW)

Twenty-five meters both sides from center line of the proposed road have been considered within ROW of the proposed road. 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).

Census survey of all the affected structures has been done within this zone. Similarly, all the trees within this zone have been counted including the name of species, diameter and height. Within forest of this area, observation of wildlife movement and their habitat through direct and indirect method has been done.

b. Direct Zone of Area (DIA)

The areas within the 150 m on either side from the center of the road (300 m corridor) have been considered for a larger analysis of land use and other environmental features. 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. 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.

c. Indirect Impact Area (IIA)

The adjacent area within 300 meter either side of the road alignment (600 m corridor) are considered as the Indirect Impact Area (IIA). In this area, physical and biological environment will experience impacts during the time of construction. The IIA is evaluated as area of avoidance of the road by wildlife, which varies to 500 m deer and small mammals and to 1 km for medium size animal.

Besides, indirect impacts, there will be cumulative impacts during operation stage due as a result of better access to the area such as increased poaching, fodder collection, deforestation, unplanned human encroachment along the road and other similar activities in the region.

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 and indirect methods has been done.

2.2. Methodology for Collection of Baseline data

2.2.1. Physical Environment Baseline

2.2.1.1. Climate

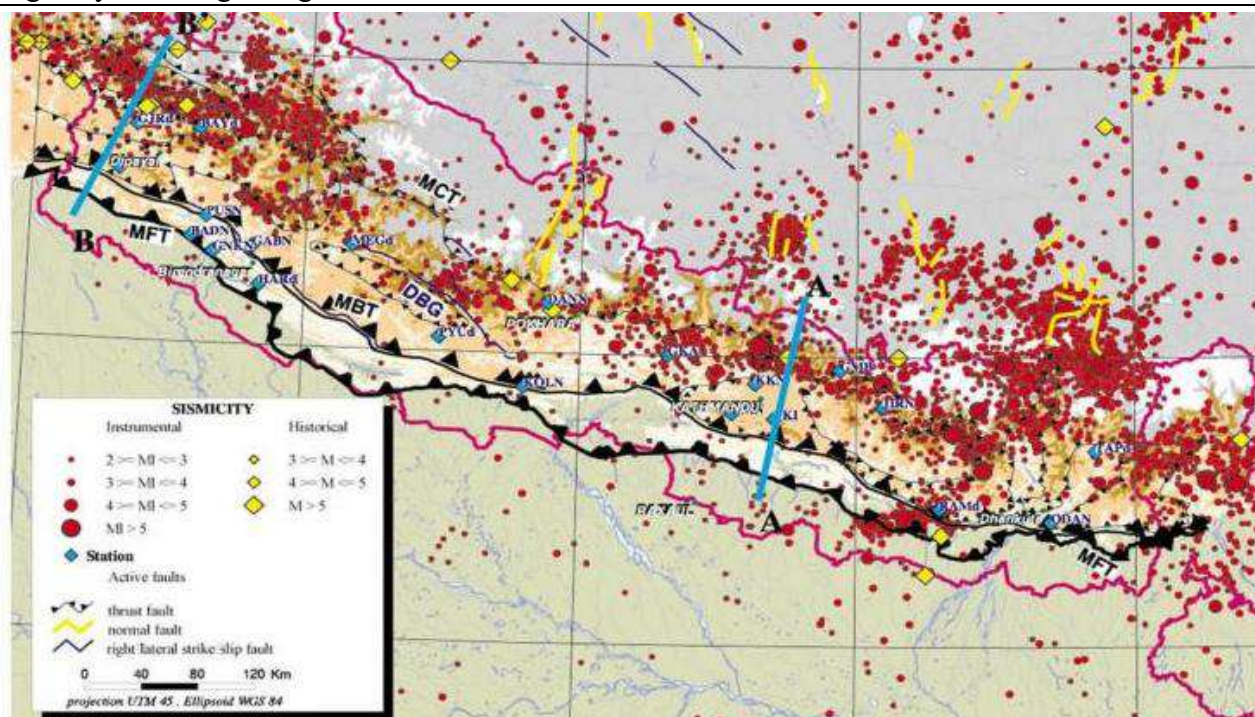
The temperature and rainfall data from Department of Hydrology and Meteorology (DHM) were used for the climate analysis. The climate data was taken for nearest station of Bhairahawa Airport Station (Station No-705) and Taulihawa Station (Station No-716).

2.2.1.2. Geology

The geological investigation includes study of relevant maps with 1:10,000 scale, reports and walkover survey to verify the physical characteristics, embankment stability, erosion, seismicity and land inundation and other threats to the proposed road alignment. Additional information about existing status of the area was documented with the help of local people. The tools used to collect the information was Focus Group Discussion (FGD), direct observations, measurements of physical parameters, interview with key informants and collection of recorded information at field level offices.

2.2.1.3. Seismic Hazards

For seismic data, reference from seismic zoning factor as per National Building Code (NBC 105:2020) has been collected and followed for designing the structures specially bridges of the project. Similarly, seismic hazard map of Nepal was also taken into



consideration as shown that the proposed upgradation site has rare seismic events and is in safe area in terms of seismic events in comparison to other parts of Nepal.

2.2.1.4. Air Quality

Air quality in the area was explored using Medium Volume sampler three sites. Air quality monitoring parameters like particulate matters PM_{2.5} and PM₁₀ similarly oxides of sulphur, nitrogen and carbon were collected as base line information. Air pollution in the area was identified taking samples from three sites viz.

Site	Location	GPS
M1	Imiliya	N27°39.593' E082°59.607'
M2	Jawai Khola	N27°38.900' E082°54.609'
M3	Chandrauta	N27°38.959' E082°51.859'

2.2.1.5. Noise Level

The average sound level in the area (representing settlements, market places, schools' and public places) was accessed using sound level meter. All the baseline was measured based on the related national guidelines. The noise level has been measured for 24 hours using Digital Sound Level meter. Equivalent noise levels due to traffic at the receivers are estimated using Federal Highway Noise model. List of sampling sites, its GPS position, minimum and maximum level of sound level as well as equivalent noise level has provided in table below and certificate of laboratory are presented in **annex** of the report.

Site	Location	GPS
M1	Imiliya	N27°39.593' E082°59.607'
M2	Jawai Khola	N27°38.900' E082°54.609'
M3	Chandrauta	N27°38.959' E082°51.859'

Noise Level Calculation Formula

The most commonly used parameters for measuring highway noise are the equivalent noise level (L_{eq}), minimum noise level (L_{min}), and maximum noise level (L_{max}).

Equivalent noise level (L_{eq}): The equivalent noise level (L_{eq}) is a measure of the average sound energy over a specified period of time (Day and Night).

To calculate L_{eq} , the following formula is used:

$$L_{eq} = 10 \log_{10} \left[\frac{1}{N} \left(10^{\frac{a1}{10}} + 10^{\frac{a2}{10}} + \dots + 10^{\frac{an}{10}} \right) \right] dAB$$

Minimum noise level (L_{min}): The minimum noise level (L_{min}) is the lowest sound pressure level observed during the measurement period.

Maximum noise level (L_{max}): The maximum noise level (L_{max}) is the highest sound pressure level observed during the measurement period.

Further, the recorded data were analyzed based on National Ambient Sound Quality Standard, 2012 and WHO Standards, 1999.

Table 2. 1: Noise level measurement from project area

SN	Name of area	Imaliya	Jawai River	Chandrauta
1.	GPS	N27°39.593' E082°59.607'	N27°38.900' E082°54.609'	N27°38.959' E082°51.859'
2.	Start time	2024-11-24; 10:30	2024-11-24; 10:30	2024-11-25; 10:30
3.	End time	2024-11-25; 10:30	2024-11-25; 10:30	2024-11-26; 10:30

Source: Field survey, 2024

2.2.1.6. Water Quality

Three major rivers along the road were used utilized for collection of surface water quality samples where water samples were drawn D/S of the existing bridge. Three water quality parameters were analyzed, out of which pH, Electric conductivity and turbidity were measured in situ whereas samples were preserved at 70% ethanol for the further laboratory analysis. Remaining analysis was performed in the laboratory of Lumbini Agro Environment Pvt. Ltd. The water sample collection date, time and results with standard value guidelines are clearly stated in the water quality report (ANNEX). The water quality parameters and method used for water quality analysis is presented in **Table 2.2**

Table 2.2: Parameters measured for water quality assessment

S. N.	Parameters	Test Methods
1.	pH at 17°C	Electrometric, 4500 - H ⁺ B, APHA
2.	Electrical Conductivity, (μS/cm)	Conductivity Meter, 2510 B, APHA
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA
4.	Total Hardness as CaCO ₃ , (mg/L)	EDTA Titrimetric, 2340 C, APHA
5.	Total Alkalinity as CaCO ₃ , (mg/L)	Titrimetric, 2320 B, APHA
6.	Chloride, (mg/L)	Argentometric Titration, 4500 - Cl ⁻ B, APHA
7.	Ammonia, (mg/L)	Direct Nesslerization, 4500 - NH ₃ C APHA
8.	Nitrate, (mg/L)	UV Spectrophotometric Screening, 4500 - NO ₃ ⁻ B, APHA
9.	Nitrite, (mg/L)	NEDA, Colorimetric, 4500 - NO ₂ ⁻ B, APHA
10.	Calcium, (mg/L)	EDTA Titrimetric, 3500 - Ca B & 3500 - Mg B APHA
11.	Magnesium, (mg/L)	
12.	Iron, (mg/L)	Direct Air - Acetylene AAS, 3111 B, APHA

Source: Lab Report, 2024

2.2.1.7. Green House Gas Emissions Calculations

The GHG emission calculation from construction phase has been done considering the material quantities required for the proposed GC 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)¹.

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.

2.2.1.8. Chemical Contamination

Apart from the other pollution effects, petro-chemical pollutants are more possible to spill due to improper utilization, handling and leakage during construction of the proposed bridge. There may have adverse effect especially on the aquatic environment of the major rivers (Belwagurdawa River and Bel River) through leakage of fuel, lubricants, oil, and cement during the road construction and other different chemical products like acid and dry cell battery during construction phase. Once discharged into water bodies and soil, petro-chemicals specially oil, grease and chemical like gypsum may have the effects of micro-organisms and other creatures in the surrounding. Thus, these aspects will be addressed by performing one time sampling for baseline and periodic water quality sampling at Upstream & Downstream of the proposed major bridge construction site in semi-annual basis during construction.

2.2.2. Biological Environment

A team comprising biodiversity experts, field surveyors, and assistants conducted the biodiversity study, covering various seasons to gather baseline data on wildlife. The survey dates are as follows:

1. April 10-16, 2024
2. August 15- 26, 2024

The methodology for collecting baseline information was developed in alignment with ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. Relevant studies conducted by the World Bank were also referred.

2.2.2.1. Desk Review

A comprehensive review of literature was conducted, including existing environmental studies, scientific publications from research and academic institutions, and other

¹ 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>

biodiversity assessments relevant to the project area and adjacent regions. National or regional plans, such as Strategic Environmental Assessments, National Biodiversity Strategies and Action Plans, forest management plans as well as conservation programs or initiatives led by the Department of Forest and other conservation partners, were also considered.

The project site and its immediate surroundings were analyzed concerning IUCN-listed threatened species, including Critically Endangered (CR), Endangered (EN), and Vulnerable (VU) species. Additionally, examined to assess the presence or absence of potential Critical Habitat trigger species and their associated habitat values such as Important Bird and Biodiversity Area (IBA), Wildlife Corridor, Ramsar Site etc.

2.2.2.2. Stakeholder Consultation

Consultations with stakeholders were conducted to gather insights on wildlife and their movement and understand the local community's dependence on natural resources. The stakeholders included:

- Division Forest Office Buddhabhumi including sub divisions at Kharendrapur and Champapur.
- Shivaraj and Buddhabhumi Municipalities and affected wards (Buddhabhumi-9 and Shivraj 1,3,4 and 5 of the project sites
- Kapilvastu Collaborative Forest Management Committee and Community Forest User Groups (Hariyali and Kanchan CFUGs)
- Local and Indigenous Communities
- NGOs working on wildlife, environmental, and social issues (eg. Bird Conservation Nepal)
- Wildlife Researcher and Activists



Photo Plate 2-1 Consultation meeting in Subdivision Forest office and with Community Forest user group (Source: Field survey, 2024)

2.2.2.3. Walk Through Observation

The expert's team conducted walk-through surveys along the road alignment and forest areas within the RoW, DIA, and IIA, documenting vegetation and wildlife observations on-site. During the walk-through observations, the team documented signs indicating the presence or absence of wildlife, such as footprints, burrows, den, pellets, feeding signs, and other evidence of causalities. Also consult with the local people who regularly visits to forest to collect fodder and grazing livestock regarding the wildlife they encounter and road crossing of wildlife.



Photo Plate 2-2 Walk through observation of vegetation and wildlife along the road
(Source: Field survey, 2024)

2.2.2.4. Transect Survey

The standard line transect method was employed to assess faunal diversity in the project area. Transect lines were plotted in the six-kilometer forest area with the interval of one kilometer for each transect. Altogether, 12 transects were walked and recorded the wildlife encounter in the area, their habitat and any evidences e.g. Sign and pugmarks, pellet, burrows, digging, foraging. Transects placed perpendicular to the road axis. The length of each transect was up to 500 meter which was determined by the habitat type and terrain. Transects were established on both sides of the road for comprehensive coverage

2.2.2.5. Bridges and Culvert Survey

Bridges and culverts, particularly those in the Kapilvastu Collaborative Forest were evaluated to determine their use by wildlife for crossing. While these structures were primarily designed for hydrological purposes and not for wildlife movement, observations revealed that both medium and small animals, including mammals, reptiles, and amphibians, were utilizing them for road crossings.

Footprints were documented at various river crossings and culverts identified during site visits to verify and confirm wildlife use. The following photographs were taken at bridges across the Bel nadi and Jwai khola rivers.



Photo Plate 2-3: Belnadi bridge and water body below Jwai khola bridge use by wildlife for drinking (Source: Field survey, 2024)

2.2.2.6. Nocturnal Survey

Nocturnal surveys were conducted between 7:00 PM and 5:00 AM in the forest area of the road to know the presence of nocturnal species and wildlife crossing the road. All encounters within the study area were documented in a comprehensive checklist for further analysis.

2.2.2.7. Road Kill Survey

Road kills observed during both day and night surveys were recorded. In addition, consulted with the local communities, forest guard and the forest department regarding road kill records. Also collected available photo, video and news information about the road kill in the project area.



Photo Plate 2-4: Feral cattle killed by hitting vehicle in the road (Source: Field survey, 2024)

2.2.2.8. Mammals

Approaches such as direct observation of animal tracks along the roadside, roadkill surveys, and analysis of animal movements (Smith and Ree, 2015) were employed to study mammals in the project area. Field surveys and interactions with local forest users were integral to this assessment. A transect survey was conducted, considering a 1-kilometer distance (500 m on either side of the road), where wildlife movement to and from the highway was most likely. Sign surveys were conducted to identify evidence such as pugmarks, footprints, hoof marks, scats, pellets, dung, and scratches on tree trunks. Roadkill surveys were performed sequentially after the sign surveys, incorporating consultations and studying available evidence. Records of mammal presence in the project area were documented and verified against “The Status of Nepal’s Mammals: The Red List Series” (Jnawali et al., 2011) for conservation status.

In addition to fieldwork, consultations were held with forest officials (from Division Forest Offices and Sub-Division Forest Offices), Local Forest Management Groups (Community Forest User Groups and Collaborative Forest Management Groups), and other stakeholders to gain a better understanding of key aspects of mammal activity and habitat use. Visual observations of mammals were made using both the naked eye and 10x42 binoculars and photographed by Nikon COOLPIX P1000 camera. Nighttime surveys also included driving along the road at a slow speed of 20 km/h to document animal crossings.

2.2.2.9. Bird Survey

The bird survey was conducted using the Mackinnon's Species Richness Counting Method (Bibby et al., 2000) to assess species richness, abundance, and distribution. Each bird species encountered whether seen or heard was recorded along with individual counts during the survey period. The survey covered the road, a 1 km buffer zone around the road, dumping sites, wetlands and other key areas. The recorded bird data were categorized and analyzed based on the following criteria:

1. IUCN Red List status (global and national) for Critically Endangered, Endangered, and Vulnerable species.
2. CITES listing.
3. Protection status
4. Presence of nesting colonies.
5. Migration status.

The "Birds of Nepal: An Official Checklist" (2022), published by the Department of National Parks and Wildlife Conservation and Bird Conservation Nepal, was used as a reference to prepare the bird species list for the project site.

A total of 9 vantage points were established along the 19 km road at intervals of approximately 2 km (road distance). A minimum of 30 minutes was spent at each vantage point to record all observed bird species along with their respective numbers. If a vantage point was found unsuitable, the nearest appropriate location was selected instead. Birds were observed by 10x42 binoculars and photographed by Nikon COOLPIX P1000 camera.



Photo Plate 2-5: Bird survey in the project area (Source: Field Survey 2024)

2.2.2.10. Amphibian and Reptile Survey

Amphibian and reptile survey was carried out by the combination of stationary point surveys and transect surveys, focusing on representative habitats throughout the proposed project area. Also visited the nearby wetlands and swampy areas. Efforts were made to assess the status of reptiles and amphibians in the study area, including species identification, territorial distribution, areas of concentration, and habitat conditions

Capture and Release method applied for sample collection of herpetofauna. Frogs and toads were captured using Insect Mesh Net for short span and released back after taking photographs for further identification process. While in the case of reptiles, photographs of directly observed creatures during survey taken for its identification. "Herpetofauna of Nepal-A Conservation Companion". For Turtles, "Turtles of Nepal: A Field Guide for Species Accounts and Distribution" (Aryal, P.C. et al., 2010) were followed for identification.

2.2.2.11. Fish Survey

Net fishing and indigenous ways of fishing (trapping and angling) used for fish sample collection Fish survey involve a combination of direct sampling, observation, and consultation to assess fish diversity, abundance, and habitat conditions. A fish survey was conducted by visiting rivers, streams, and other water bodies within the project area.

. The survey has been carried out nearby wetlands were also surveyed but excludes the farmed fishes. Consultations were held with local fishermen, and fish samples were collected during their catches. During consultations it has been found that the storm-based flash flood inundates the agricultural lands where people used to do fishing activities occasionally near Champapur



Photo Plate 2-6: Local people fishing in the roadside flooded area of agricultural land during the rain in monsoon near Champapur (Source: Field Survey, 2024)

2.2.2.12. Prominent Wildlife Crossings Survey

The direct and indirect count methods were employed to estimate wildlife road crossings along the project road. Walk through observation, drive through road at night documented the wildlife movement and potential areas of road crossing. Also consulted with various stakeholders, including local residents, livestock grazers, forest product collectors, field-level forest personnel. Additionally, Asian Development Bank's Green Infrastructure Design for Transport Projects, a road map to protecting Asia's wildlife biodiversity 2019 and Nepal's guidelines for construction of wildlife-friendly linear infrastructure, MoPIT.

Critical Habitat Screening and Assessment: Species and Landscape level

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).

The project area falls within the Terai Arc Landscape (TAL) which extends from Bagmati river east to the west in Terai landscape. The eastern section of the project area is lies within the Kapilbastu Important Bird and Biodiversity Area (IBA). Assessed the nesting and breeding success of White-rumped Vulture in the project site. Also track the movement of satellite tagged White-rumped Vulture in the project site.

2.2.3. Socio-economic and Cultural Environment

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

2.2.3.1. Reports/Documents Review

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

- Appraisal Environmental and Social Review Summary, Project Appraisal document, Appraisal Stage, (ESRS Appraisal Stage), SRCTIP 2020, The World Bank, Environmental and Social Framework (ESF).
- Environmental and Social Assessment (ESA) Report, of Kakarvitta- Pathalaiya Road Segment, and Butwal Gorusinghe Road segments of East West Highway, DCID, DoR, MoPIT
- Environmental and Social Impact Assessment, 2022, Initial Environmental Examination report and Resettlement Action Plan of Upgrading of Butwal-Gorusinghe Road Section of East-West Highway, 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
- Labor Management Procedures (LMP), 2022, ACCESS Phase-1
- Stakeholder Engagement Plan (SEP), 2020, ACCESS Phase-1, DoR-DCID, MoPIT
- Websites of the project affected municipalities

2.2.3.2. Sampling design and survey

The stratified sampling method was used for this environmental and social baseline survey design. Altogether (1562) households were identified using google base map as universe. The actual number of households were confirmed using ward data and ground verification by tole (settlement) consultation within the 300m on either side of the Right of Way of GC road section. For this, households within DIA were divided into twelve clusters as per the settlement pattern. All the households within these clusters were considered as universe. After that, different strata are identified on the basis of homogenous nature. The different strata were developed based on population composition: caste, ethnicity, disadvantage, vulnerable households with gender-disaggregate data. The sample was selected randomly generating numbers from each stratum maintaining inclusiveness based on the expert judgement. The sample size (312) is taken @ of 20 percent of whole universe.

a. Household Survey

In order to access the socio-economic status of households within the project area, sampled household survey was carried out within (300m. either side of RoW) the direct impact zone (DIA) of the project area. All together there were (312) surveyed households (20%) of universe in 300 m buffer in north and south of the highway were selected using stratified sampling method for household survey. The selected household was interviewed using structured questionnaire for household survey 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 (312) households, the household heads or available member were interviewed using structured questionnaire. 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.

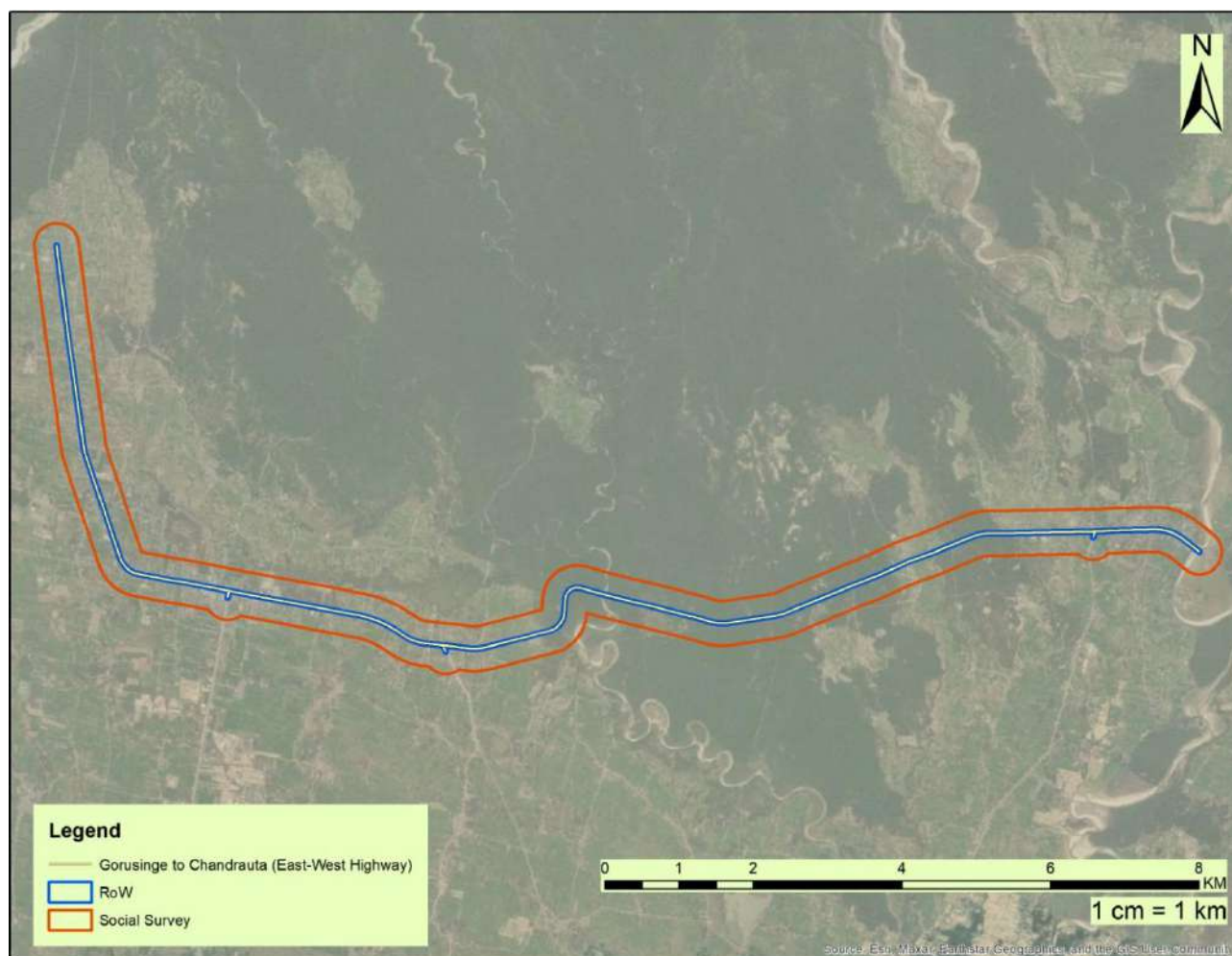


Figure 2.2-1: Survey Area for the Baseline study

b. Focused Group Discussions

A total of 12 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 ToR of the project. 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 concerned stakeholders representing local government/ward, local leaders, teachers, businessman, health workers, farmers, media person, local NGOs/CBOs, women groups, Indigenous people, forest user groups, social workers, senior citizen and local people from different ethnic group. 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, refreshment and attendance of the participants was recorded before the FGD event starts. The facilitators started the event by introducing and briefing about the GC road project, objectives of FGD event and discussed on subject matter as per checklist. All the participants were encouraged to share their view actively in the discussion. Most of the information related to public and cultural structures, status related to indigenous people, women group were collected through FGD. 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 GC road project.

C. Key Informant Interview

Division Forest Office (DFO), chair of community forest user groups, Ward chair, Mayors, Local leaders, Parliament member, member of temple management committee, school teachers, and medial personal, chair of CBOs related to differently able people etc. were the Key Informants. The 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 GC alignment by meeting them personally using standard checklist developed by the experts. 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 Altogether, 11 KIIS were conducted within the DIA and IIA of the GC 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.

2.3. Stakeholder consultation

Mapping: Government stakeholders from the local government (Mayor and ward chief), Provincial government (Division Forest Office, Sub-Division Forest Office and representatives) as well as federal government (district offices- urban and building development, survey office, district administration office etc. were identified as key stakeholders. Similarly, the project affected families as well as communities and peoples who can be directly affected or has been working in affected area and keep interest in construction works or can be affected by the road construction were considered as the primary stakeholders. They were identified and notified for the sharing their views on upgradation of the road

Notification: Different modes of communication were used for notifying the stakeholders in the project affected area. Message were dispatched through telephone contact, notification through social media, local elite persons, politicians, social workers etc. were consulted for the consultations. Furthermore, all the stakeholders were notified through public notice dated 10th February, 2025 and also informed them through official letters,

message, phone conversation and by email. The notification also shared through local government for the project affected parties as well as other interested parties as per the requirement of the ESS 10 of the ESF.

Consultations: Altogether, 28 formal and informal consultation meeting were conducted in the project area during baseline survey. There was presence of 675 people as well as stakeholders. Among those participants, 547 were male and 128 were female. The separate consultations have been carried out with women groups to ensure meaningful participation (mix and indigenous groups). Around more than 100 women have been participated in these consultations)

CHAPTER 3: BASELINE INFORMATION ON PHYSICAL ENVIRONMENT

3.1. Topography

The proposed road section passes entirely through plain terrain (generally varies from 100-150 masl). It starts from Belwagurdawa Nadi Bridge (CH 640+220) i.e., continuation of Butwal-Gorusinghe Section and ends at Umari/Shivpur Chowk, about 6.5 km west from Krishnagar chowk at Chandrauta. The project road passes through Buddhabhumi and Shivraj municipality crossing through two major settlements viz Gorusinghe and Chandrauta via small built sections such as Imiliya, Champapur, Kharendrapur and Shivpur etc. The Topographical Map showing the road alignment is attached in Annex.

3.2. Climate

The proposed project area lies in Terai region having tropical climate zone. Due to major difference in maximum and minimum temperature summer is very hot whereas winter is foggy and colder. Based on the climatic data from world weather atlas, average daily temperature ranges from 11.8°C (53.2°F) to 39.8°C (103.6°F) with the lowest temperatures occurring in January and peak temperatures in May in Kapilbastu district. Similarly, humidity varies from 25% in April to 68% in July and August. Average daily rainfall ranges from a paltry 1 mm (0.04") in November to a considerable 248 mm (9.76") in July. In the similar manner, about 80% of the total rainfall occurs in rainy season having average annual rain fall of 1699.6 mm. January proves to be the driest month with just 2.8 days of rainfall, while July has the maximum hazard of rain with 23.8 days.

A. Temperature and Rainfall of Project Area

Temperature and rainfall data of Kapilbastu (Taulihawa Station) was collected from Department of Hydrology and Meteorology (DHM). Based on the available data, the average maximum and minimum temperature of the Taulihawa station was measured to be 30.93°C and 18.79°C, respectively. The average annual rainfall in Kapilbastu District is 1,622 mm (**Table 3.1**).

Table 3.1: Annual rainfall and temperature of the project area

Station Name	Station No.	Rainfalls (mm)		Temperature (°C)	
		Annual	Monsoon	Average Min Temperature (°C)	Average Max Temperature (°C)
Taulihawa	0716	1,622	1,411	18.79	30.93

Source: Department of Hydrology and Meteorology, 2024

3.3. Geology and Soils

The road alignment falls on the sediment of the Gangetic Plain (Upper Terai). The area consists of coarse sediments developing gently sloping surface toward south. Soils along the road section are mostly of recent alluvial deposits, represented by silt, clay, gravel also including boulder and cobble. Soils are mostly stable, but it is possible to occur erosion mostly along river banks. The project site is in plain areas and no slides and unstable areas can be found at this project site. The geology and soil type map is shown in **Figure 3.1** and **Figure 3.2** respectively.

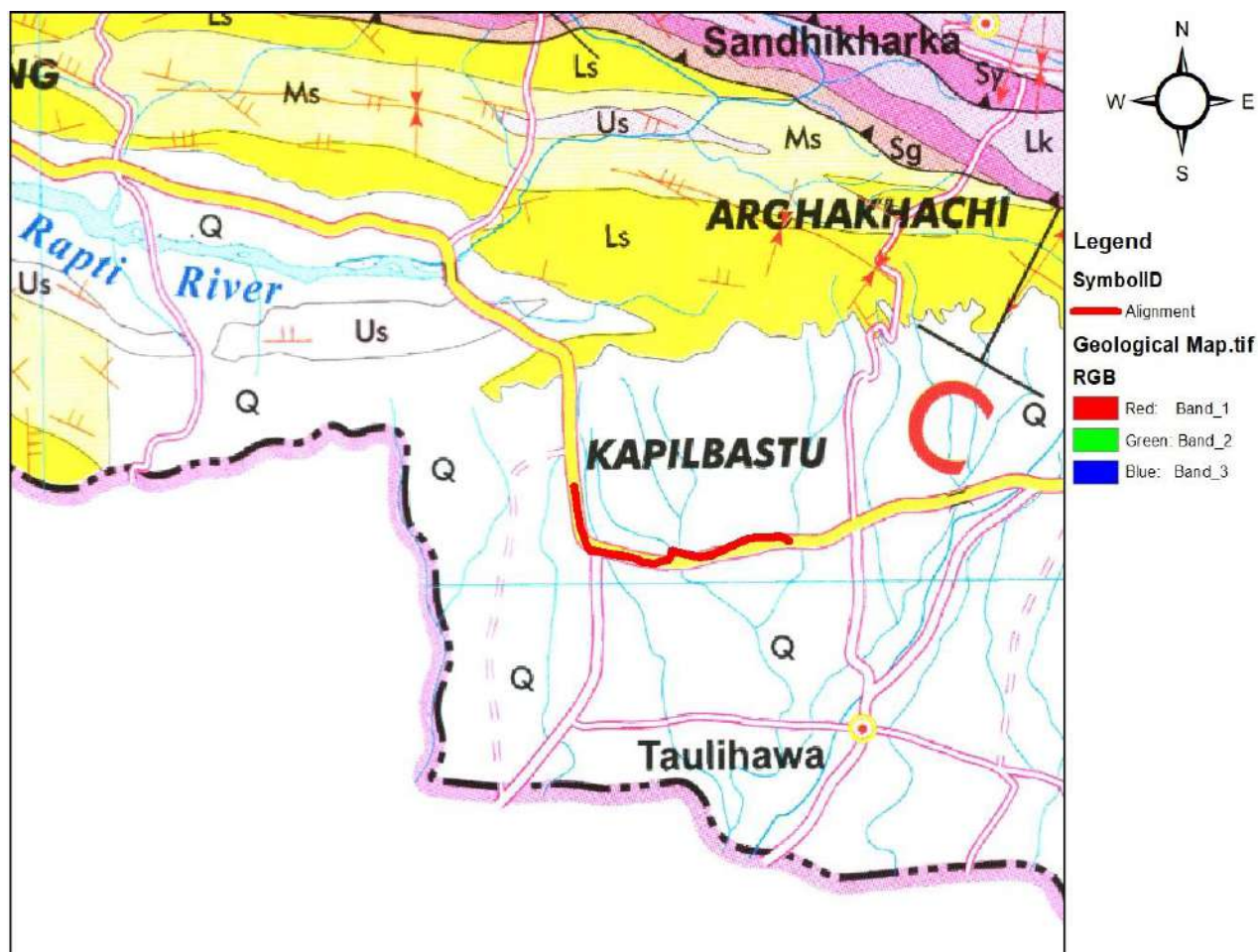


Figure 3.1: Geology map of the project area

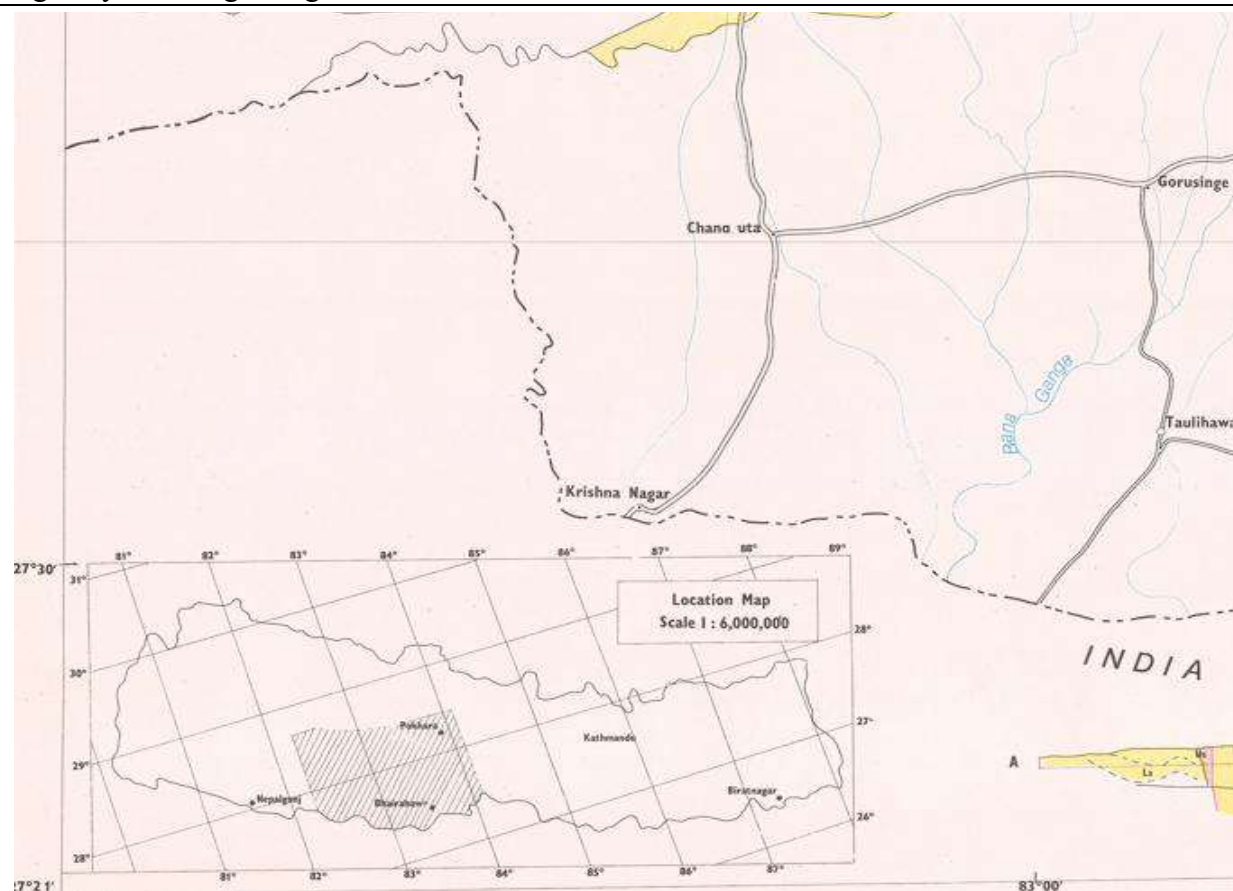


Figure 3.2: Recent Alluvial soil found in the project area

3.4. Flood Risks Hydrology (flood prone area, stream, river, existing drain facilities)

There are four major bridges, eight minor bridges and 64 box culverts as well as 7 pipe culverts for draining water downstream i.e towards south. These rivers are of local origin i.e. are originated from Churiya hence have high discharge only during monsoon. Among them Bhargardawa river is the largest one and is reported that splash flooding occurs during intense rainfall. Apart from it, other bridges are sufficient to hold floods. Most of the section lie in high land area hence do not have water lodging issues. Furthermore, Champapur and Chandrauta section of the road are relatively at low land area hence have reported issues of water lodging in some locations during monsoon. There could be special requirements to make arrangement to drain the discharge completely downstream of the road so that the road remains safe for the project. Catchments of the project area have been delineated by GIS and checked by overlapping them on Google Earth Professional. Figure 10 shows the catchment area of the river of the GC road.

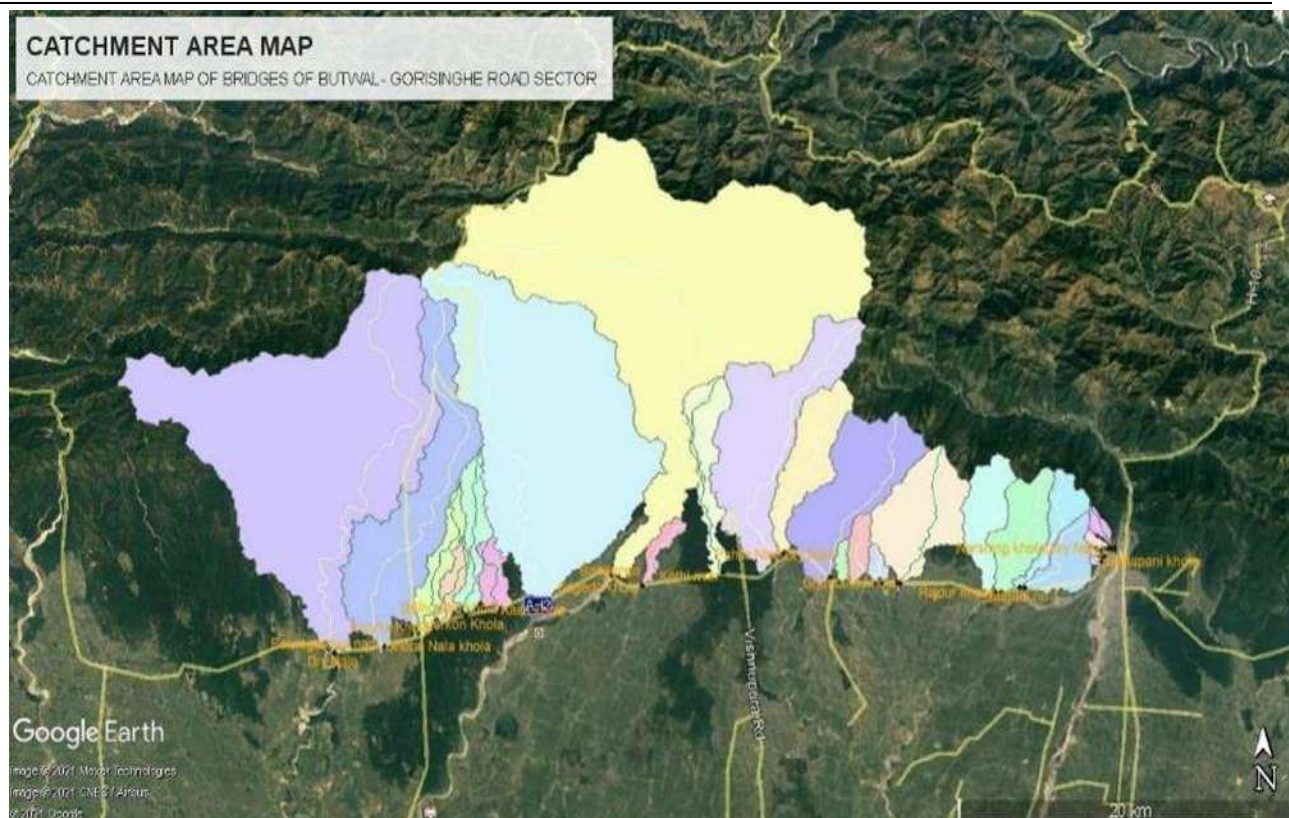
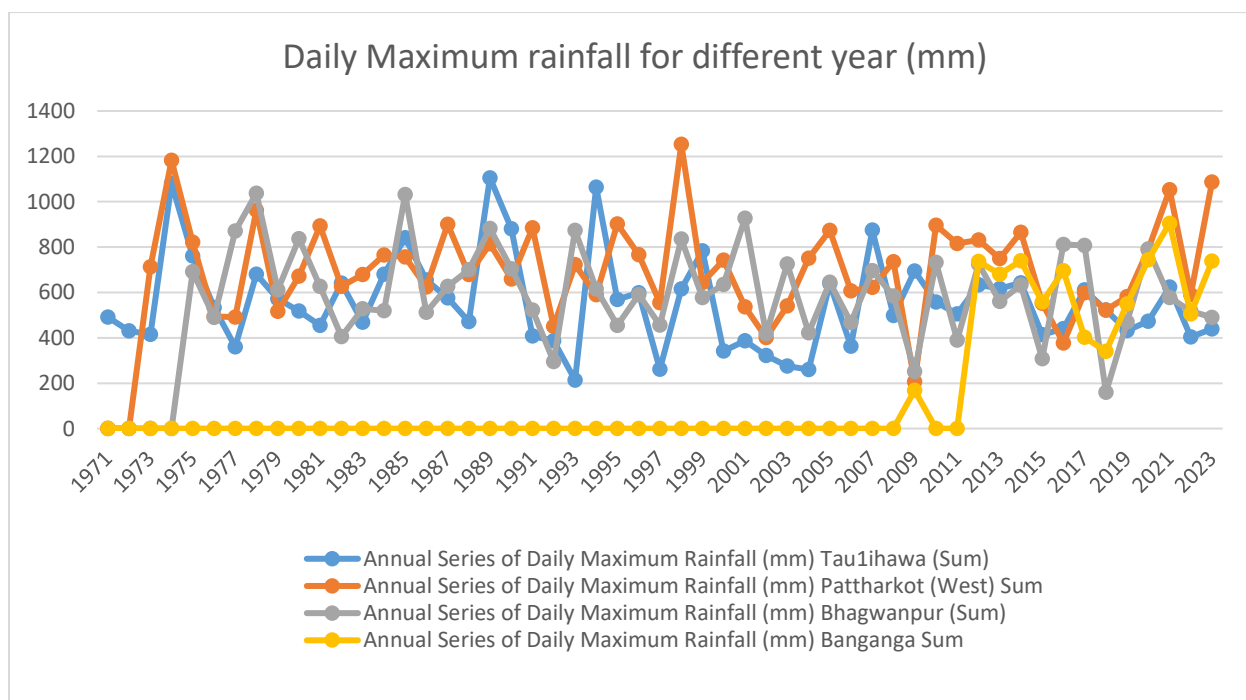


Figure 3.3: Catchment area of rivers of Butwal-Gorusinghe road



Maximum daily rainfall for different year for the Taulihawa, Pattarkot, Bhagwanpur and Banganga area are presented on above chart. (Source: Detail design report, 2025)

Table 3.2: River and rivulets across the road

S. N.	Chainage	Type	Span Arrangement	Length	Type of construction
1	640+262	MJBR	3*21.00 m	63	Additional two lane will be constructed
2	641+637	MNBR	1*7*2.525 m	7	Dismantled and complete 4 lane
3	642+199	MNBR	1*7*2.525 m	7	"
4	643+976	MNBR	1*7*2.525 m	7	"
5	645+789	MNBR	1*7.5*4.025 m	7.5	"
6	647+038	MNBR	1*6.5*4.567 m	6.5	"
7	648+157	MNBR	1*12.6 m	12.6	Additional two lane will be constructed
8	648+389	MNBR	1*6.5*4.066	6.5	Dismantled and complete 4 lane
9	648+561	MJBR	3*21.00 m	63	Additional two lane will be constructed
10	649+257	MNBR	1*17.0 m	17	Additional two lane will be constructed
11	650+768	MNBR	1*7*3.414 m	7	Dismantled and complete 4 lane
12	651+614	MNBR	1*7.5*5.055 m	7.5	"

Source: Design Report of GC Road, 2025

3.5. Seismic Hazards

In Nepal, specific standards for constructing large infrastructures to withstand seismic tremors have not yet been developed. However, the national building code published by the Government of Nepal can be used as general guidelines. According to Bajracharya (1994), the Nepal Himalaya has been subdivided into five seismic zones (Zone1, Zone 2, Zone 3, Zone 4, Zone 5) with relation to the seismic hazard (Low, Moderate and High). The road alignment falls in the seismic low to moderate hazard area (Seismic zone 3 to 4). The Peak Gravitational Acceleration (PGA) value in the project area ranges from 0.095 to 0.115 g ().

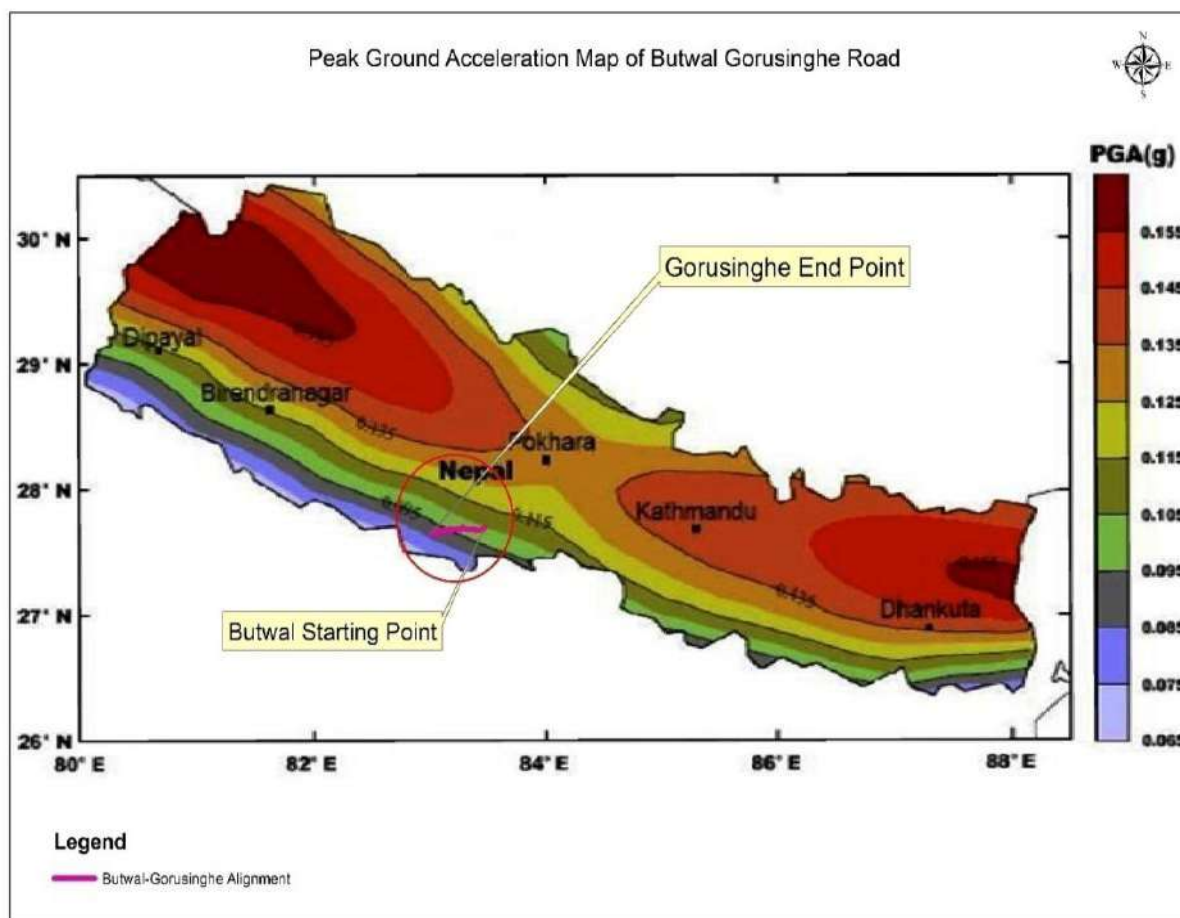


Figure 3.4: Peak gravitational acceleration map of Nepal indicating project area

3.6. Land use Patterns

The land use is predominantly agricultural, rural and forest section except few settlements. The land use pattern in the project area is categorically presented in figure 10. The entire road section lies within the RoW of DOR and there is mixed land use pattern along the both side of the road. Several Fuel Station exist in the entire project corridor. Along the project road, there is major parts of community managed forests. Several numbers of public utilities like electric poles, solar poles, cable, telephone and internet cable, water pipe line etc. either running parallel or crossing the project road at different locations. In addition, several crossings of electric cables including high-tension line are common in the road section. During reconnaissance, it has also observed that Optical Fiber Cable (OFC) lines of different telecom companies are running parallel on either left or right side of existing road

There will be no need to acquire new land for upgrading the road as it already has its 50 m RoW. The land use is predominantly agricultural and rural except at forest area. There is mixed land use pattern along the both side of road. Most of the land around the existing

road is barren land. Proposed formation will extend to 24 m at rural and forest area similarly will occupy entire RoW especially at urban areas with dense settlements at Imiliya and Chandrauta section. The details of land use pattern in the project site are presented in 3.3.

Table 3.3: Chainage length (m) land use pattern

LHS				RHS			
Chainage		Land Use	Length	Chainage		Land Use	Length
From	To			From	To		
640+200	640+290	River		640+200	640+290	River	
640+290	640+400	Barren land		640+290	640+440	Barren land	
640+400	640+500	Settlement		640+440	640+500	Agricultural land	
640+500	641+500	Barren land		640+500	641+500	Barren land	
641+500	641+540	Agricultural land		641+500	642+000	Barren land	
641+540	641+800	Barren land		642+000	642+200	Agricultural land	
641+800	642+300	Agricultural land		642+200	642+930	Barren land	
642+300	643+650	Barren land adjacent to forest		642+930	643+200	Barren land adjacent to forest	
643+650	643+900	Forest Area		643+200	643+740	Forest Area	
643+900	644+510	Agricultural land		643+740	644+300	Agricultural land	
644+510	645+000	Forest Area		644+300	644+500	Barren land	
645+000	645+210	Barren land adjacent to forest		644+500	644+700	Forest Area	
645+210	645+400	Forest Area		644+700	645+400	Barren land adjacent to forest	
645+400	645+660	Barren land adjacent to forest		645+400	645+860	Forest Area	
645+660	645+800	Forest Area		645+860	648+520	Barren land adjacent to forest	
645+800	645+900	Barren land adjacent to forest		648+520	648+600	River	

Environment and Social Baseline Report of the Goringhe-Chandrauta Section of East-West Highway including Bridges, 2025

LHS				RHS			
Chainage		Land Use	Length	Chainage		Land Use	Length
From	To			From	To		
645+900	647+760	Forest Area		648+600	649+080	Barren land adjacent to forest	
647+760	648+050	Barren land adjacent to forest		649+080	649+260	Forest Area	
648+050	648+520	Forest Area		649+260	649+330	Barren land	
648+520	648+600	River		649+330	649+800	Forest Area	
648+600	649+100	Forest Area		649+800	650+000	Barren land	
649+100	650+000	Barren land adjacent to forest		650+000	650+440	Vegetation	
650+000	650+100	Barren land		650+440	651+100	Agricultural land	
650+100	650+440	Vegetation		651+100	652+300	Barren land	
650+440	651+100	Agricultural land		652+300	652+500	Agricultural land	
651+100	651+600	Barren land		652+500	653+600	Barren land	
651+600	652+040	Agricultural land		653+600	654+800	Barren land adjacent to settlement	
652+040	652+150	Vegetation		654+800	654+940	Vegetation	
652+150	652+200	Barren land		654+940	658+000	Agricultural land	
652+200	652+330	Vegetation		658+000	659+300	Barren land adjacent to settlement	
652+330	652+840	Barren land		659+300	659+570	Agricultural land	
652+840	652+910	Agricultural land		659+570	660+000	Barren land adjacent to settlement	
652+910	653+200	Barren land with sparse vegetation		660+000	660+038	Agricultural land	

Environment and Social Baseline Report of the Goringhe-Chandrauta Section of East-West Highway including Bridges, 2025

LHS				RHS			
Chainage		Land Use	Length	Chainage		Land Use	Length
From	To			From	To		
653+200	654+800	Barren land adjacent to settlement					
654+800	654+940	Vegetation					
654+940	655+700	Barren land					
655+700	655+900	Vegetation					
655+900	655+970	Agricultural land					
655+970	656+160	Barren land					
656+160	656+240	Pond (Water Body)					
656+240	656+400	Agricultural land					
656+400	656+500	Settlement					
656+500	658+600	Agricultural land					
658+600	658+700	Settlement					
658+700	659+270	Agricultural land					
659+270	659+340	Barren land					
659+340	659+830	Agricultural land					
659+830	659+940	Settlement					
659+940	660+038	Agricultural land					

Source: Detailed Design report and field visit, 2025

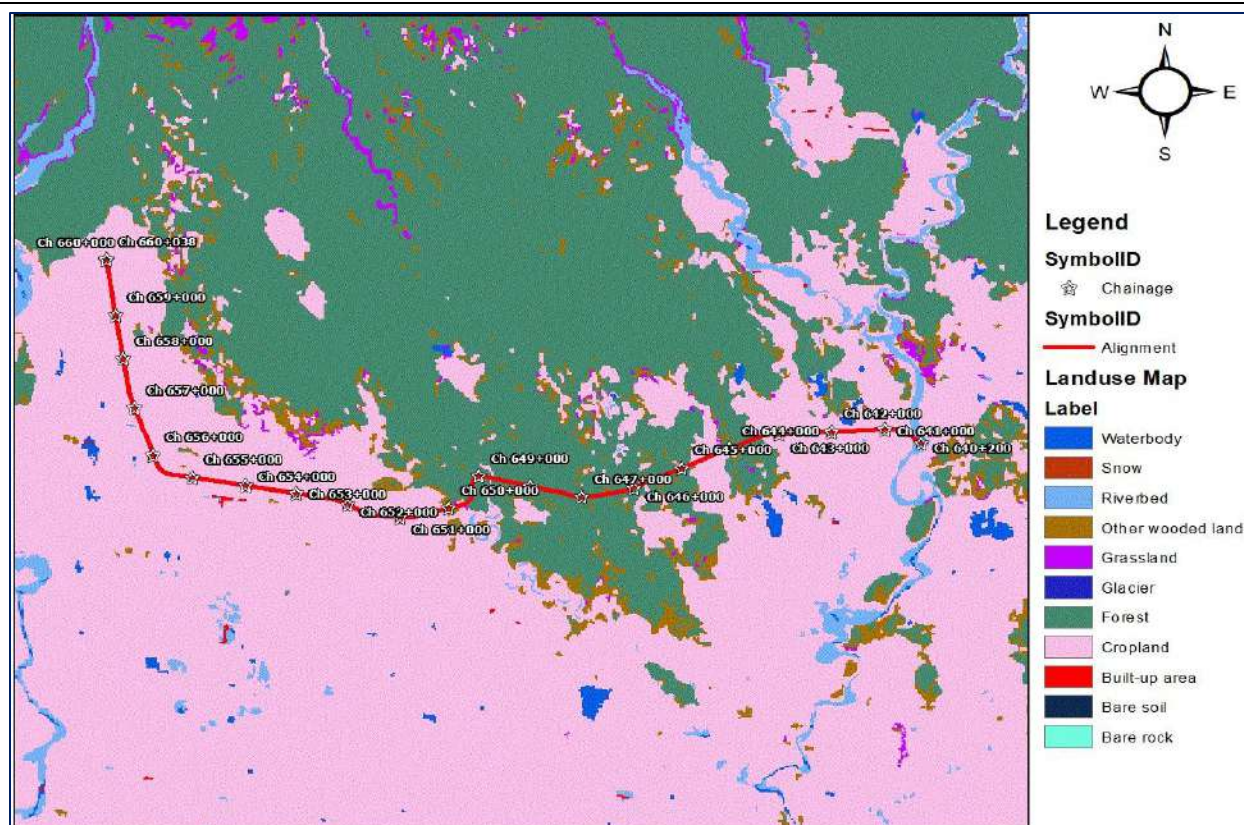


Figure 3.5: Land use pattern of project area

3.7. Air Quality

Baseline Air Quality of the project area is given in **Table 3-4** and the Lab analysis report for air quality is given in **Annexure 2**. It is noticed that all the monitored parameters were within National Air Quality Standard (NAQS), Ministry of Forests and Environment, 2012.

Table 3. 4: Baseline Air Quality (24 hour averaging time)

S.N.	Parameter s	Unit	Observed Value			Tolerance Limit (National Air Quality Standard, Ministry of Forests and Environment, 2012) ($\mu\text{g}/\text{m}^3$)	Remarks
			M1	M2	M3		
1.	TSP	($\mu\text{g}/\text{m}^3$)	110	75	85	230	Exceeding the limit
2.	PM10	($\mu\text{g}/\text{m}^3$)	70	55	65	120	Exceeding the limit
3.	PM2.5	($\mu\text{g}/\text{m}^3$)	25	15	20	40	Exceeding the limit
4.	SO ₂	($\mu\text{g}/\text{m}^3$)	N.D.	N.D.	N.D.	70	Within the limit
5.	NO ₂	($\mu\text{g}/\text{m}^3$)	N.D.	N.D.	N.D.	80	Within the limit

Note: N.D.: Not Detected, Where: M1- Imiliya, M2- Jwai Khola, M3 – Chandrauta

Source: Measurement and Lab Analysis 2024

Table 3-4 represents 24 hours air quality monitoring data. 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.

3.8. Noise Level

Noise Level of the project area as measured in three different locations viz Imiliya settlement, Jawai khola and Chandrauta settlement along the road and presented in Table 3.5. It is noticed that both sound level as well as equivalent noise level at are higher at Chandrauta chowk than in other places. All the places have not exceeded National Standard for Noise Level 2069 for urban residential area and was within the range of commercial area. Measured noise level categorically represents urban (Imiliya and Chandrauta) and forest area (Jawai River) as presented in table 3.5. The observed noise level in those places was found within the range of urban area provided in the national standard. Peak noise is recorded when vehicles (mainly trucks and buses) blow pressure horn. Even though, the value of equivalent noise is low at night its impact is high due to lack of background noise.

Table 3.5: Noise Level within Project Area

SN	Name of area	Imiliya	Jawai River	Chandrauta
1.	GPS	N27°39.593' E082°59.607'	N27°38.900' E082°54.609'	N27°38.959' E082°51.859'
2.	Start time	2024-11-24; 10:30	2024-11-24; 10:30	2024-11-25; 10:30
3.	End time	2024-11-25; 10:30	2024-11-25; 10:30	2024-11-26; 10:30
Noise level dB(A)				
4.	Maximum	72	55	75
5.	Minimum	43	35	45
Equivalent Noise dB(A)				
6.	$L_{eq(day)}$	66	52	70
7.	$L_{eq(night)}$	53	40	55

Source: Field Measurement, 2024

Table 3. 6: National Ambient Sound Quality Standard, 2012 and WB-EHS Standard 2007

S.N.	Area/Zone	NASQS limit (dBA)		WB-EHS limit (dBA)	
		Day	Night	Day	Night
1	Commercial	75	70	70	70
2	Residential	65	55	55	45

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

3.9. Water Quality

Surface water quality of the three rivers where major bridge construction has to be done were monitored and result of surface water quality is presented in Table 3.7. The different parameters like pH, Temperature, TDS, Electrical conductivity, COD, DO, TSS were measured. All water quality parameters were compared with the national drinking water quality standard for industrial release and found that none of the parameters exceeded the permissible standard value of potable water. The Lab analysis result for water quality is given in **Annexure 3**. In case of drinking water, it is noticed that beside *E. coli* contamination, all the other measured parameters are within NDWQS, 2062.

Table 3.7: Water Quality of surface water body along the Project Area

S.N .	Category	Parameters	Method	NWQS (MOE 2010)	Belgarda wa river	Bel River	Jawa i River
1.	Physical	pH	4500 H.B. APHA 23 rd edition	5.5-9.0	8.0	7.6	7.5
2.		Temp. °C	Thermometric	-	300	21.7	21.6
3.		TDS (mg/L)	2540 C. APHA 23 rd edition		162	286	395
4.		Electrical Conductivity (µS/cm)	2540 C. APHA 23 rd edition		1.49	528	730
5.	Chemical	Total Suspended Solids, TSS (mg/L)	Filtration	50	0.041	25	18
6.		Chemical Oxygen Demand (mg/L)	Dichromate method	250	38.68	65	75
7.		Dissolved Oxygen (mg/L)	Iodometric method		107.52	7.88	7.82

Source: Field Measurement and Lab Analysis, 2024

3.10. Soil Quality

Baseline data on soil quality of the near from the bridges and agricultural lands is given in **Table 3.8**. Lab analysis report of these soil samples is given in **Annexure 4**.

Table 3. 8: Soil Quality within Project Area

S.N.	Soil Test	Method	Near Belwagurdawa	Near Bel	Near Jwai Khola
1.	pH	Electrometric	8.3	8.0	7.2

2.	EC (µs/cm)	Electrometric	89	300	118
3.	TDS (ppm)	Electrometric	49	162	64
4.	SOM (%)	Walkly and Black	1.72	1.49	1.31
5.	Nitrogen (%)	Kjeldhal	0.073	0.041	0.035
6.	Phosphorus (Kg/Ha.)	Modified Olsen's	31.79	38.68	33.68
7.	Potassium (Kg/Ha.)	Ammonium Acetate	161.88	107.5 2	134.40

Source: Lab Analysis Report, 2024

For the proposed project, different associated/ancillary facilities are required like contractor and labor camps, construction yards, stockpiling yards, quarry and burrow pit sites, crusher plant sites, hot mix plants, batching plants etc. Haphazard disposal of wastes (both solid and liquid), leakage of oil and grease from construction vehicles, machineries and equipment, inappropriate storage and handling of chemicals etc. can contaminate soil, surface water and ground water during construction phase.

3.11. Existing and Predicted Traffic Volume

As per Detailed Design Report 2024, traffic data was collected for continuous seven days at two locations along the road sections. The representative Average Daily Traffic (ADT), expressed as numbers of vehicles are given Table 3.9:

Table 3.9: Traffic Count Result (ADT)

Vehicle Type	UP Direction		DN Direction	
	At Imiliya	At Chandrauta	At Imiliya	At Chandrauta
Car	1,628	629	1,646	630
Utility vehicle (Pickups, 4WD)	895	242	894	197
Minibus, Matatu	450	309	466	315
Medium bus or coaster	483	237	437	205
Large Bus, coach	606	230	546	304
Light Truck (Dynos, etc)	69	72	606	230
Heavy truck (Fuso 10-tyre, etc)	305	334	268	348
Multi Axle	259	585	271	617
Motor Cycles	7,983	2,541	8,140	2,782
Tractor-Trailer	145	122	128	154
Total	12822	5301	13403	5782

Source: Detailed Design Report, 2025

On the basis of this data, past trend, and seasonal variation factor the design has estimated Annual Average Daily Traffic (AADT) at two locations of road sections. Estimated AADT for base year (i.e. 2024) is given in Table 3.10.

Table 3.10: Traffic Estimation for Base Year

Vehicle Type	UP Direction		DN Direction	
	At Imiliya	At Chandrauta	At Imiliya	At Chandrauta
Car	1,514	585	1,531	586
Utility vehicle (Pickups, 4WD)	832	225	831	183
Minibus, Matatu	419	287	433	293
Medium bus or coaster	449	220	406	191
Large Bus, coach	564	214	508	283
Light Truck (Dynos, etc)	64	67	564	214
Heavy truck (Fuso 10-tyre, etc)	284	311	249	324
Multi Axle	241	544	252	574
Motor Cycles	7,424	2,363	7,570	2,587
Tractor-Trailer	135	113	119	143
Total	11925	4930	12464	5377

Source: Detailed Design Report, 2025

Table 3.11: Traffic Forecast for the 20 years (projected year)

At Imiliya					
Vehicle Type	2024	2029	2034	2039	2044
Car	1,514	5,308	8,070	11,791	16,443
Utility vehicle (Pickups, 4WD)	832	2,194	2,701	3,261	3,846
Minibus, matatu	419	1,185	1,538	1,944	2,386
Medium bus or coaster	449	1,271	1,650	2,085	2,559
Large Bus, coach	563	1,594	2,070	2,617	3,211
Light Truck (Dynos, etc)	64	168	207	250	295
Medium Truck (Lorries, etc)	284	748	920	1,111	1,310

At Imiliya					
Vehicle Type	2024	2029	2034	2039	2044
Heavy truck (Fuso 10-tyre, etc)	241	636	783	945	1,115
Truck Trailer and Semi-Trailer	7,424	19,575	24,092	29,087	34,312
Motor Cycles	135	238	317	409	512
Bicycles	0	0	0	0	0
Total Vehicles	11925	32,917	42,347	44,437	46,641
Total PCUs	30,070	81,246	1,02,233	1,06,797	1,11,577

Source: Detailed Design Report, 2025

Table 3. 12: Traffic Forecast for the 20 years (projected year at Chandrauta)

At Chandrauta					
Vehicle Type	2024	2029	2034	2039	2044
Car	585	2,075	3,154	4,609	6,428
Utility vehicle (Pickups, 4WD)	225	597	734	887	1,046
Minibus, matatu	287	819	1,063	1,344	1,649
Medium bus or coaster	220	628	815	1,031	1,265
Large Bus, coach	214	610	791	1,000	1,228
Light Truck (DYNAS, etc)	67	178	219	264	311
Medium Truck (Lorries, etc)	311	824	1,014	1,224	1,444
Heavy truck (Fuso 10-tyre, etc)	544	1,443	1,775	2,143	2,528
Truck Trailer and Semi-Trailer	2,363	6,266	7,711	9,310	10,983
MotorCycles	113	201	267	345	431
Bicycles	0	0	0	0	0
Total Vehicles	4,930	6,668	8,587	12,304	12,952
Total PCUs	12,555	16,933	21,735	31,040	32,545

Source: Detailed Design Report, 2025

3.12. Green House Gas (GHG) Emission Analysis for GC road Project

GHG Emissions in Construction Phase of GC road Project

There are several steps involved in road construction that contribute to the production and release of GHG emissions: site clearing, subgrade preparation, production of

construction materials (granular sub-base, base course, surfacing), site delivery, construction works, ongoing supervision, maintenance activities, and so on.

The challenge of global climate change has motivated state transportation agencies involved in the construction and maintenance of transportation infrastructure to investigate strategies that reduce the life cycle greenhouse gas (GHG) emissions associated with the construction and rehabilitation of highway infrastructure.

The bulk of the emissions associated with road construction and maintenance activities is often associated with the upstream emissions embodied in the materials used (Noland and Hanson, 2015). These materials primarily include asphalt, concrete, and steel.

Research has suggested that the life-cycle GHG emissions associated with building roads can account for 10–20% of the emissions associated with the lifetime usage of the road by vehicles (Chester and Horvath, 2009, Noland and Hanson, 2015).

The GHG emission calculation from construction phase was done considering the material quantities required for the proposed GC road. The major materials required for construction are Soil, Aggregate, Bitumen, Cement and Steel etc. The emission factors used from “Guidelines for estimating greenhouse gas emissions of Asian Development Bank projects: Additional guidance for transport projects”. CO₂ quantities calculated refers to the embodied carbon in construction materials. The emission factors and quantities of Kg CO₂ equivalent obtained indicate that Cement and Steel have more carbon embodied among construction materials. This also indicates a greater number of structure occurrence in the proposed road project. The estimation of GHG due to construction material is given in **Table 3.13**.

Table 3. 13 Estimation of GHG Emission by Construction Material Requirement

Material	Unit	Quantity required	Unit conversion	Kg CO ₂ equivalent	Emission factor
Soil	Cum	942,820.18	1,697,076,321.71	3,394,152.64	.002 kg CO ₂ per kg
Steel	MT	3,181.79	3,181,794.22	4,645,419.56	1.460 kg CO ₂ per kg
Aggregate	Cum	548,477.77	1,426,042,196.71	5,704,168.79	.004 kg CO ₂ per kg
Bitumen	Ton	5,445.93	5,445,926.18	359,431.13	.066 kg CO ₂ per kg
Cement	Ton	40,063.26	40,063,261.76	30,528,205.46	0.762 kg CO ₂ per kg
Sand	Cum	34,163.04	61,493,479.24	122,986.96	0.002 kg CO ₂ per kg
Total				44,754,364.54 Or 44,754 Tons	

Source: Detailed Design Report 2023 and Calculations from ADB Guidelines

As a whole, roadway construction only makes up a small part of the energy use of a roadway throughout its lifetime than roadway traffic in operation phase. 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. Estimation of the same for proposed GC road construction is given in **Table 3.14**:

Table 3. 14: Fuel Consumption Requirement for Construction Activities and related GHG Emission

S. No.	Description	Fuel Quantity (Liters-Diesel)	GHG Emission* (Tons CO2)
1	Site Clearance	278.67	0.835
2	Earthwork	19,247.02	48.776
3	Sub base Course & base Course	13,977.33	35.422
4	Bituminous Course	23,645.31	59.922
5	Culverts	7,017.01	17.782
6	Bridges & Underpasses	9,528.31	24.147
7	Drainage & protection Works	6,374.97	16.155
8	Reinforced Earth Wall & Retaining Wall	9,084.45	23.022
9	Traffic safety Items	29,454.99	74.645
10	Toll Plaza & Misc. Items	507.08	1.285
11	Rest Area	2,224.88	5.638
12	Extra for miscellaneous items	12,139.07	30.764
	Total	133,479.10	338.39

*Emission Factor for Diesel fuel considered as per Table 3-15 below

Source: Detailed Design Report 2025 and Calculations from ADB Guidelines

3.13. GHG Emission due to Tree Felling and Carbon saving due to Tree Plantation

A tree has the ability to provide an essential of life for all living things on our planet – oxygen, and the power to remove harmful gases like carbon dioxide making the air we breathe healthier. When you look at a tree, note that about five percent of the tree is comprised of its leaves, 15 percent its stems, 60 percent goes into its trunk and 20 percent is devoted to its roots.

Through the photosynthesis process, leaves pull in carbon dioxide and water and use the energy of the sun to convert this into chemical compounds such as sugars that feed the tree. But as a by-product of that chemical reaction oxygen is produced and released by

the tree. It is proposed that one large tree can provide a day's supply of oxygen for up to four people. As per American Lung Association, an adult human requires about 378 Liters of pure oxygen per day. Hence, a Tree can provide up to 1514 litres of Oxygen per day. The mass of 1 liter of oxygen at standard conditions of temperature and pressure is 1.43 gram. So, a tree can produce about 2.16 Kg oxygen per day.

Trees also store carbon dioxide in their fibers helping to clean the air and reduce the negative effects that CO₂ could have had on our environment. 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 year.¹

From the above studies and facts, following measurements were observed;

Total number of Trees and poles to be cut in the proposed project: 9808

- Decrease in CO₂ absorption due to loss of Trees: $9808 \times 25 = 245,200$ Tons/year
- Decrease in Oxygen production due to Tree loss: $9808 \times 2.16 \times 365 = 7,732,627.2$ Tons/year

In lieu of 9808 number of trees to be felled 1:10 (ten trees planted against one tree felled as per GON requirement) number of trees are proposed to be planted. Hence, total 98,080 number of trees to be planted under compensatory plantation requirements.

- Total CO₂ absorption due to plantation of Trees (98,080 number of trees): $98,080 \times 25 = 2,452,000$ Tons/year¹
- Total Oxygen production due to plantation of Trees: $98,080 \times 2.16 \times 365 = 77,326,272$ Tons/year¹

3.14. GHG Emissions in Operation Phase of GC road Project

Greenhouse gasses (GHG) are generated from different sources. GHG emissions can be attributed to several areas such as transportation, residential, industrial and commercial sectors. It is stated in the same source that Carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and Fluorinated gases are the major GHG emissions through human activities. Among those, CO₂ is the most widespread GHG components, and among all factors, the transportation sector is the largest emitter of CO₂.

In the transportation sector, factors that may affect the amount of GHG emissions include, but are not limited to, vehicle type and size, ambient temperature, traffic flow, fuel type, frequent deceleration and acceleration and vehicle speed. Pavement characteristics in term of pavement type and roughness could affect some of these factors. According to some studies, roads with lower IRI values have relatively higher mean speeds, resulting in less CO₂ emissions. This relationship was detected for speeds lower than 50 mph. it is

interesting to note, however, that for speeds higher than 50 mph, emissions increase with higher speeds.

In this report, the GHG Emission estimation was conducted using different variables i.e. Traffic data forecasting, Vehicle type, fuel used & efficiency, vehicle speeds, Road condition etc. The Emission factor considered from “IPCC Guidelines for National Greenhouse Gas Inventories”. The emission factors should 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 NMVOC or as particulate matter. The default CO₂ emission factor is given in **Table 3-15**.

Table 3. 15: Road Transport Default CO₂ Emission Factors

Fuel Type	Default	Lower	Upper
Motor Gasoline (kg/TJ)	69300	67500	73000
Gas/ Diesel Oil (kg/TJ)	74100	72600	74800

Source: IPCC Guidelines

The GHG emission estimation was done on the basis of Emission factors and Road Condition-Fuel efficiency estimation forecasting on “with” and “without project” scenarios.

Under “without project” scenario, the Road condition - Fuel efficiency will deteriorate in coming years along with increasing traffic. There would be periodic maintenance work, which is also considered in estimation.

Under “with project” scenario, the Road Condition-Fuel efficiency will be very good after construction period. Which in result, will be aiding in saving of carbon emission significantly. The periodic maintenance work is considered in this estimation as well.

It has been clear from the emission estimation study below that if we go “with project” it would result in significant carbon saving with the period of time against “without project”.

The GHG emission for various homogenous section is given in **Table 3.16**.

3.15. [Pollution Management Scenario at Household Level](#)

Pollution scenario from local level was also tried to access through household survey. General outcomes are as follows:

3.14.1. Solid Waste Management Scenario

It is recorded that among surveyed household, 84.2% of households produce solid waste of less than 25 kg per year and 12.2% of households produce solid waste in between 25 to 50 kg. 2.1% of household recorded waste quantity greater than 50 kg. The generated daily household waste is being managed by the municipalities in Regular basis.

It is recorded that 54.1% of the household burn wastes. As per national guidelines, burning of waste is strictly prohibited. Similarly, 6.3% of household bury solid wastes and 39.6% households manage wastes by other means (**Table 3-18**).

3.14.2. Waste Water Management

It is noticed that among surveyed household, 30.1% of households discharge waste water and sewage on septic tank/soak pit, 24.4% discharge waste water and sewage on barren land and 20.6% household discharge waste water and sewage on upland.

3.14.3. Sources of Air Pollution

It is noticed that 72.8% of the respondent have mentioned vehicle smoke as major source of air pollution within the locality. Similarly, 18.2 % have mentioned dust blowing due to the gravel road as major source of air pollution, 7.6% respondent have mentioned burning of household waste and 1.4% replied it is smoke from factories that has been emitting as major source of air pollution.

3.14.4. Major Sources of Surface Water Pollution

There are limited sources of water pollution along the road. Some crusher plants, vehicle workshops are economic activities that supports to release water pollutant in the area. Apart from it, sewerage and defecation practices has also been supporting the water pollution.

CHAPTER 4: BASELINE INFORMATION ON BIOLOGICAL ENVIRONMENT

4.1. General Ecosystem and Biodiversity

The forests growing on both sides of the road along the alignment are primarily tropical, with *Shorea robusta* (Sal) forests being predominant, and patches of *Dalbergia* and *Senegalia* forests found along the riversides. Species such as *Terminalia alata*, *Lagerstroemia parviflora*, *Phyllanthus emblica*, *Pterocarpus marsupium* are the major associate species of the Sal Forest type. Major species in the *Dalbergia*/*Acacia* forests are *Dalbergia sissoo*, *Senegalia catechu* and *Bombax ceiba*. Both native and introduced tree species were found growing along both sides of the road. Native species were mainly found in natural forests where as local people have planted exotic species in their home-stead for different purposes.

4.2. Distribution and Ownership of Forests

The road section passes through forest patches comprising community and collaborative forests. In the eastern section of the project area, there are three community forests: Janachetan Community Forest, Hariyali Community Forest, and Kanchan Community Forest. These forests are located in Buddhabhumi Municipality, Ward No. 9, and fall under the jurisdiction of the Champapur Sub-Division Forest Office, which is part of the Division Forest Office, Kapilbastu (Gautam buddha). They are managed by Community Forest User Groups and managing under their respective updated management plans. The western section traverses the Kapilbastu Collaborative Forest, managed by the Kapilbastu Collaborative Management Committee. Collaborative forest management in Nepal is a model involving the central government, local government, and forest user groups. It aims to manage large Terai forests for multiple benefits, enhance forest governance by involving distant households, and improve livelihoods through income-generating activities.

In the Champapur Barkalpur forest path, there are two lakes, Harihaharpur at the south and Breza at the north part of the road and people enter in the community forest area for collection of fodder and there is a corridor in the forest.

4.2.1. Flora (Trees Shrubs and Herbs in the Project Area)

1. Trees

The Project area lies along the tropical region of western Terai. Sal is the dominant tree species in the project area with associated other tropical tree species. The detail of tree species found in the project site are listed in the **Table 4-1**.

Table 4-1: List of Major Tree Species within Project Area

S. N	Common Name	Scientific Name	IUCN Status	CITES	GoN Protection status
1.	Sal	<i>Shorea robusta</i>	LC	-	Protected
2.	Asana/Saj	<i>Terminalia alata</i>	LC	-	Non-protected
3.	Simal	<i>Bombax ceiba</i>	LC	-	Protected
4.	Khair	<i>Acacia catechu</i>	LC	-	Non-protected
5.	Sindure	<i>Mallotus philipensis</i>	LC	-	Non-protected
6.	Bot Dhayero	<i>Lagerstroemia parviflora</i>	LC	-	Non-protected
7.	Karma	<i>Adina cordifolia</i>	LC	-	Non-protected
8.	Kusum	<i>Schleichera oleosa</i>	LC	-	Non-protected
9.	Jamun	<i>Syzygium cumini</i>	LC	-	Non-protected
10.	Mauwa	<i>Engelhardia spicata</i>	LC	-	Non-protected
11.	Kutmero	<i>Litsea monopetala</i>	LC	-	Non-protected
12.	Bhalayo	<i>Semecarpus anacardium</i>	LC	-	Non-protected
13.	Peepal	<i>Ficus religiosa</i>	LC	-	Non-protected
14.	Bar	<i>Ficus benghalensis</i>	LC	-	Non-protected

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

Source: Field Survey/ Consultation, 2024

a. Shrubs

Major shrub species found in the proposed project area are listed in the **Table 4- 2** including their IUCN, CITES and GoN protection status.

Table 4- 2: Shrub species found in the project site

S. N.	Common Name	Scientific Name	Family Name	IUCN Status	CITES	GoN Protection status
1.	Dhairi	<i>Woodwardia fruticosa</i>		LC	-	Non-protected
2.	Kera	<i>Musa paradisiac</i>		LC	-	Non-protected
3.	Aasuro	<i>Adhatoda vasica</i>		LC	-	Non-protected
4.	Tite Pati	<i>Artemissia vulgaris</i>		LC	-	Non-protected
5.	Nagbeli	<i>Lycopodium clavatum</i>		LC	-	Non-protected
6.	Kurilo	<i>Asparagus racemosus</i>		LC	-	Non-protected

S. N.	Common Name	Scientific Name	Family Name	IUCN Status	CITES	GoN Protection status
7.	Karbir	<i>Nerium oleander</i>		LC	-	Non-protected
8.	Jhadibanmara	<i>Lantana camara</i>		LC	-	Non-protected
9.	Jhingani	<i>Eurya acuminata</i>		LC	-	Non-protected
10.	Bansuli	<i>Dichroa febrifuga</i>		LC	-	Non-protected
11.	Rudhilo	<i>Pogostemon benghalensis</i>		LC	-	Non-protected

Note: LC – Least Concern, NT – Near Threat, EN – Endangered, VU – Vulnerable, DD – Data Deficit (Source: Field Survey/ Consultation 2022)

b. Herb or Ground Vegetation

Major herb or ground vegetation in the proposed project area detailed in Table 4-3.

Table 4-3: Major herbs species found around the project vicinity

S. N.	Common Name	Scientific Name	Family Name	IUCN Status	CITES	GoN Protection status
1.	Banmara	<i>Eupatorium adenophorum</i>		LC	-	Non-protected
2.	Bukiphool	<i>Osbeckia nepalensi</i>		LC	-	Non-protected
3.	Datiwan	<i>Achyranthes aspera</i>		LC	-	Non-protected
4.	Gandhe	<i>Ageratum conyzoides</i>		LC	-	Non-protected
5.	Kuro	<i>Bidens pilosa</i>		LC	-	Non-Protected
6.	Cogongrass	<i>Imperata cylindrica</i>		LC	-	Non-protected
7.	Bermuda Grass	<i>Cynodon dactylon</i>		LC	-	Non-protected

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

Source: Field Survey/ Consultation, 2024

2. Quadrat Analysis of Vegetation Along the Road Alignment

Out of the trees found in adjacent to the RoW of the highway, Sal, Shajh, Botdhairo are the most dominant species. The importance value index of Sal is highest indicating most valued tree species in the area.

Local Name of Species	Scientific Name	Density (trees/ha)	R-Density (%)	Frequency	R. Frequency	Abundance	R- Abundance	IVI
Sal	<i>Shorea robusta</i>	196	39.35	70.59	10.62	11.08	23.17	73.14
Shajh	<i>Terminalia alata</i>	71	14.20	82.35	12.39	3.43	7.17	33.76
Botdhairo	<i>Lagerstroemia parviflora</i>	43	8.58	58.82	8.85	2.90	6.06	23.49
Pyari	<i>Ficus glaberrima</i>	25	5.03	52.94	7.96	1.89	3.95	16.94
Sindure	<i>Mallotus philippensis</i>	25	5.03	35.29	5.31	2.83	5.92	16.26
Jamuna	<i>Syzygium cumini</i>	18	3.55	35.29	5.31	2.00	4.18	13.04
Mauwa	<i>Madhuca longifolia</i>	18	3.55	35.29	5.31	2.00	4.18	13.04
Khayer	<i>Acacia catechu</i>	16	3.25	23.53	3.54	2.75	5.75	12.54
Banjhi	<i>Anogeissus latifolia</i>	15	2.96	41.18	6.19	1.43	2.99	12.14
Genger	<i>Dillenia pentagyna</i>	15	2.96	41.18	6.19	1.43	2.99	12.14
Kusum	<i>Schleichera oleosa</i>	10	2.07	23.53	3.54	1.75	3.66	9.27
Karam	<i>Adina cordifolia</i>	9	1.78	35.29	5.31	1.00	2.09	9.18

Local Name of Species	Scientific Name	Density (trees/ha)	R-Density (%)	Frequency	R. Frequency	Abundance	R- Abundance	IVI
Bhalayo	<i>Semecarpus anacardium</i>	7	1.48	17.65	2.65	1.67	3.48	7.62
Sisoo	<i>Dalbergia sissoo</i>	7	1.48	17.65	2.65	1.67	3.48	7.62
Bel	<i>Aegle marmelos (L.)</i>	4	0.89	17.65	2.65	1.00	2.09	5.63
Chipple/Baklapate	<i>Cinnamomum tamala</i>	3	0.59	11.76	1.77	1.00	2.09	4.45
Kutmiro	<i>Litsea monopetala</i>	3	0.59	11.76	1.77	1.00	2.09	4.45
Rajbrikshya	<i>Cassia fistula</i>	3	0.59	11.76	1.77	1.00	2.09	4.45
Sajan	<i>Moringa oleifera</i>	3	0.59	11.76	1.77	1.00	2.09	4.45
Amala	<i>Phyllanthus emblica</i>	1	0.30	5.88	0.88	1.00	2.09	3.27
Bar	<i>Ficus benghalensis</i>	1	0.30	5.88	0.88	1.00	2.09	3.27
Gindari	<i>Premna integrifolia</i>	1	0.30	5.88	0.88	1.00	2.09	3.27
Patpate	<i>Macaranga pustulata</i>	1	0.30	5.88	0.88	1.00	2.09	3.27

Local Name of Species	Scientific Name	Density (trees/ha)	R-Density (%)	Frequency	R. Frequency	Abundance	R- Abundance	IVI
Pipal	<i>Ficus religiosa</i>	1	0.30	5.88	0.88	1.00	2.09	3.27

Source: Field survey 2024

4.2.2. Fauna found in the Project Area

Further, as per field observation and consultations, major wildlife found within the project area are listed in Tables

a. Mammals

A total of 14 mammal species were recorded at the project site. The Common Leopard is classified as a Vulnerable species and Terai Grey Langur is Near Threatened species, while the remaining species fall under the Least Concern category in the IUCN Red List. The detailed list of mammal species observed in the project area is provided in Table 4-4.

Table 4-4 Mammals found in the project area

S. N.	Common Name	Scientific Name	IUCN Status	CITES	GoN Protection status
1.	Common Leopard	<i>Panthera pardus</i>	Vulnerable	Appendix I	Non-protected
2.	Blue Bull	<i>Boselaphus tragocamelus</i>	Least Concern (LC)	-	Non-protected
3.	Spotted Deer	<i>Axis axis</i>	LC	-	Non-protected
4.	Golden Jackal	<i>Canis aureus</i>	LC	-	Non-protected
5.	Jungle Cat	<i>Felis chaus</i>	LC	-	Non-protected
6.	Wild Boar	<i>Sus scrofa</i>	LC	-	Non-protected
7.	Yellow-throated Marten	<i>Martes flavigula</i>	LC	-	Non-protected
8.	Rhesus Macaque	<i>Macaca mulatta</i>	LC	-	Non-protected
9.	Terai Grey Langur	<i>Semnopithecus hector</i>	Near Threatened	-	Non-protected
10.	Northern Pal Squirrel	<i>Funambulus pennantii</i>	LC	-	Non-protected
11.	Indian Crested Porcupine	<i>Hystrix indica</i>	LC	-	Non-protected
12.	Gray Mongoose	<i>Herpestes edwardsii</i>	LC	-	Non-protected
13.	Barking Deer	<i>Muntiacus muntjak</i>	LC	-	Non-protected
14.	Indian Flying Fox	<i>Pteropus giganteus</i>	LC	-	Non-protected

Source: Field Survey/ Consultation, 2024



Photo Plate 3- 1: Photo captured during field survey First Gray Mongoose and second digging sign of wild boar (Source Field survey: 2024)

b. Avifauna

A total of 62 bird species were recorded within the project site. Among these, three globally threatened species-White-rumped Vulture, Slender-billed Vulture, and Egyptian Vulture were observed. Notably, nesting activity of the White-rumped Vulture was documented approximately 800 meters from the road's Right of Way (ROW). The majority of the recorded bird species are classified as Least Concern under the IUCN Red List. No nesting activity was observed in the roadside trees. A detailed list of the bird species identified in the project area is provided in Table 4-5.

Table 4-5: Bird species found in the project area

S. N.	Common Name	Scientific Name	IUCN Status	CITES	GoN Protection status
1.	White-rumped Vulture	<i>Gyps benghalensis</i>	Critically Endangered	Appendix II	Non-protected
2.	Slender-billed Vulture	<i>Gyps tenuirostris</i>	Critically Endangered	Appendix II	Non-protected
3.	Egyptian Vulture	<i>Neophron percnopterus</i>	Endangered	Appendix II	Non-protected
4.	Indian Gray Hornbill	<i>Ocyrceros birostris</i>	Least Concern	-	Non-protected
5.	Lesser Adjutant	<i>Leptoptilos javanicus</i>	Near Threatened	-	Non-protected
6.	Asian Openbill	<i>Anastomus oscitans</i>	Least Concern	-	Non-protected
7.	Common Myna	<i>Acridotheres tristis</i>	Least Concern	-	Non-protected
8.	Little Cormorant	<i>Microcarbo niger</i>	Least Concern	-	Non-protected
9.	Red-napped Ibis	<i>Pseudibis papillosa</i>	Least Concern	-	Non-protected
10.	Brahminy Starling	<i>Sturnia pagodarum</i>	Least Concern	-	Non-protected
11.	Large Cuckooshrike	<i>Coracina macei</i>	Least Concern	-	Non-protected
12.	Asian Koel	<i>Eudynamys scolopaceus</i>	Least Concern	-	Non-protected
13.	Common Hawk Cuckoo	<i>Hierococcyx varius</i>	Least Concern	-	Non-protected
14.	Coppersmith Barbet	<i>Psilopogon haemacephalus</i>	Least Concern	-	Non-protected
15.	Blue-throated Barbet	<i>Magalaima asiatica</i>	Least Concern	-	Non-protected
16.	House Crow	<i>Corvus splendens</i>	Least Concern	-	Non-protected
17.	Jungle Crow	<i>Corvus macrorhyncos</i>	Least Concern	-	Non-protected
18.	Rock Pigeon	<i>Columba livia</i>	Least Concern	-	Non-protected
19.	House Sparrow	<i>Passer domesticus</i>	Least Concern	-	Non-protected
20.	Black Kite	<i>Milvus migrans</i>	Least Concern	Appendix II	Non-protected
21.	Shikra	<i>Accipiter badius</i>	Least Concern	Appendix II	Non-protected

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S. N.	Common Name	Scientific Name	IUCN Status	CITES	GoN Protection status
22.	Spotted Dove	<i>Spilopelia chinensis</i>	Least Concern	-	Non-protected
23.	Gray-hooded Warbler	<i>Seicercus anthoschistos</i>	Least Concern	-	Non-protected
24.	Red-vented Bulbul	<i>Phycnonotus cafer</i>	Least Concern	-	Non-protected
25.	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	Least Concern	-	Non-protected
26.	Himalayan Bulbul	<i>Pycnonotus leucogenys</i>	Least Concern	-	Non-protected
27.	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	Least Concern	-	Non-protected
28.	Oriental Magpie Robin	<i>Copsychus saularis</i>	Least Concern	-	Non-protected
29.	Rufous Treepie	<i>Dendrocitta vagabunda</i>	Least Concern	-	Non-protected
30.	Long-tailed Shrike	<i>Lanius schach</i>	Least Concern	-	Non-protected
31.	Plumbious Water Redstart	<i>Rhyacornis fuliginosus</i>	Least Concern	-	Non-protected
32.	Black Drongo	<i>Dicrurus macrocercus</i>	Least Concern	-	Non-protected
33.	White-bellied Drongo	<i>Dicrurus caerulescens</i>	Least Concern	-	Non-protected
34.	Hair-crested Drongo	<i>Dicrurus hottentottus</i>	Least Concern	-	Non-protected
35.	Lesser Racket-tailed Drongo	<i>Dicrurus remifer</i>	Least Concern	-	Non-protected
36.	Cattle Egret	<i>Bubulcus ibis</i>	Least Concern	-	Non-protected
37.	Paddyfield Pipit	<i>Anthus rufulus</i>	Least Concern	-	Non-protected
38.	Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>	Least Concern	-	Non-protected
39.	Green Bee-eater	<i>Merops orientalis</i>	Least Concern	-	Non-protected
40.	Brown Rock Chat	<i>Oenanthe fusca</i>	Least Concern	-	Non-protected

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S. N.	Common Name	Scientific Name	IUCN Status	CITES	GoN Protection status
41.	Indian Roller	<i>Coracias benghalensis</i>	Least Concern	-	Non-protected
42.	Gray-throated Martin	<i>Riparia chinensis</i>	Least Concern	-	Non-protected
43.	Greater Coucal	<i>Centropus sinensis</i>	Least Concern	-	Non-protected
44.	Jungle Babbler	<i>Argya striata</i>	Least Concern	-	Non-protected
45.	Cinereous Tit	<i>Parus cinereus</i>	Least Concern	-	Non-protected
46.	Black-hooded Oriole	<i>Oriolus xanthornus</i>	Least Concern	-	Non-protected
47.	Indian Golden Oriole	<i>Oriolus oriolus</i>	Least Concern	-	Non-protected
48.	Barn Swallow	<i>Hirundo rustica</i>	Least Concern	-	Non-protected
49.	Red-wattled Lapwing	<i>Vanellus indicus</i>	Least Concern	-	Non-protected
50.	Crimson Sunbird	<i>Aethopyga siparaja</i>	Least Concern	-	Non-protected
51.	Common Tailorbird	<i>Orthotomus sutorius</i>	Least Concern	-	Non-protected
52.	Rose-ringed Parakeet	<i>Psittacula krameri</i>	Least Concern	-	Non-protected
53.	Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	Least Concern	-	Non-protected
54.	Scaly-breasted Munia	<i>Lonchura punctulata</i>	Least Concern	-	Non-protected
55.	White-rumped Munia	<i>Lonchura striata</i>	Least Concern	-	Non-protected
56.	Himalayan Flame back	<i>Dinopium shorii</i>	Least Concern	-	Non-protected
57.	Black Francolin	<i>Francolinus francolinus</i>	Least Concern	-	Non-protected
58.	Common Hoopoe	<i>Upupa epops</i>	Least Concern	-	Non-protected
59.	White-throated Fantail	<i>Rhipidura albicollis</i>	Least Concern	-	Non-protected
60.	Grey-brested Prinia	<i>Prinia hodgsonii</i>	Least Concern	-	Non-protected
61.	Oriental White-eye	<i>Zosterops palpebrosus</i>	Least Concern	-	Non-protected

S. N.	Common Name	Scientific Name	IUCN Status	CITES	GoN Protection status
62.	Chestnut-bellied Nuthatch	<i>Sitta cinnamoventris</i>	Least Concern	-	Non-protected

Source Field survey, 2024



Photo Plate 3-2: Photo of White-rumped Vulture and Asian Openbill (Source Field survey: 2024)

c. Herpetofauna

Altogether 12 species of herpetofauna recorded from the project area. Both species Burmese Python and Indian flapshell turtle are listed in the Vulnerable category in the IUCN Red List. Other species found in the project site are least concern according in the IUCN conservation status and not protected according to GoN. Detail of herpetofauna found in project site is summarized in the Table 4-6.

Table 4-6: Herpetofauna found in the project site

S. N.	Common Name	Scientific Name	IUCN Status	CITES	GoN Protection status
1.	Common Rat Snake	<i>Ptyas mucosus</i>	Least Concern (LC)	-	Non-protected

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S. N.	Common Name	Scientific Name	IUCN Status	CITES	GoN Protection status
2.	Buff-striped Keelback	<i>Amphiesma stolatum</i>	LC	-	Non-protected
3.	White Lipped Pit Viper	<i>Trimeresurus albolabris</i>	LC	-	Non-protected
4.	Burmese Python	<i>Python bivittatus</i>	Vulnerable	CITES Appendix II	Non-protected
5.	Banded Krait	<i>Bungarus fasciatus</i>	LC	-	Non-protected
6.	Bengal Monitor Lizard	<i>Varanus bengalensis</i>	LC	CITES Appendix I	Non-protected
7.	Common Garden Lizard	<i>Calotes versicolor</i>	LC	-	Non-protected
8.	House Gecko	<i>Hemidactylus spp</i>	-	-	Non-protected
9.	Asian Toad	<i>Hoplobatrachus rugulosus</i>	LC	-	Non-protected
10..	Jerdon's Bullfrog	<i>Hoplobatrachus crassus</i>	LC	-	Non-protected
11.	Skittering Frog	<i>Euphlyctis cyanophlyctis</i>	LC	-	Non-protected
12.	Indian flapshell turtle	<i>Lissemys punctata</i>	Vulnerable	CITES Appendix I	Non-protected

Source: Field Survey/ Consultation, 2024



Photo Plate 3- 3: Photo of Burmese Python and Jerdon's Bullfrog (Source: Field Survey, 2024)

d. Fish Species

Major fish species found in the project area are listed in the Table 4-7 including their IUCN, CITES and GON protection status.

Table 4-7 Fish species found in the project site

S. N.	Common Name	Scientific Name	IUCN Status	CITES	GoN Protection status
1.	Gotyla	<i>Garra gotyla</i>	Least Concern	-	Non-protected
2.	Asiatic Snakehead	<i>Channa gachua</i>	Least Concern	-	Non-protected
3.	Stinging Catfish	<i>Heteropneustes fossilis</i>	Least Concern	-	Non-protected
4.	Walking Catfish	<i>Clarias batrachus</i>	Least Concern	-	Non-protected
5.	Spotfin Swamp barb	<i>Puntius sophore</i>	Least Concern	-	Non-protected
6.	Barred Baril	<i>Barilius barila</i>	Least Concern	-	Non-protected
7.	One-stripe spiny eel	<i>Macrogathus aral</i>	Least Concern	-	Non-protected
8.	swamp barb	<i>Puntius chola</i>	Least Concern	-	Non-protected
9.	Chana Sps.				Non-protected

(Source: Field Survey/ Consultation, 2024)



Photo Plate 3- 4: Photo of One-stripe spiny eel and Chana Sps. (Source: Field Survey, 2024

e. Other Important Wildlife information

In 2021, a study identified a male and a female tiger in the Churia forest range spanning Kapilbastu, Rupandehi, and Palpa. The male was located in northern Kapilbastu, while the female was photographed at multiple sites in Rupandehi and along the Rupandehi-Palpa border. In February 2024, WWF Nepal reported three tigers captured on camera during an ecological survey in the central Terai Arc Landscape (TAL) in Kapilbastu. These tigers were recorded more than 10 kilometers away from the project area within the Churiya range. The Fishing Cat and Four-horned Antelope, both listed as Vulnerable on the IUCN Red List, have been recorded in Kapilbastu district. However, they have not been observed within the project site, and the area is not suitable for either species.

f. Wildlife Habitat and Movement Corridor

The road stretches approximately 7 kilometers through forest patches that extend into the Churia region but do not continue significantly to the south. The longest forest patch, about 4 kilometers, extends southward from the road but gradually transitions into farm land and settlements further south. As a result, there is likely to be north-south wildlife movement across the road for feeding or breeding purposes. As per the discussion with the officials of divisional and sub-divisional forest offices under Divisional Forest Office, Gautambuddha (Kapilbastu) and the local people the existing bridge can be modified for wildlife crossing for medium sized animals at Bel nadi (648+561) and Jwai khola (649+257) and also Minor Bridge-Dry Nala (648+157). In addition to that the existing box culverts (645+ 789), (646+233) and (647+791) can be modified for crossings of small wildlife. Canopy bridge for Terai Gray Langur can be in those peripheral areas. As per the Wildlife Friendly Infrastructure Construction Directives 2022, culverts or bridge underpasses should have a minimum width of 8 meters and a height of 3 meters can be used as animal crossing for medium sized animals.



Photo Plate 3- 5: Photo showing Belnadi bridge (Source Field survey: 2024)

g. Protected and Internationally Recognized area of high biodiversity Value

The Goringhe-Chandrauta road section does not pass through any protected areas but traverses diverse habitats, including settlements, farmlands, rivers, and forests. The project area falls within the Terai Arc Landscape (TAL), with its eastern half located in the globally significant Kapilbastu Important Bird and Biodiversity Area (IBA). This IBA was designated due to its importance as a breeding habitat for the critically endangered White-rumped Vulture, other threatened bird species, and its role as a biodiversity hotspot. Additionally, the project site serves as an important groundwater reservoir, featuring several small wetlands and connected forests that facilitate wildlife dispersal.

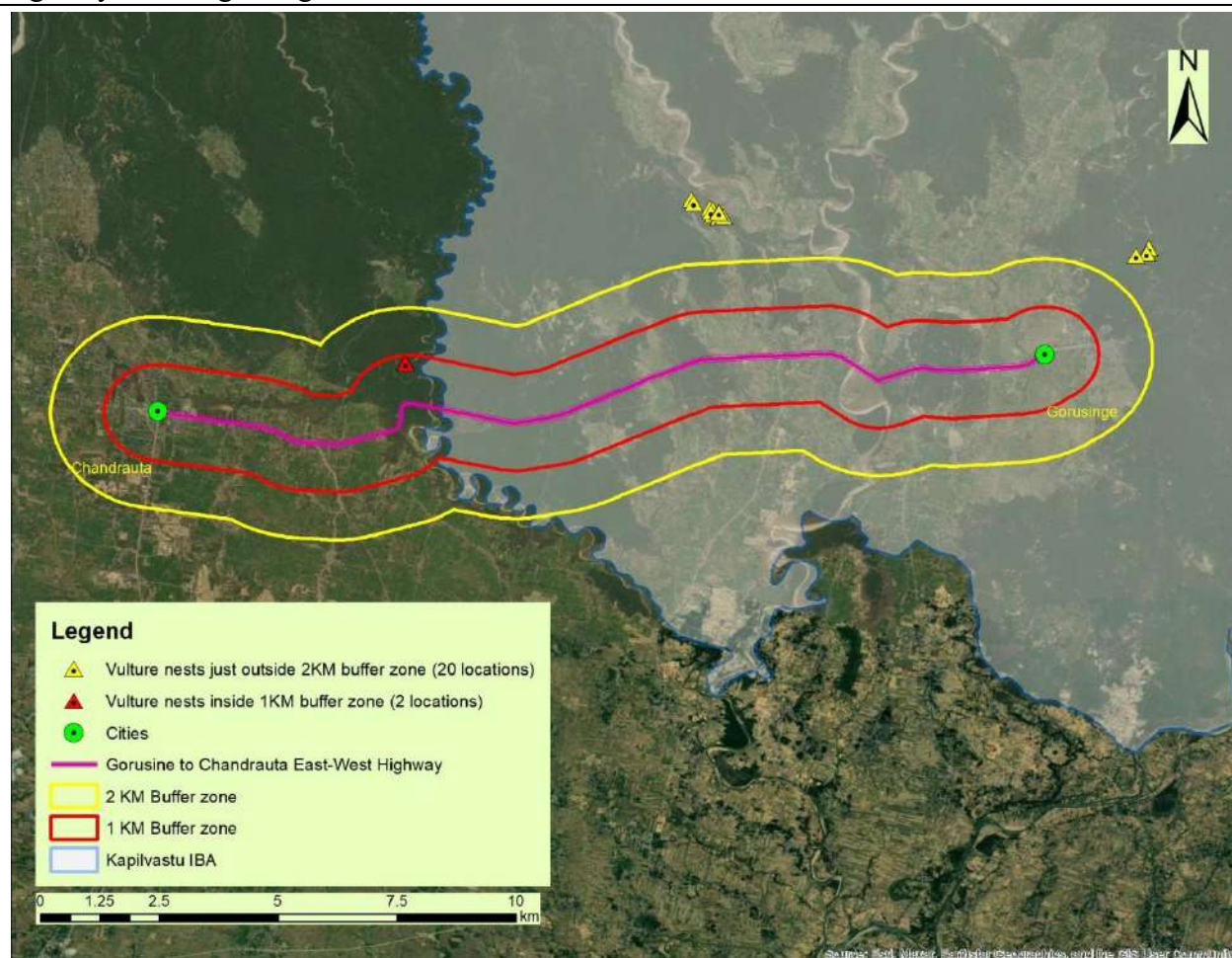


Figure 3. 6: Map showing area of Kapilbastu IBA and nesting location of White-rumped Vulture

We obtained satellite telemetry data on White-rumped Vulture movements from Bird Conservation Nepal, which indicates frequent vulture activity within the project site (Figure). Disposing of dead cattle near the road could attract vultures, increasing the risk of vehicle collisions.

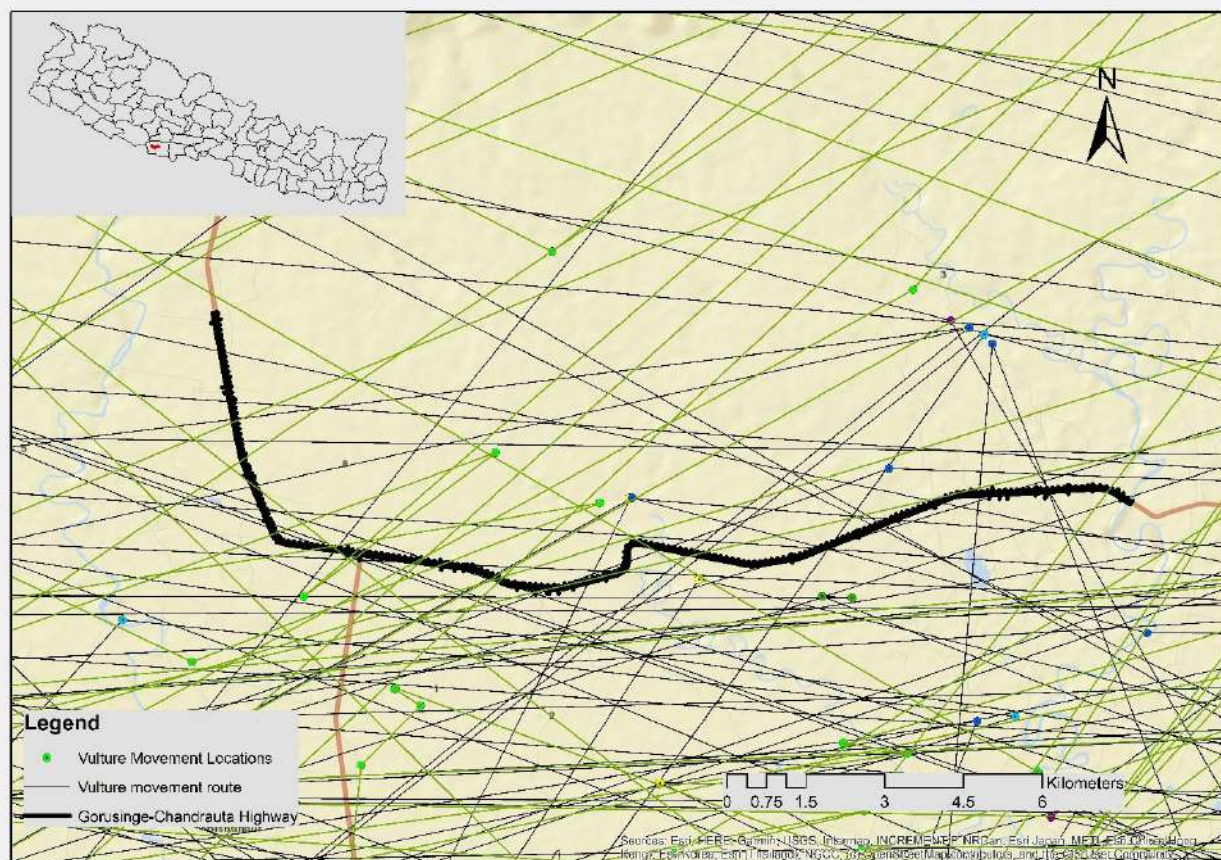


Figure 3.7: Movement of satellite tagged vultures in the project site

CHAPTER 5: BASELINE INFORMATION ON SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

The proposed Road under ACCESS highway improvement project will upgrade **19.2 km** road Section from Goringhale to Chandrauta in Kapilbastu district. The road passes through four major settlements i.e. Imaliya, Dumara, Barkalpur, Kharendrapur, Bankatti, Chandrauta. And ends at Umari Chowk (Shivapur chowk). Similarly, the proposed road covers two municipalities (Buddhabhumi and Shivraj).

The study team has explored basic information about the socio-economic and cultural environment of project area which includes demographic and economic features, along with, likely impacts on private and public structures and public utilities, public transport, social services facilities available in the project area. Basic information on religious sites and cultural aspects.

5.1. Project Affected Municipalities

There are two municipalities viz. Buddhabhumi and Shiva Raj municipality in the Kapilbastu district located in GC road section. Population of this municipalities are as follows.

5.1.1. Buddhabhumi Municipality

According to the National Census 2021, the total population of Buddhabhumi Municipality is 76,507, of which 48.3% (36,951) are male and 51.7% (39,556) are female and household size is 5.22. Similarly, there are 15,379 household in the municipality and the population density is 209 persons per square kilometer. The literacy rate of the municipality is 71.5%. The ward- 9 is touches the GC road alignment. The detail information is presented in table 5.1.

Table 5-1: Demographic information of Buddhabhumi Municipality

Local Government	Number of HH	Population			Sex ratio	Literacy
		Total	Male	Female		
Buddhabhumi Municipality	15,379	76,507	36,951	39,556	95.05	71.5
Ward no. 9	2441	11043	5222	5821	89.80	Not available

Source: CBS, 2021

5.1.2. Shiva Raj Municipality

According to the National Census 2021)), the total population of Shivaraj Municipality is 84,810. of which 48.7% (41,328) are male and 51.3% (43,482) are female and household size is 5.22. Similarly, there are 16,241 household in the municipality and the population density is 299 people per square kilometer. The literacy rate of the municipality is 72.7%. The ward 1,3,4, and 5 of this municipality touches GC road alignment. The detail information is presented in **Table 5-2**.

Table 5-2: Population data of Shiva Raj Municipality and affected wards

Local Government	Number of households	Population			Sex ratio	Literacy
		Total	Male	Female		
Shivraj Municipality	16,241	84,810	41,328	43,482	95.05	72.7
Ward no. 1	2,183	9,712	4,645	5,067	91.67	Not Available
Ward no. 3	1,914	9,320	4,488	4,832	92.88	
Ward no. 4	1,347	8,141	4,074	4,067	100.17	
Ward no. 5	3,367	15,566	7,514	8,052	93.32	
Total (Affected Wards)	8,811	42,739	20,721	22,018		

Source: CBS, 2021

5.2. Social Status of the Surveyed Households

The total surveyed households are 312 (20% of universe 1562) sample survey within Direct Impact Area, 300 m. either side) where surveyed population is 1643 and household size is 5.3. This sub-chapter includes social demography: mother tongue/language spoken, religion, caste/ethnicity, indigenous people, literacy and education along with economic status of the surveyed households.

5.3. Population by Municipality and Ward

Buddhabhumi Ward 9 has the total population is 560 with gender disaggregated (Male: 48.9%, Female: 51.1%). In the similar manner, ward 1, 3, 4 & 5 of Shivraj Municipality has 1083. with gender disaggregated (Male: 52%, Female: 48%). Which is almost similar to national level. Details of the population with HHs size and gender distribution is presented in table 5.3.

Table 5- 3: Population by Municipality and Ward

Municipality	Ward No	HHs	Population					
			Male	%	Female	%	Total	Sex Ratio
Buddhabhumi	9	105	274	48.9	286	51.1	560	95.8
Shivaraj	1	23	55	51.9	51	48.1	106	107.8
	3	36	107	58.2	77	41.8	184	139.0
	4	36	99	51.3	94	48.7	193	105.3
	5	112	312	52.0	288	48.0	600	108.3
Total		312	847	51.6	796	48.4	1643	

Source: Household Survey, 2024

5.3.1. Age Group of Surveyed Population

Age category within surveyed populations (1643) have been classified under 0-4 years (infant), 5-15 years (child), 16-60 years (adult) and 60 years and above (old). The economically active population is found 71.3 % within surveyed household. The details is given in Table 5-4.

Table 5-4: Age Group of Household Members

Age Group	Buddhabhumi		Shivaraj		Total	
	Individual	%	Individual	%	Individual	%
0-4	27	4.8	55	5.1	82	5.0
5-15	81	14.5	159	14.7	240	14.6
16-60	405	72.3	766	70.7	1171	71.3
Above 60	47	8.4	103	9.5	150	9.1
Total	560	100.0	1083	100.0	1643	100.0

Source: Household Survey, 2024

5.3.2. Mother Tongue/ Language

The below table represents the distribution of households (HHs) based on their mother tongue across affected municipalities, as well as the combined total for both areas. The analysis highlights language diversity and relative population sizes among different language-speaking communities. Nepali is the most widely spoken mother tongue in both areas is about (60%).

Table 5- 4: Mother Tongue/ Language of Surveyed HHs.

Mother Tongue	Buddhabhumi		Shivaraj		Total	
	HHs	%	HHs	%	HHs	%
Nepali	61	58%	126	61%	187	60%
Tharu	17	16%	27	13%	44	14%
Maithili	9	9%	11	5%	20	6%
Newar	4	4%	5	2%	9	3%
Magar	3	3%	9	4%	12	4%
Hindi	7	7%	23	11%	30	10%
Bhojpuri	4	4%	6	3%	10	3%
Total	105	100%	207	100%	312	100%

Source: Household Survey, 2024

5.3.1. Religion

Hinduism dominates in both municipalities (68.9%) approaching the national average i.e 81.2 %. Among the affected municipalities Shivaraj municipality has a slightly lower fraction of Hindu (66.7%) than Buddhabhumi Municipality as expressed in **Table 5-5**.

Table 5-5: Religion

Religion	Buddhabhumi		Shivaraj		Total	
	HHs	%	HHs	%	HHs	%
Hindu	77	73.3	138	66.7	215	68.9
Muslim	0	0.0	13	6.3	13	4.2
Buddhist	19	18.1	38	18.4	57	18.3
Christian	7	6.7	14	6.8	21	6.7
Other	2	1.9	4	1.9	6	1.9
Total	105	100.0	207	100.0	312	100.0

Source: Household Survey, 2024

5.3.2. Caste/ Ethnicity

The project area has multi-ethnic/caste groups which include Brahman, Chettri, Janjati, Dalit, Tarai Caste and Muslim. Among the surveyed households, Brahmins and Chhetri are dominant covering 51.9 percent, where Janajati (26.92%). In comparison to the Buddhabhumi, Shivraj municipality has some proportions of Muslim (5.8%). Whereas population of Janajati (36.18 %) is higher in Buddhabhumi municipality than Shivraj. Newar, Tharu, and Magar are found in the project area. Details of the population has presented in table 5-9.

Table 5- 6: Caste and Ethnicity

Caste/Ethnicity	Buddhabhumi		Shivaraj		Total	
	HHs	%	HHs	%	HHs	%
Brahmin and Chhetri	54	51.42	110	52.4	164	52.56
Dalit	4	3.8	20	9.7	24	7.62
Muslim	0	0.0	12	5.8	12	3.9
Janajati	38	36.18	46	22.8	84	26.92
Tarai Caste	5	4.8	18	8.7	23	7.4
Other	4	3.8	1	0.5	5	1.6
Total	105	100	207	100.0	312	100

Source: Household Survey, 2024

5.3.3. Indigenous People

is a multi-ethnic, multilingual, and multicultural country. Stretching from the Himalayas to the Terai, the people residing here exhibit diverse languages and cultures. According to the *Aadiwaasi/janajati Utthan Rastriya Partisthan Act, 2058 (2002 AD)*, a total of 60 ethnic groups is officially recognized as *Adivasi/Janajati* (Indigenous Nationalities). Furthermore, the Nepal Federation of Indigenous Nationalities (NEFIN) classifies these Nepal listed indigenous groups into five categories: advance, disadvantage, marginalized, highly marginalized, and endangered. In the baseline survey 2024, total 312 households were studied (sampled), among which 76 households belonged to Indigenous Nationalities (Newar-lies in advanced, Magar-disadvantage, Tharu, and Tamang are marginalized), was recorded with a total population (195 male and 188 female) of 383. The population distribution by indigenous group is presented in the table 5-10.

Table 5-10: Presence of Indigenous People (Aadiwaasi/Janajati) in Study area

Indigenous Nationalities	Household		Total HH	Male Population		Female Population		Total population
	Buddhabhumi	Shivaraj		Buddhabhumi.	Shivaraj	Buddhabhumi.	Shivaraj	
Newar	2	2	4	3	7	5	9	24
Magar	8	22	30	15	57	10	45	127
Tamang	1	0	1	4	0	3	0	7
Tharu	26	15	41	69	40	77	39	225
Total	37	39	76	91	104	95	93	383

Source: Household Survey, 2024

5.3.4. Literacy Status and Education

Based on baseline surveyed households, total 4.8 percent population are illiterate among them male is 1.7 and female are 3.8 percent. The population of graduate and above is 2.8 percent. The majority of the population in both Buddhabhumi and Shivraj municipalities is educated, with most individuals having completed at least read and write or higher secondary education. However, there are notable differences in educational attainment between males and females. Educational status of school going age and above of surveyed population is given in **Error! Reference source not found..**

Table 5-7: Educational Status of Study Area (5 Years and Above Population)

Educational Status	Male		Female		Total population	Percentage
	Buddhabhumi	Shivraj	Buddhabhumi	Shivraj		
Illiterate	0.4	1.3	1.0	2.1	75	4.8
Read and write	5.4	12.3	7.2	13.6	600	38.5
Higher Secondary	9.4	17.3	6.9	12.4	719	46.1
Bachelor's Degree	1.0	3.0	1.4	2.4	121	7.8
Master's Degree	0.5	0.5	0.2	0.3	23	1.5
Above Master's Degree	0.3	0.3	0.3	0.4	21	1.3
Total	17.1	34.6	17.1	31.2	1559	100.0

Source: Household Survey, 2024

5.3.5. Migration Status

In-Migration is a common phenomenon in terai region as they tend to migrate from hilly areas to terai over the period for seeking different facilities. Around 60% interviewed HH migrated from different places outside the district to ensure their better livelihood, education, health and other facilities. Buddhabhumi has a large proportion of originally settled households compared to Shivaraj, including that Buddhabhumi is relatively more stable in retaining its native population. On the other hand, Shivaraj has a higher proportion of households from outside the district, suggesting it might be a more attractive destination for migrants. Details of the population migration is presented in **Error! Reference source not found..**

Table 5-12: Status of migration in affected municipality Origin	Buddhabhumi		Shivaraj		Total	
	HHs	%	HHs	%	HHs	%
Own rural Municipality	5	4.8	11	5.3	16	5.1
Own District	4	3.8	15	7.2	19	6.1
Outside of District	54	51.4	13	64.7	18	60.3
Originally Settled	42	40.0	47	22.7	89	28.5
Total	105	100.0	207	100.0	312	100.0

Source: Household Survey, 2024

5.3.5.1 Purpose of In-Migration

The table highlights the purpose of in migration in two areas, Buddhabhumi and Shivaraj Municipality, with percentages calculated for each category relative to the total number of households in each area. Shivaraj Municipality consistently exhibits higher percentages across most in migration purposes, indicating stronger pull factors in terms of employment, business, various opportunities and receive better education. Similarly, Buddhabhumi has a slightly higher percentages of migration due to facilities, which could point to inadequate infrastructure or amenities compared to Shivaraj. Different purposes of migration are given in *Table 5- 8*.

Table 5- 8: Purpose of In-migration

Purpose of Migration	Buddhabhumi		Shivaraj		Total	
	HHs	%	HHs	%	HHs	%
Employment	30	28.6	74	35.7	104	33.3
Business/Trade	21	20.0	55	26.6	76	24.4
Education	24	22.9	54	26.1	78	25.0
Facilities	13	12.4	17	8.2	30	9.6
Others (multiple answers other than mentioned)	17	16.2	7	3.4	24	7.7
	105	100.0	207	100.0	312	100.0

Source: Household Survey, 2024

5.3.5.2 Out-Migration Status

Among surveyed households (312 HHs) 78.5% HHs have at least one member out of the country for work, education and family visits. The economy of the project area is gradually shifting from rural agricultural economy to business, service and foreign employment.

5.3.6. Major Occupation

The project area is characterized as plain Terai area and most of the people of the area are engaged in agriculture based economic activities. The main occupation of the study area is agriculture followed by foreign job, service and business. Among the total population, 46.1 percent is involved in agriculture. Similarly, 24.4 percent people are engaged in foreign job which is the main source of renitence. Likewise, 17.5 and 12.1 percent population involved in business and Service. There are notable gender differences, with males dominating foreign jobs and business, while females are more involved in agriculture. Following table provides information regarding occupational status of the project area.

The detail of individual number and their respective occupation is shown in table 5-14.

Table 5- 14: Occupation Status of the Study Area

Occupation	Buddhabhumi		Shivraj		Total economically active population	Total
	Male	Female	Male	Female		
Agriculture	5.9	14.4	7.5	18.3	375	46.1
Service	3.0	1.7	4.9	2.5	98	12.1
Foreign job	7.0	0.7	15.3	1.4	198	24.4
Business	2.8	1.2	10.3	3.1	142	17.5
Total	18.7	18.1	38.0	25.2	813	100.0

Source: Household Survey, 2024

5.3.7. Skill Training Status

Most of the residents remains unskilled around 60% in project area. Municipality has provided different trainings to the residents in the project area about 39.1% of the HHs are trained. Beautician, light vehicle driving, tailoring, security guard, basic computer and automobile repairing etc. are the most demanded in the project area. Among such demanded trainings some of the trainings has already been provided by the municipalities. Though sex disaggregated data on skill training status has not been recorded but it has been noted from group discussion that mostly women are benefited from mix group training. Details are shown in the

Table 5-

Table 5-9: Skill Training Provided by Municipality

S.N.	Trainings	Households (%)		Total
		Buddhabhumi	Shivraj	
1	Beautician	9.5	15.5	13.5
2	Light Vehicle Driving	17.1	12.1	13.8
3	Tailoring	14.3	16.9	16.0
4	Security Guard	1.9	0.0	0.6
5	Basic Computer	9.5	7.2	8.0
6	Automobile Repairing	2.9	6.8	5.4
7	Others	4.8	2.9	3.5
8	Trained HHs	40.0	38.6	39.1
	Total	100.0	100.0	100.0

Source: Household Survey, 2024

5.3.8. Land Holding Status

The table presents the distribution of land ownership in Buddhabhumi and Shivraj municipalities from a gender perspective, including categories for Male, Female, and both (representing joint ownership or other gender identities). The data reveals a clear gender disparity in land holding, with men controlling nearly two-thirds of land in both municipalities. Women own less than one-third. Table below summarizes the land holding pattern by gender in the project area.

Table 5-10: Land holding status by male and female in Study Area

Municipality	Male	Percent	Female	Percent	Both	Percent	Total
Buddhabhumi	63	20.5	34	10.9	8	2.6	105
Shivraj	131	41.7	66	21.2	10	3.2	207
Total	194	62.2	100	32.1	18	5.8	312

Source: Household Survey, 2024

5.3.9. Agriculture Land holding status

It is found that about 50.96 percent of the surveyed households have no agriculture land holdings and 38.46 have some amount of agriculture land where as only 6.09% of the HHS have agriculture land above 0.6 ha as shown in table below. This shows most of the households depends on non-farm activities.

Table 5- 11: Status of Agricultural Land Holding

Agricultural Land Holding Status	Buddhabhumi		Shivaraj		Total	%
	HHs	%	HHs	%	HHs	
No Agriculture	36	34.29	123	59.42	159	50.96
Less than 0.015 ha	3	2.86	4	1.93	7	2.24
0.015-0.03 ha	4	3.81	14	6.76	18	5.77
0.03- 0.3 ha	44	41.90	51	24.64	95	30.45
0.3 – 0.6 ha	8	7.62	6	2.90	14	4.49
> 0.6 ha	10	9.52	9	4.35	19	6.09
Total	105	100.00	207	100	312	100.00

Source: Household Survey, 2024

5.3.10. Agriculture and Livestock practice

Agricultural practice in the project area is mostly traditional and agriculture production system is conventional. Farmers are producing mainly rice, wheat and maize as cereals crops, and mustard, wheat, as cash crops at subsistence level. Irrigation and fertilizer are the main problem of farmers in the project area. Similarly, other prevailing problems in the project area related to agriculture is uncertain rainfall, flooding and river bank cutting.

5.3.11. Livestock

It is found that among 312 surveyed household, 260 households are involved in livestock rearing practice. Most of the households (126) are rearing goat followed by Buffalo (65 households), Cow/Ox (52 households), poultry (12 households) and pig (5 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.

Table 5-12 : Status of livestock raring

Livestock Type	Number of HH	Average no of cattle per HHs	Total Number of cattle
Goat	126	4	504
Buffalo	65	2	130
Cow/Ox	52	2	104
Poultry	12	11	132
Pig	5	4	20
HHs without cattle	52	-	-
Total	312		890

Source: Household survey, 2024

5.3.12. Food Sufficiency

Among the surveyed HHs, 13.78% HHs of households have food sufficiency throughout the year from their own production. Whereas 43.91 % of the households do not have their food production hence depending absolutely on other sources income for food sufficiency. Details of food sufficiency from their own production is in **Table 5-19**:

Table 5-19: Food sufficiency in the project area from own production

Food Sufficiency from own production	Buddhabhumi	Shivaraj	Total HHs	%
	HHs	HHs		
Less than 3 months	17	42	59	18.91
3-6 months	16	20	36	11.53
6-9 months	12	25	37	11.87
9-12 months	20	23	43	13.78
Other sources of income	40	97	137	43.91
Total	105	207	312	100

Source: Household Survey, 2024

Irrigation Facilities

In regards to irrigation facilities, around 90.4% people do not have irrigation facilities rather they depend on monsoon for cultivation. On the contrary, only 9.6% have irrigation facilities.

Table 5-13: Status of Irrigation Facilities

Irrigation Status	Buddhabhumi		Shivaraj		Total	
	HHs	%	HHs	%	HHs	%
Yes	9	8.6	21	10.1	30	9.6
No	96	91.4	186	89.9	282	90.4
Total	105	100.0	207	100.0	312	100.0

Source: Household Survey, 2024

5.3.13. Types of Houses based on material

It is found that all the surveyed households have shelter for living. Modern housing is the most common across both Municipalities, accounting for 91%. Semi modern and traditional housing together represent only 9.0% of the total as shown in the table. Modern housing structure unit is made by reinforced cement concrete with pillars foundation, cement bonded bricks/stone outer wall and reinforced cement concrete roof. Semi-modern housing structure unit is made by cement bonded bricks/stone foundation, cement or mud bonded bricks/stone outer wall and galvanized sheet or tile or Unplasticized Polyvinyl Chloride (UPVC) roof. Traditional housing structure unit is made by mud bonded bricks/stone foundation, mud bonded bricks/stone or wood/planks or mud bonded bamboo outer wall and galvanized sheet or tile or UPVC or thatched/straw roof. Temporary sheds/Jhupra is made by metal pole or wooden pillars foundation, stick or bamboo or galvanized sheet outer wall and galvanized sheet or thatched/straw roof.

Definition of housing unit is adopted from Nepal Population and Housing Census (NPHC), CBS 2021.

Table 5-14: Types of House Structure

Type of House	Buddhabhumi		Shivaraj		Total	
	HHs	%	HHs	%	HHs	%
Traditional (stone/and mud wall with straw roof)	3	2.9	3	1.4	6	1.9
Semi-modern (stone/block/brick and cement wall with Jasta/slate roof)	8	7.6	14	6.8	22	7.1
Modern (stone/brick/block and cement wall with RCC roof)	94	89.5	190	91.8	284	91.0
Total	105	100.0	207	100.0	312	100.0

Source: Household Survey, 2024

5.3.14. Household Asset

The household assets/utilities owned by the surveyed households include television, table/ chair, sewing machine, motor cycle, bicycle, iron press, radio, rice cooker, refrigerator, AC, 4-wheeler vehicle and cell phone.

5.3.15. Household Income Source

The major sources of household income are remittance (48.10%) followed by small business (31.32%), service (24.05%), pension (24.68%) and Wage Labour (14.55%) as shown in the **Table 5-**.

5.3.16. Average Annual Income

Annual Average Income per Household NRs. 572,086 in the project area which is higher than the national poverty line income as per the national census (2021) which is 72,400. Hence in an average, the project area does not have people within below poverty line income. Details of the average annual income of surveyed households of both municipalities including different income sources are presented in table 5-22.

Table 5-22: Average Annual income by income category of Surveyed HHs

Income Category	Buddhabhumi		Shivaraj		Total	
	HHs	Amount	HHs	Amount	HHs	Amount
Cereal crop sale	8	472,000	11	1,115,000	19	1,587,000
Vegetables sale	1	120,000	2	40,000	3	160,000
Cash crop sale	2	220,000	3	700,000	5	920,000
Livestock	11	591,000	14	1,087,000	25	1,678,000
Wage labour	26	4,952,000	20	4,029,200	46	8,981,200
Service	23	9,196,230	53	17,686,000	76	26,882,230
Trade/business	29	11,045,000	70	28,998,000	99	40,043,000
Remittance	49	29,794,000	103	55,458,000	152	85,252,000
Pension/rent/interest /Social Allowance	28	4,110,000	50	8,877,500	78	12,987,500
Total	105	60,500,230	207	117,990,700	312	178,490,930
Annual Average Income Per Household		576,193		570,003		572,086
Annual Per Capita Income		108,036		108,948		108,637

Source: Household Survey, 2024

5.3.17. Household Expenditure Pattern

When asked about the annual household expenses, it depicts the annual expenditure of the interviewed HHs. Majority of the HHs 104 spent on ritual/festivals followed by food and clothing 105 HHs each. Total expenditure amount of the interviewed HHs is NPR 91,287,850. The survey reveals that people have tendency to celebrate festival and rituals more often and spent more money as compared to basic necessities.

Table 5- 23: Annual expenditure by expenses category

Expenses Category	Buddhabhumi		Shivaraj		Total	
	HHs	Amount	HHs	Amount	HHs	Amount
Foods	105	11,297,000	207	23,893,000	312	35,190,000
Clothing	105	3,574,000	207	6,181,000	312	9,755,000
Education	85	4,971,000	157	9,176,000	242	14,147,000
Health	100	3,707,600	206	6,260,200	306	9,967,800
Facilities	102	2,482,200	205	4,579,600	307	7,061,800
Accessories	5	535,000	13	643,000	18	1,178,000
Agricultural tools, fertilizers	59	597,500	72	1,538,600	131	2,136,100
Transportation and Communication	101	1,693,200	201	2,883,700	302	4,576,900
Festivals/rituals	104	2,049,000	204	3,306,250	308	5,355,250
Alcohol, tobacco	14	696,000	16	351,000	30	1,047,000
Others	5	103,000	6	770,000	11	873,000

Source: Household Survey, 2024

5.3.18. Sanitation and Water Supply

This sub-chapter includes the findings about the availability of sanitation and water facilities available within the surveyed households, which includes toilets and water source for domestic use, which have direct relation with the community and their accessibility for good health over the time.

5.3.19. Toilet Facility

Most of the surveyed households (93.6%) have toilet facilities at their home compound whereas about only 0.3 percent HHs have no toilet facility and go to nearby forest or field for toilet as reported by the respondents. Nepal Government has declared an “Open Defecation Free (ODF) Nation” in 2019; however, 0.3 percent HHs still do not have toilet facility in the project area. About 6.0 percent households have pit toilet as shown in the table.

Table 5- 15: Toilet Facilities in the Surveyed Households

Sanitation Facilities	Buddhabhumi		Shivaraj		Total	
	HHs	%	HHs	%	HHs	%
Permanent Structure with pan/commode	101	96.2	191	92.3	292	93.6
Temporary pit	4	3.8	15	7.2	19	6.1
No toilet, open space	0	0.0	1	0.5	1	0.3
Total	105	100.0	207	100.0	312	100.0

Source: Household Survey, 2024

5.3.20. Sources of Water for Domestic Use

Among the surveyed households, majority of the HHs are using Piped/tap water (71.2%) followed by hand pump water (22.4%), and Deep tube well with (6.4%) as sources of water for domestic use. The detail information about the sources of water used by surveyed households in the project area is shown in **table 5-25**.

Table 5-16: Sources of Water Use

Water Source	Buddhabhumi		Shivaraj		Total	
	HHs	%	HHs	%	HHs	%
Piped Tap	71	69.60	126	68.1	197	63.14
Natural (Well/Spring/Spout)	1	0.98	0	0.0	1	0.32
Ground (Deep tube Well)	6	5.88	12	5.8	18	5.78
Jar	1	0.98	9	4.3	10	3.21
Tanker	8	7.86	6	2.9	14	4.48
Hand pump	17	13.72	46	27.1	63	20.19
Others	1	0.98	8	3.9	9	2.88
	105	100	207		312	100

Source: Household Survey, 2024

5.3.21. Energy Sources

Lightning Sources

Electricity is the main source of lighting energy within the surveyed household. Out of 312 surveyed HHs, 310 HHs (99.4%) are using electricity for lighting purpose. The households using Kerosene for the lighting purpose is 0.3 percent and using kerosene is 0.3 percent only, which shows the decreasing use of kerosene and other sources of energy and increasing use of electricity for lighting as shown in **table 5-26**.

Table 5- 6: Sources of Lightning Energy

Lighting Sources	Buddhabhumi		Shivaraj		Total	
	HHs	%	HHs	%	HHs	%
Electricity	103	98.1	207	100.0	310	99.4
Kerosene	1	1.0	0	0.0	1	0.3
Others	1	1.0	0	0.0	1	0.3
Total	105	100.0	207	100.0	312	100.0

Source: Household Survey, 2024

5.3.22. Cooking Sources

Major sources of energy for cooking used by the surveyed households are Liquefied Petroleum Gas (LPG), which is 87.8 percent followed by firewood (42.9%), bio-gas (0.3%), and cow dung/straw (1.3%) as shown in table 5-27. Decreasing use of cow dung/straw within the surveyed households is noticed, which is good for human health and local environment.

Table 5- 27: Sources of Energy for Cooking

Source of Cooking Energy	Buddhabhumi		Shivaraj		Total	
	HHs	%	HHs	%	HHs	%
Fire wood	6	5.71	20	9.68	26	8.33
LPG Gas	93	88.59	180	86.95	273	87.5
Bio-gas plant	0	0.0	1	0.48	1	0.32
Dung cake	3	2.85	1	0.48	4	1.28
Electricity	3	2.85	5	2.41	8	2.57
Total	105	100	207	100	312	100

Source: Household Survey, 2024

5.3.23. Public Service Facilities

Public services available in the project area include market centers, industries, municipality offices, ward offices, and police stations, transportation and infrastructure development and ongoing and future projects, which are presented in following sub-chapters. Major public and private sector services are presented in table 5-28. Similarly, major market centers within the project area are Gorusinghe, Imaliya, Kharendrapur, Chandrauta and Shivapur. These market centers have availability of small shops, hotels, lodges, restaurants and so on are involved and has been facilitating the adjoining villages. 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 etc. There is frequent mobility of public for business as well as public services in these areas.

Table 5-28: Services available in the project area

S.N.	Occupation	HH visit frequency in a month	No. of Service center
1	Health post	2	4
2	Hospital	2	3
3	School (primary/secondary), college	26	13
4	Major Market	10	4
5	Hatbazar	4	2
6	Veterinary center	2	1
7	Maternal facility	1	4
8	Electricity office	1	1
9	Public transport (Bus, Microbus, Safari, Tempo)	30	3

Source: Household Survey, 2024

5.3.24. Industries within the Project Area

As per FGD participants, there were different types of industries were reported within the project area, which include carpet, grill, crusher, rice mill, oil mill, vehicle repair, furniture, garment, bakery, soap, cement and brick block, dalmoth, spice, incense stick and candle, hume pipe, oxygen gas, bag, dairy, poultry, banana product, toothpick, water processing, and so on as shown in **Annexure 8**.

5.3.25. Municipality Offices and Police Stations

Municipality offices and Police Stations for the people of GC corridor are easily accessible. Among 2 project affected municipalities (within the survey area), 2 municipality offices are near outside to the GC road, alignment. Similarly, among 3 ward offices (within the survey area), 1 ward offices is within 1 km, and another is far from GC road.

5.3.26. 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

municipality and ward offices, police stations, education institutions, health posts/hospitals are available.

5.3.27. Infrastructure Development Status and Ongoing and Future Projects

Physical infrastructure facilities like electricity, drinking water, school buildings, linking roads are good in condition. Regular maintenance for rural roads connected with the highway 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 GC road and bridges upgrading sub-project.

5.3.28. Gender Status

According to focus group discussion (FGD) findings, it was mentioned that there is a improvement trend in women status in terms of education and decision making. Some of the women are involvement in skill trainings provided by the municipalities but they are not able to develop entrepreneurship. Women education including informal education practice has been observed in the project area. Gender status in the project area has also been assessed through the household survey. About 80 percent surveyed households agreed that the status of both man and women in decision making is equal. As per the-Gender and Gender Based Violence Assessment report of ACCESS project for BG section (Dec, 2021) also highlighted that though some women have received the skill-based training but still difficulties to get employed or establish their own enterprises.

So, there is still gaps in gender situations. Mostly women are involved in the household work which is yet to be recognized in terms of monetary value. Gender related concerns raised during FGD are as follows:

- 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-friendly working environment and accommodation.
- Force labor and human trafficking

5.3.29. 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.

5.3.30. Gender Role on Decision Making

The decision making role in activities such financial, property selling/purchasing, foreign employment etc. by male is 44% whereas by female 12.2% within the surveyed households. However, equal role of both male and female 43.8% in decision making.

5.3.31. Health Status

Illness Reported by Surveyed Households

It is reported that among 312 surveyed households, 312 households have encountered with some kinds/types of illness/ diseases last year. Major diseases found within the survey households are Typhoid, Viral Fever in households followed by Gastric in 96 Households and Common Cold/Fever 96 in 312 households. Other diseases include Diarrhea, Malaria, Jaundice, Pregnancy/Gyne -related, Uterus, skin disease, Asthma, Eye infection is 6 and others is 8, Cholera, HIV/AIDS, Diabetics, Thyroid, TB, Cancer, Paralysis, Heart attack, Ortho, Kidney, Liver, Dengue, Accident, Blood pressure, Stomach disorder/ ache, Tumor and other diseases as in Table.

5.3.32. Health status of Diseases

As reported by the surveyed households, 63.8 percent HHs have visited private clinics for first treatment followed by District Hospitals (12.7% HHs), Health posts (11.3% HHs), Primary Health Center (6.5% HHs), Hospitals outside the District (4.7% HHs) and Nursing home (2% HHs). The finding of the household survey reveals that majority of households have visited private clinics more than public/ government health institutions. This may be because they are not satisfied with the treatment at government health institutions.

5.3.33. Cultural Environment

The project area is rich in cultural sites, situated within the alignment area. The Forest areas, temples and lakes 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.

5.3.34. 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:

- Durga Mandir (temple), Supadeurali temple, Masjeed (mosque), are main religious places in Chandrauta Bazar area.
- Chandrauta Bazar is the place where people come for religious and tourism activities.
- Harihar, Bel lakes are of Shivaraj and Buddhabhumi Municipality a new tourist destination for boating, fishing and scenery /sight-seen for natural beauty.
- Different temples and other sites are helpful to promote internal tourism in small scale in every settlement as Lumbini province has rich culture and tradition.

5.3.35. Festivals and Cultural Practices

Major festivals and ceremonies are such as Fagu Purnima/holi, Shivaratri, etc. besides these 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. used to celebrate along the GC road.

5.3.36. Funeral Practices

Bel river is of the major cremation sites found in the GC section. There is small shed and connecting access trail (earthen) in the upstream section. There is a funeral service before the cremation takes place. Funeral sites in the project area are mainly the river banks. The construction work will have minimal impact on these sites. This will consider during the construction of road and bridges.

5.3.37. Perception about the Project

KII, FGD and HHs surveyed respondents have shown keen interest towards the GC project. While collecting opinion about the likely supports to the project, about 82.6 per cent HHs have shown positive supports towards the project. Local people are interested to work on the project. They also suggested to give priority to local workers. Skilled work force is less available or not available for the project construction. So, skill training should be provided to local youths and employ in the project. Within the 312 surveyed households, sufficient un-skilled workers are available for the construction related works.

5.3.38. Private and Public Properties, Structures within RoW

The upgrading works of GC road project is expected to result in the displacement of residential/business structures, livelihoods. Similarly, there will be impact on public and community structures such as waiting sheds, temples, school gate, police check post, community buildings, and Bar/Pipal Chautara (as resting places). Possible impact to private and public properties within RoW of GC road. Seven structures (PAH) are in the Buddhabhumi Municipality and 43 structures are in the Shivaraj Municipality whereas 18 public structures located in Buddhabhumi and 64 located in Shivaraj Municipality will be impacted.

Table 5-17: Project affected private and public structures

SN	Type of Possible Affected Private Structures	Buddhabhumi	Shivaraj
1.	Residence	2	8
2.	Business	1	1
3.	Business cum Residence	5	32
4.	Associated Structures	0	4
Type of Possible Affected Private Structures			
1.	Waiting Place	9	10
2.	Chautara	4	10
3.	Police Post	1	2
4.	Temple	2	4
5.	Public Toilet	1	1
6.	School Gate	1	0
7.	Compound Wall	1	1
8.	Hand Pump	5	30

Table 5- 32: Project affected public utilities

S. N	Types of structures	Nos
1	Solar street light	21
2	Telephone pole/Cable pole	147 metals + 7 woods=154
3	Transformers	24
4	Electric pole (concrete)	805
5	Electric pole (steel)	193
6	Electric pole (wooden)	5
	Total	1202

Source: Baseline Survey, 2024

CHAPTER 6: CONCLUSION

The baseline study of the Gorusinghe-Chandrauta road section provides a comprehensive assessment of the existing physical, biological and social conditions along the project corridor. The study highlights key environmental and social baseline condition related to the road's current status, terrain, forest cover, traffic flow, settlements, socio-economic conditions, and biodiversity. The road does not pass through any protected areas, it traverses diverse habitats, including settlements, farmlands, river crossings, and forests (community and collaborative). The project area falls near the Terai Arc Landscape (TAL), with its eastern half located in the globally significant Kapilvastu Important Bird and Biodiversity Area (IBA). This IBA was designated due to its importance as a breeding habitat for the critically endangered White-rumped Vulture, other threatened bird species, and its role as a biodiversity hotspot (BCN, DNPWC and DoFSC, 2024). Additionally, the project site serves as an important groundwater reservoir, featuring several small wetlands and connected forests that facilitate wildlife dispersal.

There is likely to be north-south wildlife movement across the road for feeding or breeding purposes. Therefore, following locations were identified as most potential wildlife crossing areas. Herpetofauna and small Mammals Crossing Culvert at Chainage: 643+336, Animal Crossing Culvert at Chainage: 645+800, Animal Crossing Culvert at Chainage: 647+100, Animal Crossing Belnadi Bridge at Chainage: 648+561, Herpetofauna and small Mammal Crossing Culvert at Chainage: 649+036, Animal Crossing Jwaikhola Bridge at Chainage: 649+257, Terai Gray Langur Movement at Chainage: - 649+085. It has been also observed that crossing of stray animals along the road corridor and frequent movement at the eastern side of Belnadi,

The possible impacts during the construction phase in existing structures includes the loss of private and community structures. There will also be temporary disruptions to public utilities, such as public tube wells, electric poles, telephone poles, transformers, irrigation canals, and water supply pipes, due to the project. The details of all affected private and community structures will be included the in the stand-alone Resettlement Action Plan (RAP) of the GC section.

To assess the project's impact, the study categorized the area into three zones as Right of Way (RoW-50 m), Direct Zone of Area (DIA)- areas within the 150 m on either side and Indirect Impact Area (IIA)- adjacent area within 300 meter either side of the road. The GC Road section passes through settlements as —Imaliya, Dumara, Barkalpur, Kharendrapur, Bankatti, Chandrauta and Umari Chowk (Shivapur Chowk). Additionally, the road crosses three community forests and one collaborative forest, primarily composed of *Shorea robusta* (Sal) forests, along with *Dalbergia* and *Senegalia* patches along riverbanks. The project site recorded 14 species of mammals, 62 species of birds, 12 species of herpetofauna, and nine species of fish, underscoring its ecological significance.

The proposed road upgradation covers two municipalities-Buddhabhumi and Shivraj. A household survey of 312 households (20% sample size) representing 1,643 population revealed an average household size of 5.3. The majority religion is Hinduism (68.9%), with a multi-ethnic composition consisting of Brahmin and Chhetri (51.9%), Janajati (26.92%), and others. The literacy rate stands at 94%, and around 60% of households have migrated from other districts due to employment, business, educational opportunities, and improved living conditions. The primary occupations in the project area include trade & business, foreign employment, farm and non-farm wage labor, indicating a diversified livelihood strategy. The ESIA report will identify all the possible E&S impacts and mitigation measures as per the mitigation hierarchy.

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Annexures

Annexure 1: Proposed Road Alignment in Topographic Map

Annexure 2: Air Quality of the Project Area

Annexure 3: Lab Report of Water Quality of Project Area

Annexure 4: Lab Report for the Air water Noise sampling

Annexure 5: Species wise Number of Trees within ROW

Annexure 6: Summary Findings of FGD and KII

**Annexure 7: Questionnaire and FGD Checklist used for Social
Survey**

Annexure 8: Gazette Section showing ownership of RoW

Annexure 9: Photographs

Annexure 1: Proposed Road Alignment in Google Map and Typical Drawings of the road sections

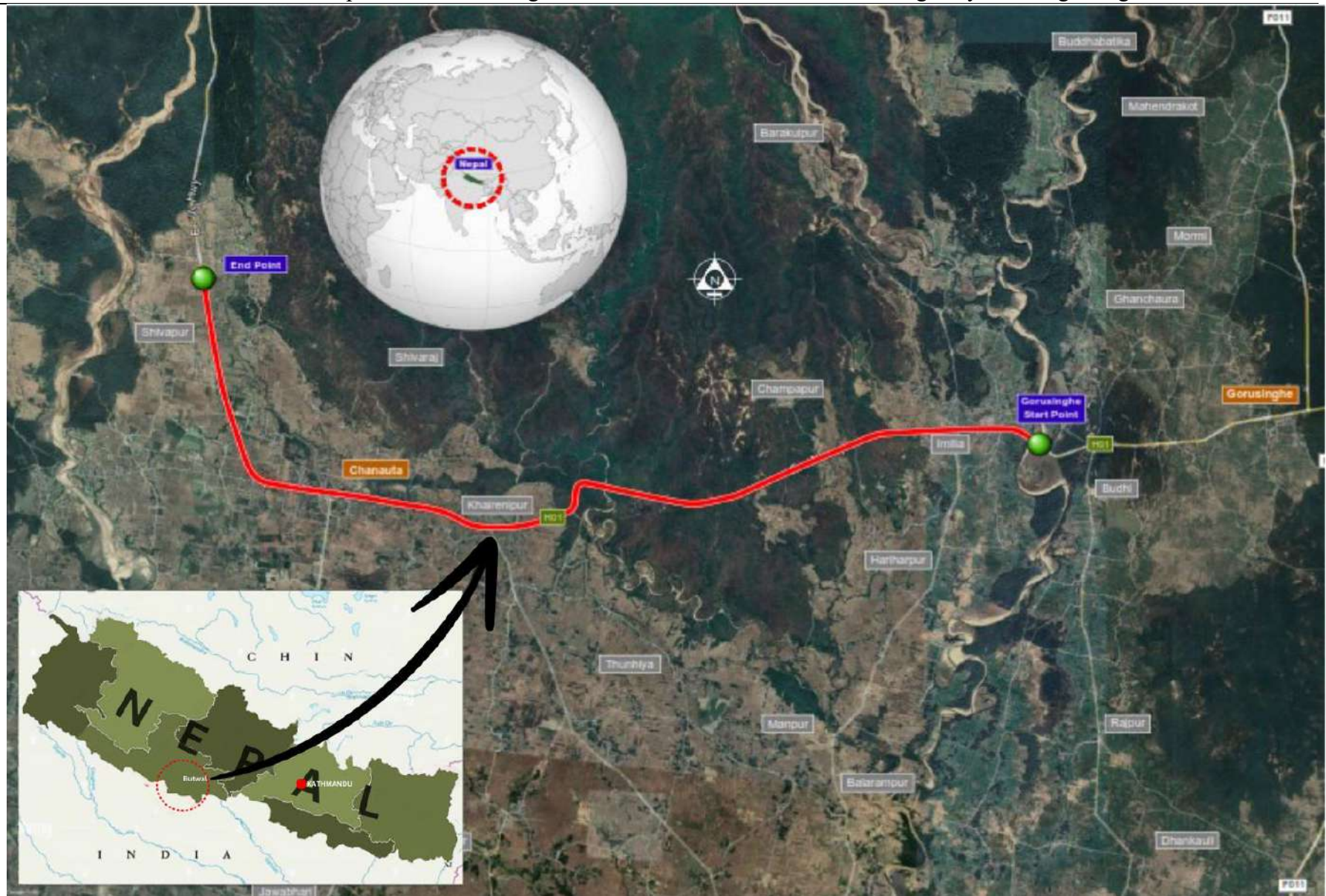


Figure 1: Google Earth map of project area (Source: Google earth, 2024)

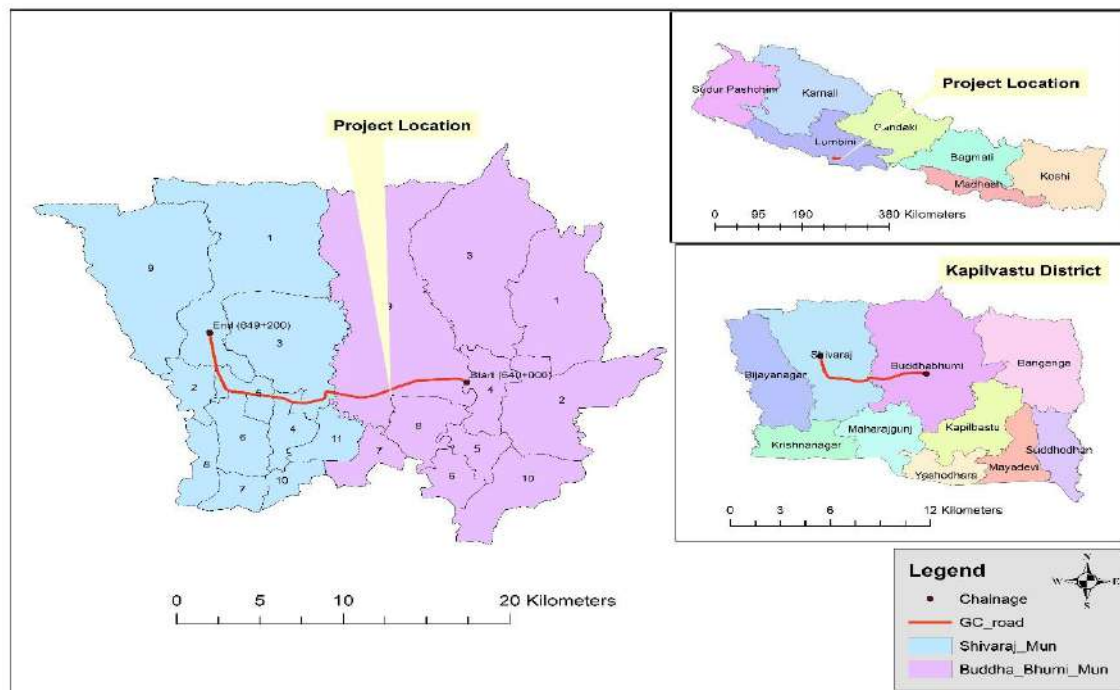


Figure 2: Location map of project area (Source: Department of Survey, 2076)

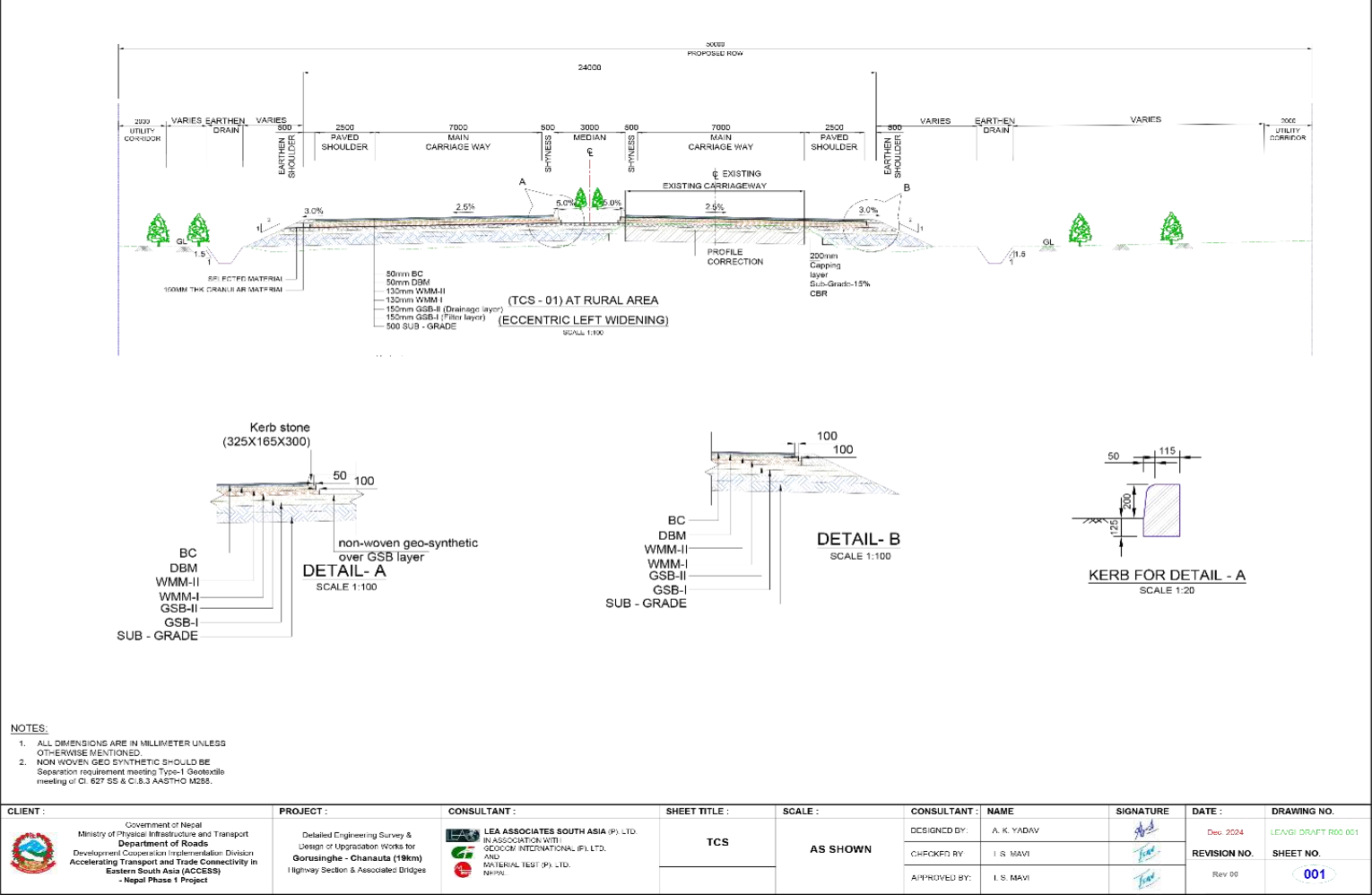


Figure 3: TSC of Rural Area

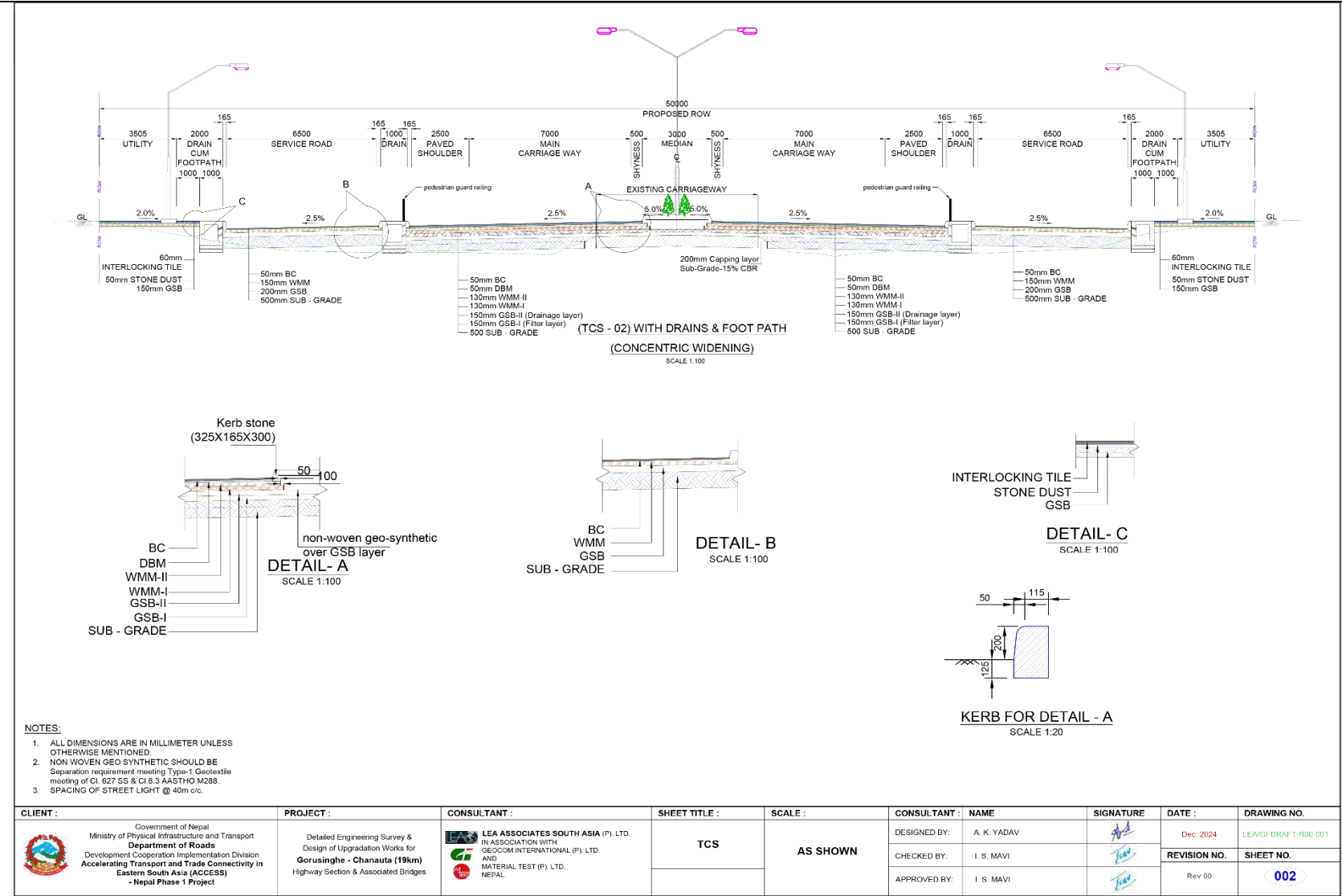


Figure 4: TSC with Drain and Foot Path in Urban Area

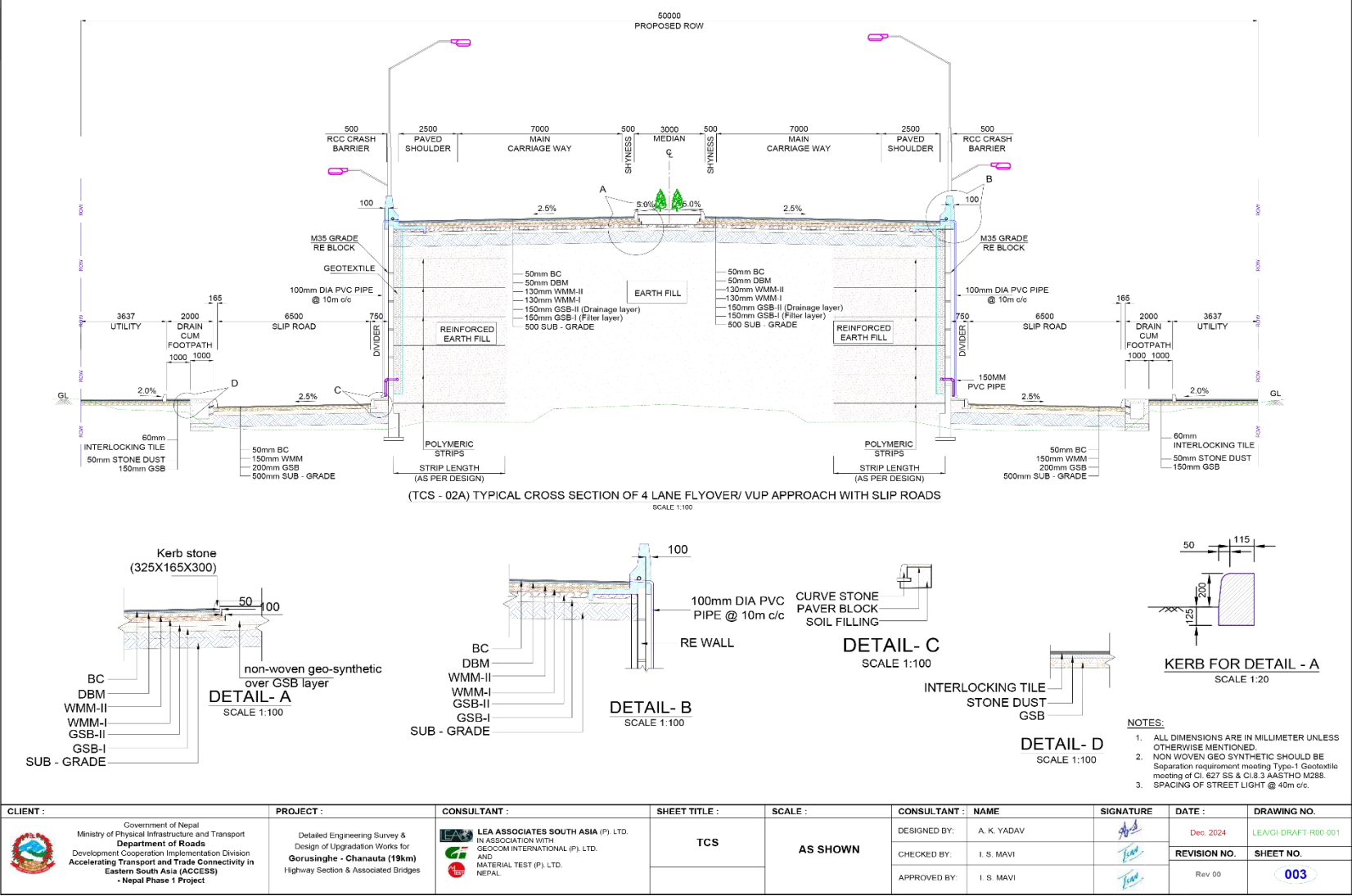


Figure 5: TSC of 4 Lane Flyover/VUP Approach with Slip Roads

Annexure 2: Air Quality of the Project Area



Lumbini Agro Environment Lab Pvt. Ltd.

लुम्बिनी एग्रो इन्भाएरमेन्ट ल्याब प्रा. लि.



Ref No: 871081/082

Helping the land to help the people
Sunwal-12, Nawalparasi, Estd: 2020

Regd No.: 239602/077/078
Vat No.: 609773466

Issue Date: 2024-05-14

Quality Test Report

Entry No.: LAEL-382-2081

Client: Geocom International Pvt. Ltd.

Address: Kapilvastu

Contact no. of Client: 9843950840



Sample Type: Ambient Air

Sampling Start Date: 2024-08-15

Sampling End Date: 2024-08-16

Sampled By: Laboratory

Test Results

S.N.	Parameters	Unit	Observed Value			Tolerance Limit (National Air Quality Standard, Ministry of Forests and Environment, 2012) ($\mu\text{g}/\text{m}^3$)	Remarks
			M1	M2	M3		
1.	TSP	($\mu\text{g}/\text{m}^3$)	110	75	85	230	Within the limit
2.	PM10	($\mu\text{g}/\text{m}^3$)	70	55	65	120	Within the limit
3.	PM2.5	($\mu\text{g}/\text{m}^3$)	25	15	20	40	Within the limit
4.	SO ₂	($\mu\text{g}/\text{m}^3$)	N.D.	N.D.	N.D.	70	
5.	NO ₂	($\mu\text{g}/\text{m}^3$)	N.D.	N.D.	N.D.	80	

Note: N.D.: Not Detected

M1- Imiliya, GPS Location: N27°39.593' E082°59.607'

M2- Jwai Khola, GPS Location: N27°38.900' E082°54.609'

M3 - Chandrauta, GPS Location: N27°38.959' E082°51.859'

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Analyzed By

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Checked By

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Authorized By

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Annexure 3: Lab Analysis of Water Quality of Project Area



Lumbini Agro Environment Lab Pvt. Ltd.

लुम्बिनी एग्रो इन्भाएरमेन्ट ल्याब प्रा. लि.

Helping the Land, Helping the People
Summit-12, Kathmandu, Nepal, 2020



Regd No.: 239602/077/078
Vat No.: 609773466

Issued Date: 2081-09-01

Quality Test Report

Name of Client:	Balla Khola	Lab Code:	LAEL-377-2081
Collector:	Parendra Gupta	Location:	Kapilvasta, N27°39.051' E082°54.965'
Source:	Surface water	Sampled By:	Laboratory
Sampling Date:	2081-08-15	Test Performance Date:	2081-08-16 to 2081-08-21
Receipt Date:	2081-08-16		

S.N.	Category	Parameters	Method	Observed value	Wastewater Discharge Guidelines, Nepal (MOE 2010)
1.	Physical	pH	4500-H ⁺ .B. APHA, AWWA, WEF, 24 th Edition	7.6	5.5-9.0
2.		Temp. °C	Thermometric	21.7	-
3.		TDS (mg/L)	2540 C. APHA, AWWA, WEF, 24 th Edition	286	
4.		Electrical Conductivity (µS/cm)	2510 B. APHA, AWWA, WEF, 24 th Edition	528	
5.	Chemical	Total Suspended Solids, TSS (mg/L)	2540 D. APHA, AWWA, WEF, 24 th Edition	25	50
6.		Chemical Oxygen Demand (mg/L)	5220 B. APHA, AWWA, WEF, 24 th Edition	65	250
7.		Dissolved Oxygen (mg/L)	4500-O C. APHA, AWWA, WEF, 24 th Edition	7.88	

Note:

1. This report is based on the sample submitted to this laboratory by the client
2. The integrity of the sample and results are dependent on the quality of sampling. The results refer only to the parameters tested of the samples provided/collected for analysis.

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Analyzed By
Dipesh Sahani
BSc.Ag

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Checked By
Dipesh Sahani
BSc.Ag

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Authorized By
Sudip Paudel
MSc. Env. Sci

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Environment and Social Baseline Report of the Gorusinghe-Chandrauta Section of East-West Highway including Bridges, 2025

Regd. No. 53875/064/065



AASTHA SCIENTIFIC RESEARCH SERVICE PVT. LTD.

Maitidevi, Kathmandu, Nepal, Tel: +977-1-4533748
E-mail: aasthalab2079@gmail.com

(Center for complete scientific solution)

Test Report



Report No. : 405C
Entry No. : AASTHA – 491 – 2081/82
Sample : Water
Client : Lumbini Agro Environment Lab
Source : Goru Singhe Khola

Date received : 21/08/2081
Date completed : 22-23/08/2081
Sampled By : Client
Issue Date : 24/08/2081

S. N.	Parameter	Test Method	Observed Values
1.	Iron (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	0.51
2.	Manganese (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	0.13
3.	Lead (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	<0.01
4.	Cadmium (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	<0.003
5.	Nickel (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	<0.01
6.	Chromium (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	<0.05
7.	Copper (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	0.01
8.	Zinc (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	0.02
9.	Arsenic (mg/l)	3114 C, APHA, AWWA, WEF, 24 th Edition.	<0.01

Analyzed By

Checked By

Authorized By
(Chairperson)

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3. Even in the case of stable samples such as limestone, minerals, soil etc. they will not be stored more than two months unless specially requested by the client.
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Environment and Social Baseline Report of the Gorusinghe-Chandrauta Section of East-West Highway including Bridges, 2025

Regd. No. 53875/064/065



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E-mail: aasthalab2079@gmail.com

(Center for complete scientific solution)



Report No. : 405A
Entry No. : AASTHA - 491 - 2081/82
Sample : Water
Client : Lumbini Agro Environment Lab
Source : Balla Khola

Date received : 21/08/2081
Date completed : 22-23/08/2081
Sampled By : Client
Issue Date : 24/08/2081

S. N.	Parameter	Test Method	Observed Values
1.	Iron (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	0.15
2.	Manganese (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	0.13
3.	Lead (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	<0.01
4.	Cadmium (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	<0.003
5.	Nickel (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	<0.01
6.	Chromium (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	<0.05
7.	Copper (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	0.01
8.	Zinc (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	0.02
9.	Arsenic (mg/l)	3114 C, APHA, AWWA, WEF, 24 th Edition.	<0.01

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(Chairperson)

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(Center for complete scientific solution)



Report No. : 405B
Entry No. : AASTHA - 491 - 2081/82
Sample : Water
Client : Lumbini Agro Environment Lab
Source : Jwai Khola

Date received : 21/08/2081
Date completed : 22-23/08/2081
Sampled By : Client
Issue Date : 24/08/2081

S. N.	Parameter	Test Method	Observed Values
1.	pH	4500-H*, B, APHA, AWWA, WEF, 24 th Edition.	7.5
2.	Temperature (°C)	Thermometer	21.6
3.	TDS (mg/l)	2540 C, APHA, AWWA, WEF, 24 th Edition	395
4.	Electrical Conductivity (µmhos/cm)	2510 B, APHA, AWWA, WEF, 24 th Edition.	730
5.	Total Suspended Solids (mg/l)	2540 D, APHA, AWWA, WEF, 24 th Edition	18
6.	COD (mg/l)	5220 B, APHA, AWWA, WEF, 24 th Edition	75
7.	DO (mg/l)	4500-O C, APHA, AWWA, WEF, 24 th Edition	7.82
8.	Iron (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	0.27
9.	Manganese (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	0.08
10.	Lead (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	<0.01
11.	Cadmium (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	<0.003
12.	Nickel (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	<0.01
13.	Chromium (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	<0.05
14.	Copper (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	0.01
15.	Zinc (mg/l)	3111 B, APHA, AWWA, WEF, 24 th Edition.	0.02
16.	Arsenic (mg/l)	3114 C, APHA, AWWA, WEF, 24 th Edition.	<0.01

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Analyzed By

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Checked By

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(Chairperson)

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Annexure 4: Lab Report for Sound level measurement



Lumbini Agro Environment lab Pvt. Ltd.

लुम्बिनी एग्रो इन्भाएरमेन्ट ल्याब प्रा. लि.



Ref No: 86/081/082



Regd No.: 239602/077/078
Vat No.: 609773466

Issue Date: 2081-09-01

Quality Test Report

Entry No.: LAEL-381-2081	Type of sample: Sound Level
Client: Geomac International Pvt. Ltd	Sampling Date: 2024-11-26
Address: M3 - Chandrauta, N27°38.959' E082°51.859'	Date completed: 2024-11-27
Contact No.: 9843950840	Location: Chandrauta road Premises
Contact Person: Sachin Jha	Sampled By: LAEL-field person
Device: SL-1352	Run Time: 24 hrs
Basic Functions	Range
Accuracy	±1.4dB
Resolution	0.1dB
Frequency Range	3.5-8KHz
Dynamic Range	50dB
Level Range	Low:30-80dB Medium:50-100dB
	High:80-130dB Auto:30-130dB
Time Weighing	FAST (125ms) SLOW(1s)

Test Results

Start Time: 2024-11-24	10:30:00	
End Time: 2024-11-25	10:30:00	
Max: 75 dB(A)		
Min: 45 dB(A)		

Description	Sound Level dB(A)
<i>L_{eq}(day)</i>	70
<i>L_{eq}(night)</i>	55

Day denotes 7:00 to 22:00 hours
Night denotes 22:00 to 7:00 hours

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Lumbini Agro Environment Lab Pvt. Ltd.

लुम्बिनी एग्रो इन्भाएरमेन्ट ल्याब प्रा. लि.



Ref No: 85/084/082



Regd No.: 239602/077/078
Vat No.: 609773466

Issue Date: 2081-09-01

Quality Test Report

Entry No.: LAEL-380-2081	Type of sample: Sound Level
Client: Geomac International Pvt. Ltd	Sampling Date: 2024-11-26
Address: M2- Jwai Khola, N27°38.900' E082°54.609'	Date completed: 2024-11-27
Contact No.: 9843950840	Location: Jwai Khola road Premises
Contact Person: Sachin Jha	Sampled By: LAEL-field person
Device: SL-1352	Run Time: 24 hrs
Basic Functions	Range
Accuracy	±1.4dB
Resolution	0.1dB
Frequency Range	3.5-8KHz
Dynamic Range	50dB
Level Range	Low:30-80dB Medium:50-100dB High:80-130dB Auto:30-130dB
Time Weighing	FAST (125ms) SLOW(1s)

Test Results

Start Time: 2024-11-26	10:30:00	
End Time: 2024-11-27	10:30:00	
Max: 55 dB(A)		
Min: 35 dB(A)		

Description	Sound Level dB(A)
<i>L_{eq}(day)</i>	52
<i>L_{eq}(night)</i>	40

Day denotes 7:00 to 22:00 hours
Night denotes 22:00 to 7:00 hours

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Lumbini Agro Environment lab Pvt. Ltd.

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Ref No: 84/2081/092

Helping the land to help the people

Sumwal-12, Nawalparasi, Estd: 2019



Regd No.: 239602/077/078

Vat No.: 609773466

Issue Date: 2081-09-01

Quality Test Report

Entry No.: LAEL-379-2081	Type of sample: Sound Level
Client: Geomac International Pvt. Ltd	Sampling Date: 2024-11-24
Address: m1- Imiliya, N27°39.593' E082°59.607'	Date completed: 2024-11-25
Contact No.: 9843950840	Location: Imiliya road Premises
Contact Person: Sachin Jha	Sampled By: LAEL-field person
Device: SL-1352	Run Time: 24 hrs
Basic Functions	Range
Accuracy	±1.4dB
Resolution	0.1dB
Frequency Range	3.5-8KHz
Dynamic Range	50dB
Level Range	Low: 30-80dB Medium: 50-100dB
	High: 80-130dB Auto: 30-130dB
Time Weighing	FAST (125ms) SLOW(1s)

Test Results

Start Time: 2024-11-25	10:30:00	
End Time: 2024-11-26	10:30:00	
	Max: 72 dB(A)	
	Min: 43 dB(A)	

Description	Sound Level dB(A)
<i>L_{eq}(day)</i>	66
<i>L_{eq}(night)</i>	53

Day denotes 7:00 to 22:00 hours
Night denotes 22:00 to 7:00 hours

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Annexure 5: Species wise Number of Trees within RoW

Annexure 6: Questionnaire and FGD Checklist used for Social Survey

Checklists for KII and FGD for Socio-economic Survey

**Government of Nepal
Ministry of Physical Infrastructure and Transport
Department of Roads
Development Cooperation Implementation Division (DCID)
Accelerating Transport and Trade Connectivity in Eastern South Asia (ACCESS)–
Nepal Phase 1- Project
Upgrading of Goringhale- Chandrauta Road Section (19Km) of East-West
Highway
Socioeconomic Baseline Study of GC Road for IEE/ESIA**

Checklist for Focus Group Discussion

Process:

- 1. The IEE/ESIA team will present the development of the project focussing on:**
 - a. Location of the project to the communities
 - b. Explain the ancillary required for the construction of the road
 - c. Explain how the local people will be affected during construction and in operation period
 - Land and property acquisition
 - Obstruction of irrigation canals, foot trails, subways, water supply pipelines, drainage, cable electric poles/transformer etc. during construction
 - Construction related risks to the community
 - Vehicular movement and related risks
 - Job and employment opportunities
 - Influx of outside workers and associated social and cultural risks
 - Improvement of access and related benefits to education, health, and economy
- 2. Question and Answer session**
- 3. Seek following information from the locals**

About Project:

- a. Willingness to cooperate in the acquisition of private assets and willingness to provide property for the project
- b. Envisaged mode of compensation for the private land and Asset
 - Additional Assistance
- c. Approximate current value of land price along the roadside
- d. Availability of skilled/unskilled worker for construction works from the adjacent settlements
- e. Is there any incident of accidents since last years
- f. Are there any special requirements to be fulfilled prior to demolishing the affected structure-Temple/chautara
- g. Availability and willingness to give land and houses for temporary use in lease.

About People

- h. Ethnographic description of the major ethnic group residing the within 300 m. either sides of road
- i. Economic status of people settlement wise
- j. Major Health problems of the area (Frequently observed disease among child, youth, the elderly, women and PWDs)

About Agriculture

- k. What is the current season wise cropping pattern in the area
- l. What is the production per unit of the land for each crops/cereal.
- m. Food security and food sufficiency (is the local production sufficient to feed area people, if not mode of coping for food deficit)
- n. What potential exists for vegetable and horticulture or other agro-based economic opportunity

Is there any potential to establish commercial farms and enhance agri-business along with upgradation of the road?

About Infrastructures

- o. Any infrastructure (foot trail, existing water supply line, water spouts, irrigation canal etc) they think will be affected by the project

Road Safety status/Community Awareness

- Foot over bridge
- Zebra crossing
- Cattle crossing
- Resting places for driver and passenger

Accidents and incidents

- Vehicle type responsible for incident/accident (private, public or heavy/light)
- No of Incident/Accidents
- Cause of Accident
- No. of injuries
- No. of causality
- Number of deaths

About culture and historical places

- p. Name the temples in the project area and provide their religious significance.
- q. Is any of the temple lies close to the project sites that has to be dismantled. If so, what is its religious significance? Is there management committee?
- r. Are there any special sites where people gather to celebrate during key festivals? For how long it runs active and in general how many people visit?
- s. Is there any site of cultural, historical and touristic significance in the area?

About Road t Needs

- t. What are the first five development needs of the participating municipalities
- u. What is expected by the people from the project (at the minimum)

About Gender

Educational status of women social status of women

- in household decision making
- in household works
- in land and property
- livestock
- in social organisation
- v. How the status of women could be improved?
- w. How familiar are you with the concept of gender equality?

Existing situation of Gender-Based Violence/CSEA/SH

- Is their particular location, places in the community where people feel women and girls are more at risk of experiencing GBV?
- Did the survivor seek support or assistance after experiencing gender-based violence? Where? How?

- How does your community generally respond to incidents of gender-based violence?
- In your community, where would one, who experience GBV, typically go to seek services?
- Are survivors supported by the community?
- What are the perceived impacts of gender-based violence on individuals, families, and communities?
- How does gender-based violence affect community cohesion and well-being?

Access to Support Services/ response mechanism at community level

- Where do people who have been sexually violated seek help?
- Are there support services available in your community for survivors of gender-based violence?
- How accessible are these support services?
- What improvements could be made to enhance access to support services?

Preventive Measures

- What preventive measures do you think could be implemented to reduce gender-based violence in your community?
- Are there existing programs or initiatives aimed at preventing gender-based violence?

The End

Attendance sheet for the Focus Group Discussions

Name of Municipality:

Location:

Date:

SN	Name	Address	Male/Female	Age	Signature

Government of Nepal
Ministry of Physical Infrastructure and Transport
Department of Roads
Development Cooperation Implementation Division (DCID)
Accelerating Transport and Trade Connectivity in Eastern South Asia (ACCESS)–Nepal
Phase 1- Project
Upgrading of Goringhale- Chandrauta Road Section (19Km) of East-West Highway
Socioeconomic Baseline Study of GC Road for IEE/ESIA
Key Informant Interview (KII) Checklist

Name of Respondent/Organization:

Date

Location Details:

Place:

Municipality and Ward:

District:

1. Concerned Municipality/RM/Ward- chair

- What type of role supposed to be played by your municipality to smooth implementation of the project?
- Does your organization conduct advocacy on equal wage for same work to women and men.
- Is there IPs having ancestral domain or customary rights?
- What the poverty level in your municipality/ward (NPR 72000 per person/per year)? Did you distribute poverty card?

2. Health Care (Health Post and Health Centers)-center head

- What are the main health problem that has been facing in your area? Please mention the top three common diseases?
- How often community people come to seek health care in your area? Weekly, bio-monthly, monthly, yearly or never?
- Do you think the government family health insurance scheme is effective to provide the health services to the community people? If yes, how? If not, why?
- Do people visit to traditional health practitioner/traditional healer (women, men)?

3. Education (school)-Principal of School and Government

- What number of girl student enrolled in the school in your settlement?

- Do parents discriminate between girl and boys in education in terms sending them private and public schools?
 - What is the status of drop out cases in your settlement?
- 4. Impact on Private and Community Structures (Community People, Ward Chair/Member) Committee head of temple/Representative of Committee and club management committee**
- How many private structures (residential, commercial, residential cum commercial, toilet, cattle shed etc.) likely to be affected by the project?
 - Are structure owner ready to dismantle the structures if they provide compensation?
 - Are there formal committees established for community structures like temple?
- 5. Municipality/Ward Elected Representatives (Deputy Mayor, Women member of ward and Dalits)**
- Does your organization support to enhance the economic empowerment of women, IPs and excluded groups? If yes, what are the activities implementing by your organization
 - Do you have any idea about the project?
 - In your view what is the major social problem in this road alignment?
 - Are there positive versions of community people about the project?
 - Are there any pipeline projects that has to be considered while implementing this project?
 - Are there other sectors/stakeholders/community that has to be consulted for finding the cumulative impacts on this project or finding the future projects near by the road?
- 6. Transportation Facilities/Travel Time (Leader of community-traffic, Transportation management committee)**
- Stray animal
 - Road kill
 - Human - animal conflict
 - Do you think after constructions of the road transportation facility improve?
 - Is travel time reduced by upgrading of the road?
 - Is your economic activity increased after the project implementation?
 - Do you think surplus time due to better transportation facility contribute your economic activities?

- Do you think what could be the factors that can increase/decrease road accident after construction of the road?

7. Vendors (Tea Shopkeeper, Fruit Seller, key vendor personnel etc.)

- How long are you running this tea shop?
- Who are supporting you to run the tea shop (family members, hired workers - girls, boys and others)?
- How many members are there in your family who depends on income of this shop?
- How much do you earn in a day?
- Do you know about the project?
- Do you need to relocate your shop due to construction?

Checklist for KII and FGD for Biodiversity Baseline Survey

Department of Roads
Development Cooperation Implementation Division (DCID)
Accelerating Transport and Trade Connectivity in Eastern South Asia (ACCESS)–
(Phase-I)
Upgrading of Gorusinghe- Chandrauta Road Section (19Km) of East-West Highway
Key Informant Interview (KII)

Forest and Biodiversity

S.N	Key Informant and Main Check Items	Yes/No	Status/Details	Remarks
a.	Divisional Forest Officer (DFO) (Including sub-division forest office chief)			
	Forest biodiversity and wildlife hotspot in the project site and vicinity.			
	Important forest patch, wildlife habitat, wetland and connectivity		(Name of location and details)	
	Known (recorded in past) threatened and significant wildlife			
	Road accident cases of wildlife		(Last two- year's record)	
	Forest encroachment, illegal logging and wildlife hunting			
	Prominent wildlife crossing areas		(Location details)	
	Other existing, ongoing and planning linear infrastructure projects in the forest area in and around the project site.			
b.	President of Collaborative Forest and Community Forest Management Committee			
	Is the forest management plan is updated and inclusive of biodiversity component			
	Mainstreaming biodiversity components in the management plan and their implementation status			
	Forest resources using guideline and practices			

S.N .	Key Informant and Main Check Items	Yes/No	Status/Details	Remarks
	Forest conservation and management practices (plantation, wildlife drinking pond construction, wildfire control, conservation campaign), good governance and inclusive and equal distribution of forest resources.			
	Forest degradation (encroachment, illegal logging, wildlife hunting, cattle overgrazing etc) problem			
	People wildlife conflict scenario (human casualties and crop damage)			
c.	Forest Guards			
	Wildlife encounter and observe in the forest		(Local name)	
	Major wildlife road crossing locations and directions			
	Road kill accident of wildlife and other wildlife casualties observed in the forest			
	Unusual observation (rare record) of wildlife and their behaviour			
d.	Local Government Authority (Mayor and ward president of project site)			
	Natural resources and harmony with local people (coexistence, conflict, exploitation)			
	Natural resources management practices (plantation, pond construction, rotational grazing etc)			
	Developmental activities in or through the forest habitat		(list)	
	Annual program for biodiversity conservation and promotion			
	Riverbed excavation		(if yes, location)	
e.	Conservation Organisations (NGO/INGO eg. Bird Conservation Nepal, WWF Nepal, IUCN Nepal, National Trust for Nature Conservation) and Independent Biodiversity Researchers			
	Critical habitat, biodiversity hotspot, important wildlife corridor and watershed in and around the project site			
	Threatened and conservation significant wildlife of the project site			

S.N .	Key Informant and Main Check Items	Yes/ No	Status/Details	Remarks
	Significant wildlife habitat (eg. Vulture nesting colony, Den etc) known in the project site			
	Landscape conservation priority (eg. TAL, Chure Conservation, IBA etc.) and situation			
	Wildlife tracking results (eg. Satellite tag movement of vultures, camera trapping record of mammals etc.)			
	Future projection of habitat modification and wildlife movement with reference to climate change scenario			

Department of Roads
Development Cooperation Implementation Division (DCID)
Accelerating Transport and Trade Connectivity in Eastern South Asia (ACCESS)–
(Phase-I)
Upgrading of Goringhe- Chandrauta Road Section (19Km) of East-West Highway

Focal Group Discussion (FGD)
Forests and Biodiversity

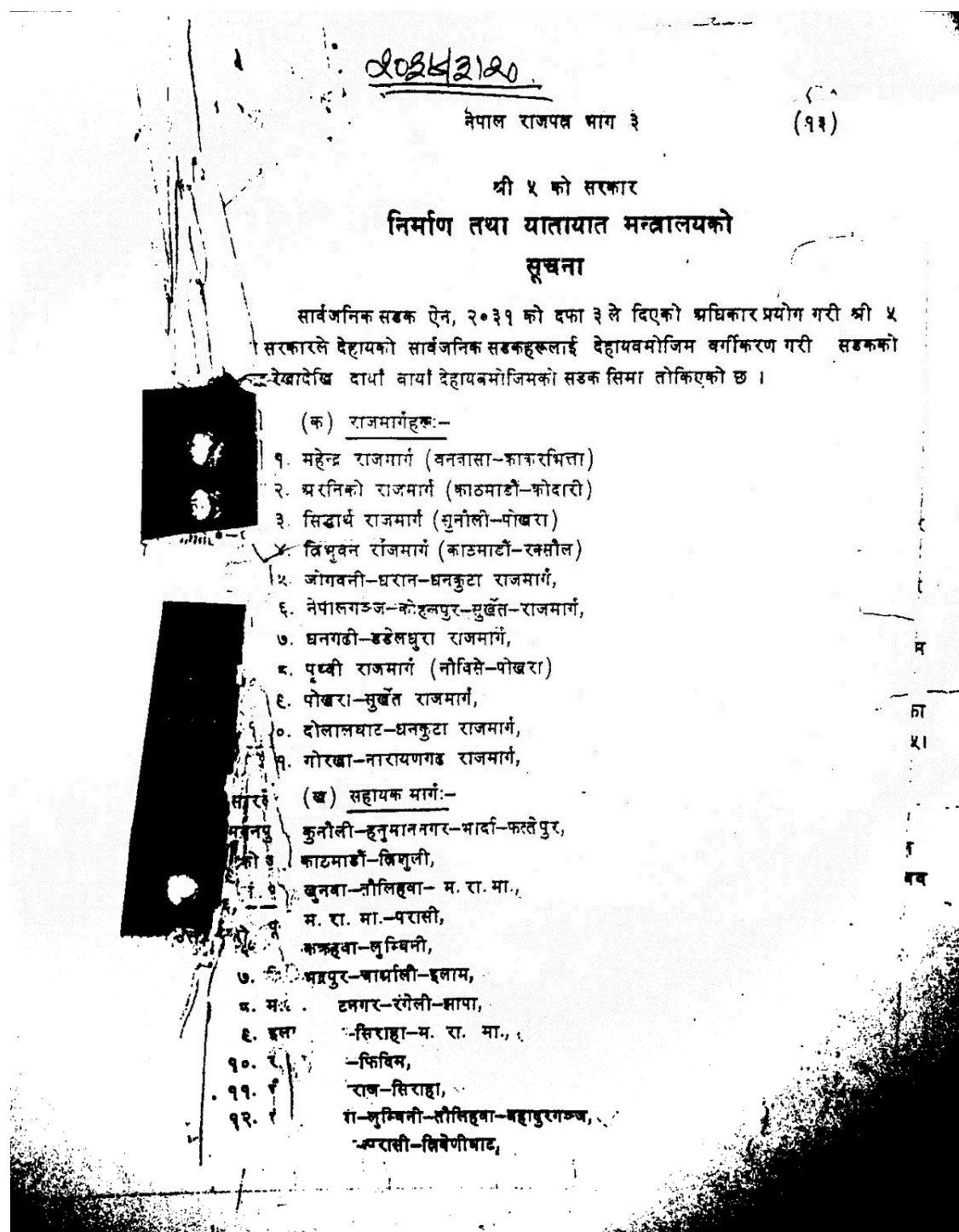
S.N	Key Informant and Main Check Items	Yes/No	Status/Details	Remarks
A.	Collaborative Forest and Community Forest User Group members			
	• Forest coverage changes (increasing or decreasing in their community forest in last ten years)			
	• Main resources getting from forest (firewood, timber, fodder etc.)			
	• Wildlife encounter and incident they have observed			
	• Forest management practice is satisfactory or need to improve (activities details)			
	• Willingness to conserve forest habitat and wildlife			
	• Challenges of forest habitat conservation and management			
B	Local clubs, civil societies and social groups (eg. Mother Groups)			
	• Are they play active role in forest and wild conservation (eg. tree plantation, solid waste management, conservation campaign etc)			
	• Environmental problem in their locality and action they performed to control		(list)	
	• Are they play active role in saving lives and goods during natural calamities (flood, forest fire etc.)			
C	School Teachers and Children			
	• Are students aware about forest habitat and wildlife of their surrounding			
	• Environmental teaching practice and extracurricular activities			

Environment and Social Baseline Report of the Gorusinghe-Chandrauta Section of East-West Highway including Bridges, 2025

S.N .	Key Informant and Main Check Items	Yes/ No	Status/Details	Remarks
	• Are students formed Eco club in their school? If yes what are the major activities			
	• Annual calendar of environmental activities (marking of green days etc.)			
	• Conservation and awareness campaign (eg. discourage catapult use, gardening in school and home, control plastic pollution)			

Annexure 7: Gazette Section showing ownership of ROW

: RAJ PATRA NEPAL GAZETTE MENTIONING ROW OF THE EXISTING HIGHWAY
25 METER BOTH SIDES



२०२४/३/२०
नेपाल राजमार्ग भाग ३

१८. बनेपा-पनौती,

१९. गोकर्ण-साँखु,

२०. काठमाडौं-दक्षिणकाली,

२१. काठमाडौं-बुढानिलकण्ठ,

२२. सितामञ्जल-भक्तपुर,

२३. चतरा-धरान,

(घ) शहरी मार्गहरू:-

नेपाल अधिराज्यका नगर पञ्चायत क्षेत्रभित्रका सबै सडकहरू (राजमार्ग, सहायक मार्ग र जिल्ला मार्ग बाहेक)

१. प्रकरण (क) मा लेखिएका राजमार्ग र उपत्यकाको चक्रपथको केन्द्र रेखादेखि दायाँ बायाँ दुवैतिर पच्चीस पच्चीस मिटर सडक सिमा तोकिएको छ।

२. प्रकरण (ख) मा लेखिएका सहायक राजमार्गको केन्द्र रेखादेखि दायाँ बायाँ दुवैतिर पन्ध्र पन्ध्र मिटर सडक सिमा तोकिएको छ।

३. प्रकरण (ग) मा लेखिएका जिल्ला मार्गको केन्द्र रेखादेखि दायाँ बायाँ दुवैतिर दश दश मिटर सडक सिमा तोकिएको छ।

४. प्रकरण (घ) मा लेखिएबमोजिम सार्वजनिक सडकको न्यूनतम १ मिटर र अधिकतम ५ मिटरसम्मको फूटपाथ समेतलाई सडक सिमा तोकिएको छ।

राजमार्ग (निर्माण व्यवस्था) ऐन, २०२१ को दफा २ को खण्ड (ख) र दफा ३ मोजिम प्रकाशित यस मन्त्रालयको मिति २०२१।११।११, ०२४।१२।१२ र ०२५।०३।०३ को सूचना खारेज गरिएको छ।

आज्ञाते-

नारायणप्रसाद शर्मा

श्री ५ को सरकारको अधिकार

Annexure 8: Photographs

GLANCE OF THE PROJECT SITE	
	
Existing two-lane sections	Existing major bridge (CH 640+200)
	
Belgurdawa river (CH 640+200)	Forest area on both side of road (CH 670+320)

Some Consultation Photographs at Site



Consultation Meeting with DFO in Taulihawa



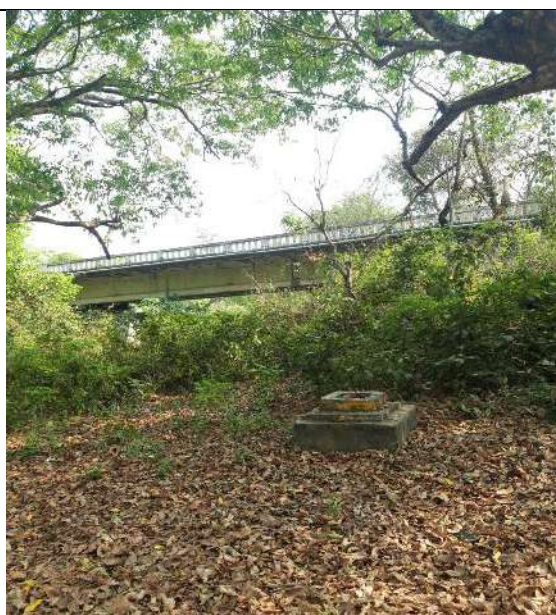
Consultation Meeting in Shivaraj Municipality, Chanauta (CH 651+400)



Consultation Meeting with Mayor of Buddhibhumi Municipality at Sub Division Office Arghakhanchi Chowk, Gorshinghe



Consultation Meeting with Ward President at Shivaraj Municipality ward No-4, Chanauta

	
Cremation site near Bel River (CH 648+600)	Feral Cattle Rescue Center (CH 647+800)
	
Forest Fire along the road (CH 644+400)	Solid waste dumps in the Culvert area (CH 649+400)