Environmental Impact Assessment

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Nepal: South Asia Subregional Economic Cooperation Electricity Transmission and Distribution Strengthening Project

Volume 1: Main Report

Prepared by Nepal Electricity Authority for the Asian Development Bank (ADB).

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Acronyms and Abbreviations

AAQ	Ambient Air Quality
ACSR	Aluminum Conductor Steel-Reinforced Cable
ADB	Asian Development Bank
AH	Affected Household
AQI	Air Quality Index
AZE	Alliance for Zero Extinction
BC	Before Christ
BCE	Before the Common Era
BCN	Bird Conservation Nepal
BIA	Business Impact Analysis
BOD	Biochemical oxygen demand
CAAN	Civil Aviation Authority of Nepal
CAP	Corrective Action Plan
CBD	Convention on Biological Diversity
CBIP	Central Board of Irrigation and Power
CE	Common Era
CFUG	Community Forest User Groups
CGWB	Central Ground Water Board
CH	Critical Habitats
CITES	International Trade in Endangered Species of wild Fauna and Flora
CO	Carbon Monoxide
COD	Chemical oxygen demand
COVID-19	Coronavirus Disease 2019
CR	Critically Endangered
CSEMP	Construction Specific Environmental Management Plan
CWTP	Community Work Training Program
DB	Decibel
DDC	District Development Committee
DFO	Division Forest Offices
DNPWC	Department of National Park and Wildlife Conservation
DO	Dissolved Oxygen
EA	Executing Agency
EHS	Environmental, Health, and Safety
EIA	Environmental Impact Assessment
EM	Environmental Manager
EMF	Electromagnetic Field
EMMU	Environmental Management Unit
EMP	Environmental Management Plan
EMS	Environmental Management System
EN	Endangered
EPA	Environmental Protection Agency
EPC	Engineering, Procurement and Construction
ERP	Emergency Response Plan
ESA	Ecologically Sensitive Area
ESIA	Environmental Impact Assessment and Social Assessment
ESMU	Environmental and Social Management Unit
ESO	Environmental and Social Officer
ESZ	Environmentally Sensitive Zones
FGD	Focused Group Discussion

FRA	European Union Agency for Fundamental Rights
GDP	Gross Domestic Product
GESI	Gender Equality and Social Inclusion
GHG	Greenhouse Gases
GIIP	Good International Industry Practice
GIS	Geographic Information System
GLA	Greater Lumbini Area
GPS	Global Positioning System
GRC	Grievance Redressal Committee
GRM	Grievance redress mechanism
HC	Hydrocarbon
HDD	Horizontal Directional Drilling
HEP	Hydroelectric Power
HFL	Highest Flood Level
HH	Household
HIA	Health impact assessment
HIV/AIDS	Human Immunodeficiency Virus /Acquired immunodeficiency syndrome
HPO	Hydropower Purchase Obligation
HSO	Health and safety officer
HV	High Voltage
IBAT	Integrated Biodiversity Assessment Tool
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEE	Initial Environmental Examination
IES	International Environmental Specialist
IFC	International Finance Corporation
IFI	International Financial Institutions
ILO	Indigenous and Tribal Peoples Convention
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
LARP	Land Acquisition and Resettlement Plan
LC	Least concern
LILO	Line in Line out
LTFP	Long Term Financial Plan
Masl	Meters above sea level
MCA	Millennium Challenge Account
MEA	Multilateral Environmental Agreements
MOEF	Ministry of Forest and Environment
MOEWR	Ministry of Energy, Water Resources and Irrigation
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NBSM	National Bureau of Standards and Metrology
NDA	Non degraded Airshed
NDWQS	National Drinking Water Quality Standards
NEA	Nepal Electricity Authority
NEBOSH	National Examination Board in Occupational Safety and Health
NEFIN	Nepal Federation of Indigenous Nationalities
NES	National Environmental Specialist
NGO	Non-governmental Organization
NIP	National Implementation Plan
NO_2	Nitrogen Dioxide
NOC	No Objection Certificate
NSAID	Non-Steroidal Anti-Inflammatory Drugs
NT	Near Threatened

NTFP	Forest-based Resources and Non-timber Forest Products
NTU	Number of Transfer Units
O&M	Operation and Maintenance
OHL	Overhead Line
OPGW	Optical Ground Wire
PAF	Project Affected Families
PCB	Polychlorinated Biphenyl
PCR	Physical Cultural Resource
PGA	Peak ground acceleration
PIC	Project Implementation Consultants
PISC	Project Implementation and Supervision Consultant
PISC	Project Management Consultant
PM	Particulate Matter
PMD	Project Department
PMU	Project Management Unit
PPE	Personal Protective Equipment
PTCUL	Power Transmission Corporation of Uttarakhand Limited
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RF	Reserved Forest
RIPP	Resettlement and Indigenous People Plan
ROW	Right of Way
SAEH	Sexual Exploitation, Abuse and Sexual Harassment
SASEC	South Asia Subregional Economic Cooperation
SBV	Slender Billed Vulture
SCADA	Supervisory Control and Data Acquisition
SEMPs	Specific Environmental Management Plans
SF6	Sulphur Hexafluoride
SO_2	Sulphur Dioxide
SPS	Safeguard Policy Statement
SS	Sub-Station
SS	Site-Specific
SWMA	Solid Waste Management Act
TAL	Terai Arc Landscape
TB	Tuberculosis
TDS	Total Dissolved Solids
TL	Transmission Line
TSS	Total Suspended Solids
UG	Underground
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPCL	Uttarakhand Power Corporation Limited
VOC	volatile organic compounds
VU	Vulnerable
WHO	World Health Organization
WLS	Wildlife Sanctuary
WRV	White Rumped Vulture
WWF	World Wildlife Fund

Units of Measurement

dB(A)	A-weighted Decibel
HZ	Hertz
in/sec	Inch per second (25.4mm/sec)
km	Kilometer
km/h	Kilometers per Hour
km^2	Square kilometer
kV	Kilovolt
L_{eaq}	Equivalent Continuous Level
mg/l	Milligram per liter
mg/m^3	Milligram per cubic meter
mg/kg	Milligram per kilogram
m^3/s	Cubic meters per second
m^3/h	Cubic meters per hour
m^3/d	Cubic meter per day
m	Meter
m^2	Square meter
m^3	Cubic Meter
m^3/s	Cubic meter per second
$MtCO_2e$	Million tons of CO_2 equivalent
PPM	Parts per million
°C	Degrees Celsius
$\mu g/m^3$	Micrograms per cubic meter

Exchange Rates

Currency Exchange Rates as of May 2024
1 US$ = 133 (Nepalese Rupee)
($ refers in this report to US-Dollars)

Executive Summary

Introduction

1. This Environmental Impact Assessment (EIA) is part of the process of compliance by Nepal Electricity Authority (NEA) with the Asian Development Bank's (ADB) Safeguard Policy Statement (2009) in relation to the South Asia Subregional Economic Cooperation Electricity Transmission and Distribution Strengthening Project - New Butwal 400kV Transmission Line (NBTL) or the "Project".

2. Safeguard requirements for all projects funded by ADB are defined under ADB's Safeguard Policy Statement (2009) which establishes an environmental screening, assessment and management process. All ADB projects must comply with its requirements and Operational Manual F1, 2013 to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process.

3. In accordance with its environmental assessment requirements, the EIA provides a road map to the environmental measures needed to avoid, minimize, and/or mitigate the adverse environmental impacts and risks associated with the Project on physical, biological, social, and physical-cultural resources in the project area of influence during the construction and operation and maintenance (O&M) phases of the Project. More specifically, the EIA:

   - Describes the project design, construction activities and operational parameters;
   - Describes the existing socio-environmental conditions within the project area of influence;
   - Describes the extent, duration and severity of potential direct, indirect, cumulative, and induced environmental impacts and risks;
   - Analyzes all significant environmental impacts and risks; and
   - Formulates the mitigation actions and presents them in the form of an Environmental Management Plan (EMP) for implementation following project approval.

Project Description

4. The Project comprises two components:

a) **Component 1: Transmission line** – New Butwal to Lamahi - The 400 kV (quad bundle) transmission line (NBTL) is proposed to be built in Nepal's western region. The total length of NBTL is about 160 km, which is distributed in Lumbini Province. It starts from the tower No. 16 of the multi circuit transmission line from New Butwal Sub-Station located at Nawalparasi–West District; then the NBTL passes through Rupandehi, Kapilvastu and adjacent to the existing Motipur SS and ends at proposed Lamahi SS at the Dang District. Component 1 will comprise 2 lots:

   - New Butwal – Motipur (69km)
   - Motipur – Lahami (92km)

b) **Component 2: Substation** - The proposed Lamahi SS is situated in ward No. 9 of Lamahi Urban Municipality in the Dang District. The proposed land for the substation is 11.00 ha. On the northern part of the substation compound, 12-line bays are proposed along the 400 kV TL corridor. Additionally, 8-line bays are on the southern parts along the 220 kV TL corridor, and 12-line bays on the eastern parts along the 132 kV TL corridor. The Lamahi - Kohalpur 132 kV TL is currently passing above the Lamahi SS. To facilitate a LILO arrangement, a double-circuit entry will be established on the eastern side. The civil and building works for the project include substation land grading, equipment foundation and oil pit, control building, water supply and drainage, and site boundary wall construction. Lamahi SS has a new GIS substation with a voltage level of 400/220/132/33/11 kV.

Summary of Key Impacts & Mitigation

5. Key impacts identified and mitigation measures are summarized as follows:

Air Quality, Noise and Water Quality

6. Impacts to water quality is likely to be of low significance, although there is the possibility of groundwater contamination around work sites and the substation. Standard design and construction measures will ensure that there are no residual impacts. Air quality and noise impacts may be more significant, but in general the alignment passes through forest areas and few human receptors will be affected by noise and air quality during the construction of NBTL. Dust will need to be carefully managed close to the substation where significant earthworks will be undertaken. Noise impacts, during both construction and operational phases can be managed through good international industry practice (GIIP) measures, e.g. through time and activity restraints and the use of noise reduction walls around transformers.

Geohazards

7. The EIA has identified a number of areas prone to flooding and landslides. Flooding aspects are relatively easy to address through design measures. However, landslide risks are rather unpredictable, especially in the areas around Butwal and Shivapur forest. Coordination between NEA, EPC Contractor and Chure Conservation Area officials is required to ensure that the risks to project infrastructure are fully managed as part of the design phase.

Tree Cutting

8. Original assessments of tree numbers to be cut along the alignment was in the region of 170,000. NEA have adapted their tower designs to include an increased height of up to 90m in forest areas. The consequence of this increased height is a reduction of tree cutting to around 46,000. This is still a substantial number of trees, but this will be offset by tree re-planting on a 1:10 basis and 1:25 basis for special status species.

Special Status Fauna

9. This EIA has identified several endangered and critically endangered species at specific risk from the construction and operation of NBTL, namely Elongated tortoise, Tricarinate Hill-turtle and a range of vultures, including White-rumped Vulture and Slender Billed Vulture. Both the tortoise and turtle are currently threatened in the Shivapur forest area, both from hunting and forest fires. Further development of this area through access roads and the presence of construction crews will place

additional stress on these species. Impacts to the vultures are predominantly linked to the operational phase where the risk of collision with the earth wires of NBTL exists. A range of measures have been adopted, based on site surveys of these species and consultations with international experts and NGOs, to reduce the potential significance if impacts to these species. This has included re-alignment of NBTL in two key locations and the requirement for bird diverters on the entire 160km of the line. Surveys of the tortoise and turtle indicate a low risk of encountering these species during the construction phase. However, construction phase mitigation has been prepared for these species, as well as a requirement for conservation measures to be developed between NEA and conservation groups.

Occupational and Community Health and Safety

10. Any project of this scale, involving multiple work sites and electrical infrastructure represents a risk to both occupational and community health and safety. A range of GIIP measures will be adopted during design, construction and operational phases. However, as with any project, the risk of accidents occurring will remain. EMF impacts have been assessed and are not considered to represent a risk to human health given the proposed project safety zones.

Cultural Heritage

11. The EIA has identified important cultural heritage sites all along the NBTL. Some of these sites were not identified in the national IEE, including Sainamina complex. The process of impact assessment has however, led to re-routing of the alignment around the most sensitive sites identified to date. Notwithstanding the above, it is possible that additional consultations with stakeholders regarding cultural heritage could lead to the need for additional mitigation and management measures in the design phase of the Project. It is also possible that chance finds could occur during excavation works. A detailed chance find procedure will be prepared and adopted to manage this topic.

Consultations

12. To date a wide range of consultations have been undertaken with the community and with government departments and NGOs. 602 community members have been consulted during public meetings, 144 of which were female. A further 161 women have been consulted during gender specific focus group discussions. Meetings have also been held with various organizations such as Bird Conservation Nepal, Royal Society for Protection of Birds and WWF Nepal. Further, NEA have communicated directly with all 71 community forest user groups affected by the project and with all five Division Forest Offices. Relevant issues raised by stakeholders have been addressed in this EIA and where relevant mitigation measures have been included as part of the Project EMP to address concerns.

Conclusions and Recommendations

13. This EIA has established that, except for the residual impacts mentioned above, there are no significant environmental issues that cannot be either totally prevented or adequately mitigated to levels acceptable to the national standards and international guidelines for project activities. During the development of this EIA extensive consultations have been undertaken with stakeholders and international specialists to refine the Project alignment to reduce, where technically feasible, the risk of significant impacts affecting the sensitive Project environment. Impacts to cultural heritage have

been significantly reduced due to realignments, including around Sainamina where the alignment was re-routed through consultation with the Department of Archaeology.

14. Further, a wide range of mitigation and monitoring measures have been included in the Project Environmental Management Plan (EMP) incorporated into the EIA. NEA will implement the EMP measures ensuring adequate budget and human resources are allocated to this.

15. However, some of the identified impacts will require offsetting, specifically those relating to vegetation clearance and potential impacts to vultures. Measures have been incorporated into the EIA to replant trees on a 1:10 basis (1:25 for special status species) which, in the longer term will have positive impacts to the regional environment. NEA have also committed to collaboration with Chure Conservation Area to develop conservation measures in the Chure region and these will be further elaborated in an updated EIA as these measures are confirmed between NEA and Chure Chure Terai Madhesh Conservation Development Committee. Conservation measures for special status reptiles, including the Elongated tortoise will also be further developed between national specialists and NEA.

16. Impacts to vultures require specific attention. Detailed discussions with Bird Conservation Nepal and international vulture conservationists have indicated that additional surveys are required before the NBTL alignment is finalized. Accordingly, no works will commence on NBTL until 12 month vulture surveys have been completed to further understand the behavior of the vultures. It however, recognized that even after the surveys are completed and mitigation measures are adopted (which may include further re-alignment of NBTL) there still remains a risk of vultures colliding with NBTL. This EIA recommends specific offset measures to counter this risk. This involves retrofitting of distribution lines close to vulture nesting sites and vulture feeding stations to mitigate against electrocutions on these lines. Electrocutions on distribution lines kill substantially greater number of vultures than collisions with transmission lines and as such the proposed offsets have the opportunity to result in a net positive impact to vultures in the region.

17. The Project EMP, its mitigation and monitoring programs, will be included within the bidding documents for project works for all Project components of NEA with physical works involved. The bid documents will state that the EPC Contractor will be responsible for the implementation of the requirements of the EMP allocated to them (including specific design phase actions) and preparing their own Construction Specific EMP (C-SEMP) which will adopt all the conditions of the EMP and add in site specific elements that are not currently known, such as the EPC Contractor's storage and camp locations. This ensures that all potential bidders are aware of the environmental requirements of the Project and its associated environmental costs. The EMP and all its requirements will then be added to the EPC Contractor's Contract, thereby making implementation of the EMP a legal requirement according to the Contract.

18. The EPC contractors will then prepare their detailed designs and C-SEMP which will be approved and their works supervised and monitored. Before the detailed designs are approved the EIA will need to be updated to reflect the final cable routes, reviewed and cleared by ADB for disclosure on the ADB website and locally. Should NEA note any non-conformance with the EMP (and C-SEMP) the EPC Contractor can be held liable for breach of the contractual obligations of the EMP. To ensure compliance with the C-SEMP the EPC Contractor is required to employ an Environmental and Social Officer and team of safeguards experts to monitor and report Project activities throughout the construction phase. Project supervision consultants will also include environment, health and safety experts to support supervision and monitoring of Project EMP implementation and to build the

capacity of NEA. A team of environmental support consultants will also be engaged to further monitor works.

19. Finally, NEA will be responsible for implementing all offsets in the operational phase, including those relating to vultures and reptiles.

I. INTRODUCTION

1.1. Background

20. As of 2021, the World Bank reports that Nepal has made significant strides in improving access to electricity, with 89.9% of its population now having access, a marked increase from the 54% recorded in 2010. In alignment with this progress, the Government of Nepal has established a comprehensive goal to ensure electricity accessibility for the entire population of the country by the year 2027. This goal entails a targeted distribution of electricity, with 90% of the population receiving it through the national grid and the remaining 10% benefiting from decentralized generation solutions. The concerted effort showcases Nepal's commitment to enhancing nationwide access to electricity, thereby contributing to economic development, improved living standards, and sustainable growth.

21. In tandem with its effort to expand accessibility, the Government of Nepal is actively addressing the challenge of unreliability electricity supply. The country currently experiences frequent power outages, particularly in rural areas. The western Nepal is facing significant issues related to the quality and reliability of electricity supply. In support of the Government's energy development goals, the Asian Development Bank (ADB) has provided grant assistance under Project Preparatory Facility for Energy (PPFE) which will support preparation of detail studies of several potential projects including the New Butwal-Lamahi 400 kV Transmission Line (NBTL) and associated substation at Lamahi. NBTL intends to connect the western part of the country with the National Grid and create new out-gates for export.

22. Nepal Electricity Authority (NEA) is the implementing agency for this part of PPFE. By addressing these crucial infrastructural and reliability challenges, Nepal aims to foster an enhanced and consistent electricity supply, contributing to improved socio-economic conditions and overall development.

1.2. Project Overview

23. The proposed NBTL is situated in Nepal's western region, specifically within the Lumbini Province. It spans 160 km, commencing from Tower No 16 at Sunwal in Nawalparasi-West District and concluding at Lamahi Substation in Dang District.

24. For the section between New Butwal Substation and Tower 16, a multi-circuit towers being constructed by MCA Nepal will be utilized. The geographic scope of the NBTL encompasses the municipalities of Nawalparasi Werst, Rupandehi, Kapilvastu, Arghakhanchi, and Dang district within the Lumbini Province.

25. The proposed Lamahi Substation (SS) is situated in ward No. 9 of Lamahi Urban Municipality in the Dang District. The proposed land for the substation is 11.00 ha.

1.3. Implementing Agencies

26. As mandated by the cabinet of Government of Nepal, NEA will serve as the implementing agency. NEA will set up a project department (PMD) supported by project supervision consultants (PSC).

1.4. Purpose of the EIA Report

27. Safeguard requirements for all projects funded by ADB are defined under ADB's Safeguard Policy Statement (2009) which establishes an environmental screening, assessment and management process. All ADB projects must comply with its requirements and Operational Manual F1, 2013 to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. In accordance with its environmental assessment requirements, the EIA provides a road map to the environmental measures needed to avoid, minimize, and/or mitigate the adverse environmental impacts and risks associated with the project on biological, physical, social, and physical-cultural resources in the project area during the construction and O&M phases. More specifically, the EIA:

- Describes the project design, construction activities and operational parameters;
- Describes the existing socio-environmental conditions within the project area of influence;
- Describes the extent, duration and severity of potential direct, indirect, cumulative, and induced environmental impacts and risks;
- Analyzes all significant environmental impacts and risks; and
- Formulates the mitigation actions and presents it all in the form of an Environmental Management Plan (EMP) for implementation following project approval.

1.5. Category of the Project

28. For each ADB project, screening and categorization is conducted at the earliest stage of project preparation when sufficient information is available and is undertaken to (i) reflect the significance of potential impacts or risks that a project might present; (ii) identify the level of assessment and institutional resources required for the safeguard measures; and (iii) determine disclosure requirements. ADB uses a classification system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts.

29. Based on the ADB Safeguards Policy Statement (2009), this Project falls under ADB's environment Category A. This is due to the following facts: a) the project passes through several important bird areas and key biodiversity areas comprising special status species, including endangered reptiles, b) nesting sites for endangered and critically endangered vultures are located within 2km of the proposed route, c) the project passes predominantly through forest areas and extensive tree cutting is required, and d) several cultural heritage sites of high significance have been identified within close proximity to the alignment, including archeological sites.

30. This EIA has been prepared on behalf of NEA by a team of ADB funded TA consultants – The EIA Team (Nick Skinner, International Environment Expert, Asish Dhakal, National Expert with support from Biodiversity Specialists John Pilgrim (Critical Habitat), Rick Harness, Duncan Ecclestone, Asmit Limbu and cultural heritage experts Justin Bedard and Kai Weise). This draft EIA is substantially based on the findings of the national Initial Environmental Examination (IEE) prepared for the Project (approved 17th December 2023). The findings of the IEE have been updated where relevant to include additional

information from surveys and consultations with national and international experts relating to issues such as special status avifauna, reptiles and cultural heritage.

1.6. Report Structure

31. Section 1: Introduction – The section in hand provides introductory information.

32. Section 2: Policy, Legal, and Administrative Framework – This section presents an overview of the policy/legislative/administrative framework as well as the environmental assessment guidelines of Nepal that apply to the project.

33. Section 3: Description of the Project – Section 3 describes the Project need and its environmental setting. A scope of works is also provided indicating the type of construction works required and operational aspects.

34. Section 4: Analysis of Alternatives – This section presents a summary analysis of the 'no project' alternative as well as any alternative alignment and technical design options that were considered.

35. Section 5: EIA Approach – Section 5 outlines the methodology used to complete the assessment.

36. Section 6: Description of the Environment – This section of the report discusses the local environmental baseline conditions. This section is divided into subsections relating to the physical, biological, and social environment.

37. Section 7: Environmental Impacts and Mitigation Measures – Outlines the potential environmental impacts and proposes mitigation measures to manage the impacts. The residual impacts of the Project are also presented.

38. Section 8: Stakeholder Engagement, Information Disclosure and Grievance Mechanism – Section 8 provides a summary of all the stakeholder consultation activities undertaken and includes the Project's grievance redress mechanism.

39. Section 9: Environmental Management Plan – This section of the EIA comprises an Environmental Mitigation Plan and an Environmental Monitoring Plan, as well as the institutional arrangements for environmental management.

40. Section 10: Conclusions and Recommendations – The final section of the EIA provides the conclusions and recommendations, including a summary of residual impacts.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

41. This chapter is about the applicability of national laws and regulations, international agreements, and ADB safeguards requirements to the project. The chapter also lays out the various permissions required for the project from national authorities. It considers the environmental, health and safety (EHS) policies and procedures that are presently available with NEA as well as their existing environment safeguards capacity with respect to environmental management plan (EMP) implementation.

2.1 Administrative Framework and Main Regulatory Bodies

42. The main regulatory bodies responsible for administration of the environmental policy and legislation pertinent to the component are:

43. **Ministry of Forest and Environment:** Ministry of Forests and Environment (MoFE) is the apex body to formulate and implement the policies and regulations related to environmental protection, natural resource management, pollution control, and health and safety. They implement their plan and program through their Department of Forests and Soil Conservation, Department of Plant Resources, Forest Research and Training Center, Department of National Parks and Wildlife Conservation, and Department of Environment.

44. **Ministry of Energy, Water Resources, and Irrigation (MOEWRI) and Department of Electricity Development:** Department of Electricity Development (DoED) assists the Ministry of Energy, Water Resources, and Irrigation (MOEWRI) to develop and promote the electricity sector and to improve the financial effectiveness of the sector at the national level by attracting private sector investment. DoED reviews national environmental assessment documents (EIA/IEE) for energy related projects and forwards them with comments to MOEWRI for approval in case of IEE, and to forward to MOFE for review and approval in case of EIA.

45. **Nepal Electricity Authority:** Nepal Electricity Authority (NEA) is a semi-government entity entrusted to generate, transmit and distribute adequate, reliable, and affordable power by planning, constructing, operating, and maintaining all generation, transmission and distribution facilities in Nepal's power system - both interconnected and isolated. In addition, they (i) recommend to Government of Nepal, long and short-term policies and plans for the power sector; (ii) recommend, determine, and realize the tariff structure for electricity consumption with prior approval of Government of Nepal; and (iii) arrange for training and study so as to produce skilled manpower in generation, transmission, distribution and other sectors. The Project Management Directorate (PMD) of NEA is dedicated to managing ADB projects of NEA, and is responsible for the preparation, procurement, and construction supervision of all ADB supported projects. They are responsible also for ensuring and reporting to ADB on the environmental safeguard requirements being met by the projects. Upon commissioning of the projects, the operation and maintenance responsibilities are transferred to NEA line departments.

2.2 National Environmental Framework

46. Environmental policies of Government of Nepal are In favor of environmentally sound economic development and growth. The following are the summaries of the relevant policies, acts regulation and guidelines.

47. Table 1 expands on the above and outlines all national environmental, health and safety policies, laws and regulations and their applicability to the Project.

Table 1: Relevant Environmental, Health and Safety and Social Legislation

#	Name of Policy / Law / Regulation	Applicability to Project	Remarks
1	15th Periodic Plan (2019/20 to 2023/24)	It has designated development of 35,000 MW in 2023/24 AD from 1,250 MW in 2018/19 AD of Hydro Electric Power with 5,000 MW of Alternative Energy and targeting per capita energy consumption of 3,600 kWh in 2043/44 AD from 245 kWh in 2018/19 AD. In addition to increasing clean hydro power generation and access to energy its third objective is to "contribute to balance of payment by increasing regional energy export and gradually substituting the import of petroleum products. As a continuation the 16th Periodic Plan Concept Paper from 2024/25 to 2028/29 has categorized existing low standard, mis management of infrastructure demand and supply and weak commitment to sustainable development among the major challenges for infrastructure development in Nepal. It stresses on Environment Friendly, Sustainable and Rewarding infrastructure development works.	
2	Land for National Priority Project, 2019	Environmental study must be conducted as per prevailing laws if forest land is to be used. Ministry concerning to the project should forward necessary documents related to project for approval of using land to MoFE.	NEA through MoWERI will be make submission to MoFE for Approval
3	Nature Conservation National Strategic Framework for Sustainable Development 2015-2030	Under its Programmes that need to be given priority by the agencies concerned for nature conservation integration into development efforts under number 4 Development of physical infrastructure and environment recommended 12 policy reforms number 12 recommends making electricity transmission lines passing through the forest area higher than average trees to prevent cutting them as ranked high through harmonization and coordination and facilitation with Environment and Energy Ministries.	NEA PMD will prioritize In reducing number of trees to be felled with Increasing transmission tower heights.
4	Lumbini Province Environmental Protection Regulation 2020	The important part of the regulation is it designates thresholds for requirements for Brief Environmental Study in Annex 1, Initial Environmental Examination in Annex 2 and Environmental Impact Assessment in Annex 3. Other prominent rules include Rule 13 which states that approved EIA with a minimum of two years will be entitled for Environmental Auditing from the Ministry. Rule 16 is on pollution control, management, and penalty for causing environmental pollution or waste generation that causes degradation of environment or harmful effect on human health. Rule 17 is on the provision of Environment Friendly Symbol by the Provincial Ministry for Industries, business, technology, activities and also these will be encouraged with provision of grants. Described conditions to be met include Minimization of Pollution and Greenhouse Gas, promotion of alternative energy, conservation of natural resources, pollution mitigating and clean as well as healthy environment contributing actions. Rule 22 and 23 is on Climate Change related projects that re climate friendly and risk management. Rule 24 is on the authority of the Provincial Government to declare any special	

#	Name of Policy / Law / Regulation	Applicability to Project	Remarks
		area as Environmental Conservation Area based on its cultural, archeological, religious, and environmental importance. Any activities in such area will need permission from the Ministry.	
5	Lumbini Province Forest Regulation amendment in 2023	Use, Delineation of Boundary and Management of National Forest, Provision for activities in Forest Conservation Area, Provision for activities in Partnership Forest (Rule 11 to 20), Community Forest (Rule 21 to 30), Collaborative Forest (Rule 31 to 42), Religious Forest (Rule 43 to 45), Private Forest and Trees in Public Land (Rule 57 to 58). Rule 47 and 48 is related to Development Projects permission requirements, costs, compensatory plantation and management for clearance of forest to be occupied by it. Rule 49 is declaration of forest area into Bird Sanctuary and Rule 50 is on Provision for declaration of Wildlife Corridor in Forest Land. Rule 51 details on prohibited activities in Bird Sanctuary and Wildlife Corridor: these includes A) Entry without permission B) Any activities such as chasing, catching, scaring, hunting or harming wildlife, C) Construction of any Physical Structure without Permission, D) Entry of Vehicles without Permission, E) Entry Domestic Animals or Livestock, F) Disposal of Waste, G) Noise Pollution, H) Any activities resulting in degradation of habitat of wildlife, I) Exceeding Speed Limit of 20km/h by Vehicular Transportation, J) Non abidance of any prevalent laws. Rule 67 is on permission requirement for collection of plants of medicinal value or Non-Timber Forest Products from Forest Land. Rule 61 sub rule 1 Timber and Firewood collection will be permitted between Ashoj 1 (September 18 for year 2023) to Jestha 32 (June 14, for year 2024). Can be translated to be indicative of beginning prohibition during monsoon season.	
6	Wildlife Friendly Infrastructure Construction Guidelines 2078 (2021/22)	It directs on inclusion of Wildlife Friendly Infrastructure in sensitive zones, regulatory permissions, inclusion of experts on study and design of structures and management of structures Guideline 11 directs on the existing or under construction infrastructure (prior to the publication of this guideline) if it is identified necessary for inclusion of wildlife friendly infrastructure by concerned protector or Division Forest Authority can recommend the concerned agency to do so and if such recommendation is received the concerned agency as per requirement conduct study and construct such infrastructure.	Project will consider adequate bird friendly design. Avian safety measured will be considered.
7	President Chure-Terai Madhesh Conservation and Management Master Plan 2017/17	The masterplan is designed for the conservation of the distinctive geology, biology, hydrology and ecology of the region. Its Implementation Is to achieve control of erosion leading to availability of quality environmental services, Increased productivity and decreased peoples hardship and calamities. The master plan has Identified 7 paleo historical and 8 Archeological sites In the Chure Region. Of these 2 paleo historical sites Surai Khola Region Includes Chure hills of Surai Khola, Dobata, and Dhan Khola Region where relics of giraffe, pig and other four-footed animals, crocodiles and other mammals are found. Other being Tinau Khola Region	

#	Name of Policy / Law / Regulation	Applicability to Project	Remarks
8	Work Procedure and Guidelines for development works within Chure	Section 5: Standards Provision Standard No. 5 Approval from Relevant Environmental Assessment/Relevant Agency needs to be assured, Landslide/Erosion Hazard mapping to be carried out for neighboring areas of the bottom station, top station alignment and angle points, slope stability analysis to be carried out in details with activities benefitting Chure Conservation and finally while laying the foundation, transporting equipment, carrying out stringing works and while commissioning ensure no soil erosion happens.	
9	Bijayasal Conservation Action Plan for Nepal 2018-2022	*Pterocarpus marsupium* is a Near Threatened plant species. The plan was developed with the objective of promoting in-situ and ex-situ conservation measures for its sustainable use. The plan has three strategies 1) Enhance understanding and knowledge and its status, distribution, propagation, ecology and habitat, 2) Increase viable population by 15% at national level through management priority sites and 3) Strengthen multi-stakeholder participation for conservation. Strategy 2 has directed activities towards Kanchanpur and/or Kapilbastu districts as high priority districts for including Bijaysal conservation in operation plans of Forest User Groups in these districts.	
10	Tiger Conservation Action Plan 2023-2032	The action plan aims to achieve a balanced state for tiger and human society. With previous conservation action plan the number of tigers has increased in Nepal. However, there has been an increase in loss of lives of human and livestock. Some causes have been referred to climate change worsening the problem with drying up of wetland, spread of habitat degrading invasive alien plant species, wildlife diseases, increasing incidence of natural disaster landslides, forest fires and floods. Major conservation issues include related to habitat and dispersal corridors, wildlife crime, human-tiger conflict, national and transboundary cooperation, and knowledge base. The major challenges is indicated that development of large scale linear infrastructure in Terai Arc Landscape will fragment habitat, another challenge indicated is that between 2019 to 2023 most of the attacks were in day time and mostly in corridors namely Kahta, Basanta and Bharandabhar. The action plan objectives 1 include securing tiger habitats and corridors. Under this object output C is on impact of linear infrastructures on major tiger habitats and corridors. Under this output C1 is ensuring effective implementation of wildlife friendly infrastructure construction directives 2022 in tiger habitat in coordination with concerned stakeholders, C2 ensuring social and environmental impact assessment before the development of all infrastructure projects where applicable and effective implementation of the recommendations therein, C3 identifying potential sites for wildlife friendly infrastructure, C4 select, design and construct wildlife friendly flyovers or under pass at strategic locations, C5 restrict project development in core area and important corridors, C6 enhance engagement with infrastructure planners and developmental agencies to promote wildlife friendly infrastructures and integrate effective mitigation measures in the infrastructural planning process and C7 developing measures in existing linear infrastructures in coordination with the	

#	Name of Policy / Law / Regulation	Applicability to Project	Remarks
		line agencies. Objective 2 is on poaching and illegal trade of its parts, Objective 3 is reduction in human tiger conflict and enhancing economic opportunities for local communities, Objective 4 is on strengthening cooperation and collaboration for tiger conservation and Objective 5 is on strengthening monitoring. The implementation will be seen through Department of National Park and Wildlife Conservation for activities in protected areas and its buffer zones while Department of Forest and Social Conservation and Provincial Ministries will implement activities outside protected areas and dispersal corridors.	
11	Vulture Conservation Action Plan 2023-27	The plan has been formulated with the objective of addressing threats from diclofenac and other harmful NSAIDs (Non-Steroidal Anti-Inflammatory Drug) in livestock treatment> The action plan has 6 objectives. 1) prevention of NSAID poisoning and control the deliberate poisoning of cattle carcass, 2) promote scientific research to enhance knowledge, 3) release of captive vulture into safe environment, 4) promote safe food supply to vultures, 5) habitat conservation and safeguarding from power infrastructure, 6)sensitizing stakeholders and build their capacities, 7) build partnership at local, national and international level and 8) strengthen vulture safe zone (it is an area surrounding one or more wild vulture nesting colonies, large enough to encompass the mean foraging range (>30,000km^2) completely free from diclofenac use. Among major conservation threats electrocution and collision with medium voltage distribution lines and medium to high voltage transmission lines is stated to potentially pose a fatal risk to the bird. The objective 5 on power infrastructure major actions include i) prepare and implement site specific management plans in identified priority areas, ii) update information on previously known current and potential habitats, iii) control cutting of the nesting and potential trees in their nesting habitat and iv) encourage and support local communities to manage and protect habitat, (v) the awareness campaign, sensitize and aware local forest user groups and other stakeholders, protect the nesting sites from all the possible disturbances, information collection on the distribution of power lines in vulture habitat, sensitivity mapping of threatened vultures against hydropower and transmission lines and employ mitigation measures to prevent electrocution and collision in areas where it occurs. DNPWC will be the leading agency in the implementation of the action plan.	
12	Environment Protection Act 2019	The act emphasis on new aspects like provisions of Brief Environmental Study, IEE and EIA under the jurisdiction of local authority, provincial government, and central government. Need of Strategic Environmental Assessment for policies/plans/programs, and considerations of climate change for projects are among the newly enforced aspects of this act. After completion of 2 years from the date of commencement of the service of the proposal Ministry of Forest and Environment or designated agency shall conduct environmental audit within 6 months and maintain it up to date. Chapter 5 of the act is on protection of national heritages, prohibited activities, establishment of operation fund, establishment of a council Its duties,	

#	Name of Policy / Law / Regulation	Applicability to Project	Remarks
13	Environment Protection Rules 2020	Environment Protection Rules (EPR), 2020 has defined thresholds for environmental assessment under 3 categories; Brief Environmental Study through schedule 1, IEE with schedule 2 and EIA from schedule 3. It has defined the roles of the provincial government and the local government as well in the process of environmental assessment of development projects. Rule 15 relates to export of Hazardous Substances. Rules 16 Sub-rule 1 to 9 directs on Management of Hazardous Wastes. Likewise, Rule 23 talks about Environmental Monitors work and responsibilities. Section 6 Rules 32 to 34 is on sensitivity of national heritage sites that also includes Archeological Sites,	The alignment is in Lumbini Province and Foot hills of Chure Conservation Area where probability of encountering Archeologically Important sites are high hence the project will abide by national regulation and ADB's SPS sensitivity to Include chance find procedure.
14	Solid Waste Management Act, 2068	The SWMA has stipulated the requirements while managing the solid wastes in the city, towns or, industrial as well as the work places of projects and their labor camps. The processing and managing harmful waste, health institution waste, chemical waste, or industrial waste subject to the prescribed standards shall be the responsibility of person or entity generating such waste is with the generator.	
15	Soil and Watershed Conservation Act, 2039	The Act outlines the essential parameters necessary for proper watershed management. Section 10 specifies prohibited activities in vulnerable land to landslide, floods, soil erosion or soil cutting. Permission from watershed conservation officer watershed conservation office will be necessary in such conserved watershed areas for such area To block or collect in any way the water of any stream, canal, rill, lake or reservoir or ground water or divert the blocked or collected water elsewhere or return the same through a ditch, diversion channel, drainage or in any other manner or use such water in any work by so blocking, collecting, diverting, returning or otherwise, To cut or otherwise destroy any such trees, plants or other forest products as that person may deal with according to his/her will pursuant to the prevailing law relating to forests, To cut or otherwise destroy any existing forests, trees, plants, weeds, grasses or other natural vegetations, To carry out any act causing the collection or dumping of stone, sand mud, etc. or any act causing the collected or dumped stone, sand, mud etc. to be swept away, To dig, excavate or take away stone, sand or other kind of soil, To throw away solid wastes or similar other detritus contaminating the environment or build a site for collecting or keeping such solid wastes or detritus.	

#	Name of Policy / Law / Regulation	Applicability to Project	Remarks
		To establish an industry, business or settlement of habitation	
16	National Park and Wildlife Conservation Act, 1973	It addresses the conservation of ecologically valuable areas and indigenous wildlife. The Act prohibits trespassing in park areas, prohibits wildlife hunting, construction works in the park area, damage to plant and animal, construction of huts and houses in park area without permission of authorized persons. It lists 26 species of mammals, 9 species of birds, and 3 species of reptile as protected wildlife. Clause 15 C states that government may declare areas outside protected areas as biological corridors.	
17	Control of International Trade of Endangered Wild Fauna and Flora Act, 2017	It prohibits purchase, sell, possess, use, plant, rear, captive breed, transport or import or export threatened or vulnerable wild fauna or flora or specimen	
18	Acid and Other Hazardous Chemical Act 2022	The act is on control of purchase, transport, storage of Acid and other hazardous chemical substances. Article 12 elaborates on safety and precautionary measures to be followed while transporting such materials in accordance to permission letter and driver and assistant driver to have training on hazard risk management. It directs on the container standards, chemical substance placement, danger signage on transporting vehicle, cautionary routes for transportation. Article 14 has 7 requirements on its safe storage including marking on danger signage. Article 16 is on occupational health and safety requirements for person using such substances. Article 17 elaborates on disposal rules to be followed. A) use of gloves, mask and other PPE to be used B) permission from respective District Development Authority for disposal will be necessary C) Designated safe procedure and protocol to be followed for disposal and D) Disposal needs to ensure that disposal in done in such a way that it cannot be reused.	
19	Forest Act, 2019	Article 41 is on no change in land use of forest area but this condition will not be applied In forest land which has already been provided for Infrastructure development projects Article 42 is on to use the forest land that should be provided for planting trees which Is equal to the forest area used by the project, adjacent to the national forest, near the project area having similar geographical land ecological feature Article 45 Establishment of Forest Development Fund where plantation cost must be deposited in relation to compensatory plantation	Project will include compensatory plantation in project cost estimate for the trees and poles to be removed during implementation. Cost estimate provided by Department of Forest considering multiyear production or purchase, transportation, plantation at the rate of

#	Name of Policy / Law / Regulation	Applicability to Project	Remarks
			1600/ha (more for erosion prone areas), fencing/wall for protection and number of forest guards for five years are mainly considered.
20	Forest Rules 2023	These rules elaborate legal measures for the conservation of forests and wildlife. Tree cutting clearance is required from the Department of Forest. Expenses incurred for cutting trees and transportation is to be borne by the infrastructure developer. Rule 6 (1) Development projects can be given permission for movement of vehicles and persons In the forest with conditions. Rule 20(7): Time Duration for collection of forest products Divisional Forest Officer with Province Director can permit the felling of trees and transportation of forest products throughout the year with adequate arrangement for damage to regeneration tees and plants for development projects. Rule 87: (1) Formulation of Development projects to prioritize avoiding forest area. (4) While determining national forest area for the development project, required area for right of way, security perimeter, green belt, access road must be Included. Rule 90 is on approval from Government. Rule 91 is providing land suitable for forest development. Rile 93 is on cost deposit such as In conditions of land not being available, for compensatory plantation Rule 96 is on applying mitigation measures as mentioned in the environmental study reports, its implementation priority needs to be given to project affected forest user groups or local communities, and wildlife friendly infrastructure needs to be constructed to avoid adverse impact on wildlife, their habitat and their habitat accessibility. Rule 97 is on providing compensation for the loss or damage to trees of individual, groups or communities or also for livelihood. Rule 98 is permission from Division Forest Office on entry to the forest for implementing development projects. Rule 102 is arrangement for tree removal Royalty fee for forest products such as soil, sand, gravel, timber, firewood, stone during project construction must be deposited in the account of the concerned office as per the rate of Forest Rules, 2051	

#	Name of Policy / Law / Regulation	Applicability to Project	Remarks
21	Forest Product Collection and Selling Directives 2016	5 (6) Valuation of marked trees, volume must be calculated as per Schedule 7 of Forest Rules 10 Except for national priority projects forest entry permits must be given	
22	Disaster Risk Reduction and Management Regulations 2019	The regulations direct on organizations Inclusion on disaster preparedness under Rule 9 sub rule 1,2 and 3 Rule 11 Is In District Disaster Management Fund with every district provided by GoN, Authority, Province Government, Aid, Grant from foreign government, International organization.	
23	Electricity Act 1992	It is related to surveys, generation, transmission and distribution of electricity. Article 24 states that these activities need to be carried out avoiding substantial adverse Impact on environment from soil erosion, flood, landslide, air pollution etc.	
24	Electricity Rules 1993	Rule 50 and Schedule-13 of the Rule, 2050 defines the minimum distance to be maintained on either side of the electric wire, transmission and distribution lines and associated safety clearance corridors (double insulator system shall have to be used for installing electric line of more than 11,000 volt across the road in a densely populated area. No electric lines should be carried out from above a house, provided that the lines of upto 400/230 volt may be carried out from above a garage, cottage, or fence and such electric lines shall be installed at a height which shall not be less than three meters from the highest point of such garage, cottage or fence.). Rule 66 is regarding restrictions on the utilization of buildings and land under power lines (transmission as well as distribution lines). Chapter 6 is assigned to safety provisions for electrical works.	
25	Accessible Physical Structure and Communication Service Directive for People with Disabilities 2013	This directive has stated mandatory provisions for making public places accessible for people with disabilities both physically and also in terms of communication. This directive has also stated the proper dimensions on making different structures accessible for people with disabilities.	
26	Gender Equality and Social Inclusion (GESI) Operational Guidelines 2017	The main objective of the guideline is to provide guidance on implementation of gender equality and social inclusion in all aspects of Ministry of Physical Infrastructure and Transport (MoPIT) policies, institutions and in its program/ project implementation processes in an integrated manner. The specific objectives are to : (1) ensure that a gender and social inclusion responsive approach is adopted and monitored in MoPIT to improve the access of women, poor and the excluded to resources, opportunities and benefits from the programs/ projects and services of the Ministry. (2) ensure GESI issues are addressed both in programs and in institutions.	

#	Name of Policy / Law / Regulation	Applicability to Project	Remarks
27	National Climate Change Policy 2019	The policy was introduced by Government of Nepal as a guidance to different levels and thematic areas for ensuring development of a resilient society achieved with reduction in risk of climate change impacts. In addition to promoting green economy, internalizing climate change issues in policy making of nation, biodiversity at risk, inclusion of climate resiliency in physical infrastructure, disaster risk reduction at governance level, Under Policy 8.2 for Forest Biodiversity and Watershed Conservation under strategy (h) Epidemic of forest pests and disease, drought, wildfire and spread of Invasive Alien Species will be reduced and managed, (i) Financial benefits received from carbon storage through REDD+ and Clean Development Mechanism will be distributed in a just manner. Likewise, under Policy 8.3 Water Resources and Energy for ensuring energy security through low carbon energy among 8 strategies under this thematic area strategy (f) directs at adopting mitigation measures that reduces adverse impacts on river ecosystem while generating hydroelectricity. The thematic area Industry, Transport and Physical Infrastructure is under 8.5 it has 7 strategies of which (a) identification of key points and causes of emission in industry and transport sector will be identified and mitigation standards will be developed. Strategy 8.6 is for Tourism and Natural and Cultural Heritage it has 5 strategies (d) states that Natural and Cultural Heritages that are at risk of adverse impact of climate change will be identified and such areas will be conserved and managed. Policy 8.8 is about Disaster Risk Reduction and Management with 10 strategies. Policy 8.9 is on Gender Equality and Social Inclusion, Livelihoods and Good Governance 8.10 on Awareness and Capacity Development.	SF6 used in GIS substations and in switchgear are GHG whose leakage control system will be placed.
28	Green Hydrogen Policy 2024:	The policy specifies on use of Hydro Electric Power to generate Green Hydrogen which will be used to minimize adverse impact of climate change, create low carbon economy etc. The policy also refers to a study carried out by Asian Development Bank three years earlier on feasibility of producing hydrogen from hydro electric power in Nepal. The long term objective of the policy is energy security and strengthening economy of the nation.	
29	Ancient Monument Preservation Act 2013	This act defines all archeological objects other than under private ownership is to be under the custody of Department of Archaeology, Destruction, removal, changed, use It In unauthorized way and any type of damage to It Is subject to legal punishment.	
30	Ancient Monument Preservation Rules 1989:	Rule 4.1 directs on obtaining permission through application to the Department of Archaeology for installing electricity or any other infrastructure, digging the land for drinking water or sewerage, construct or repair road, celebrate festival and fare, conduct musical dance program, park vehicles, place poster or photograph.	
31	National Energy Crisis Reduction and Electricity	The government has declared a National Energy Crisis Reduction and Electricity Development Decade (2016-2026) with the aim to end the existing energy crisis of the country and to	

#	Name of Policy / Law / Regulation	Applicability to Project	Remarks
	Development Decade (2016-2026 AD)	develop Hydroelectric projects. During the period, the government has planned not only end the current power crisis but also develop the Hydroelectric project. per the plan, existing load shedding hours was reduced within a year and ending it in the next two years by importing electricity from India to completely end the load shedding within three years.	
32	National Implementation Plan for Stockholm Convention on Persistent Organic Pollutants in Nepal 2017	Old pesticide stores, transformer maintenance workshops, temporary landfill sites and scrap vendors have been considered by this publication to be potential sites for hazardous wastes. The Action Plan sets out (i) institutional and regulatory measures (formulation of hazardous chemicals management rule); (ii) measures to reduce releases from stockpiles and wastes; and (iii) identification of contaminated sites and their remediation in an environmentally sound manner etc. It reports gaps in insufficient infrastructure and capacity for disposal and reduction of POPs. PCBs categorized among the Annex A Industrial Chemicals, recorded in dielectric fluids and electrical equipment, were dechlorinated and decontaminated between 2011 to 2014 in the national implementation plan (NIP) (54 metric ton [mton] of oil and 155 mton of equipment by March 2014). A survey prior to this decontamination revealed 419 mton PCB contaminated equipment (oil: 147 mton). It states that the other PCB contaminated transformers were not available for decontamination either for not being accessible or because the oil had been replaced. During this same period, a 2013 study found 209.52 m2 of surface in NEA Transformer Maintenance Workshops in Kathmandu Valley contaminated with PCB leaking transformers and such sites are still awaiting remediation. Likewise, sites where old electrical and electronic equipment are demolished can be contaminated by POPs.	

2.3 National EIA Classification

48. Transmission line projects of capacity above 132kV and outdoor substations tapping from more than a 220kV transmission line require only an IEE as per EPR. However, if transmission line traverses through/located at national parks, wildlife reserve, hunting reserve, in such case an EIA is triggered. Currently avoiding the national EIA triggering factors are among the high priority of the project and national IEE have been carried out and approved.

2.4 National Health, Safety and Labor Framework

49. The health and safety framework in Nepal consists of several acts, notifications, rules, and regulations as detailed in Table 2.

Table 2: Applicable National Health, and Safety Requirements

Sl. No.	Name of Policy / Law / Regulation	Applicability to Project	Remarks
1	Child Labor (Prohibition and Regulation) Act, 1999	Children under 14 should not be employed as laborer	
	Labor Act 2017	According to this Act No person shall employ any labour in forced labour, directly or indirectly. No person shall so employ a child in any work as to be contrary to law No employer shall discriminate any labour on the ground of religion, colour, sex, caste, tribe, origin, language, ideological conviction or other similar ground. No employer shall employ labours to work more than eight hours a day and forty-eight hours a week. According toe Chapter 12 Section 69 The duties of the employer towards the labour in respect of occupational safety and health shall be as follows: (a) To make safe environment for work by making appropriate safety and health arrangements at the workplace, (b) To make provision for the use, operation, storing and transportation of chemical, physical or biological materials or equipment so that it would not adversely affect the safety and health, (c) To provide necessary information, notice and training relating to the safety and health to the labour, as required, (d)To provide necessary training and information in an appropriate language to the labour in relation to the use and operation of the equipment or chemical, physical or biological materials related to the work	
2	Labor Rule 2018	Employers are required to maintain occupational health and safety policy such as safety and security, health, probable accident in workplace, precautions on handling chemical substance. A Safety and Health committee needs	

Sl. No.	Name of Policy / Law / Regulation	Applicability to Project	Remarks
		to be formed in entity engaged with more than 20 workers. Environmental cleanliness, passage of fresh air, proper light and temperature, solid waste management, sound control measures, 15 cubic meter space to Employees to the extent possible as per the nature of work, healthy drinking water, bathroom or modern toilet, tobacco free zone, mandatory medical check up for the entities undertaking health hazardous activities are Included. Childcare Center for more than 50 female employees' workplace. Rule 16 states that based on nature of work all workers needs to be clarified on the time table of work. According to Rule 17 Women workers having child below three years of age needs to provide feeding site additionally women pregnant women workers need to be provided additional half an hour of resting time (can be in one slot or divided into different resting slots). Rule 39 elaborates on special provision of health and safety. 39(A) Is on protection measures for eyes such as PPE, regular eye checkup for working conditions such as mirror, magnets, plate, Iron, concrete, cement, lime, smoky environment, welding etc. activities. 39(B) Is on safety working conditions under harmful chemical substances or radiation needs to have necessary safety measures. For protection with regular health checkup. Rule 39(C) Is on safety measures from fire. use of PPE, provision of ample amount of water for extinguishing fire, emergency fire exit with its passage always kept open, fire exit signage (fire alarm/siren), blasting materials, Inflammable substances, or harmful chemicals to be placed away from dense settlement areas and Its transportation or usage to be executed by qualified personnel. Rule 39(D) states that to reduce lethargy In workplace (especially for workers requiring more mental exertion of working with computers) as feasible working environment needs to be created Rule 46 for a workplace requiring minimum workers of 50 at a time to have resting place, canteen, Rule 49 details on First Aid Provisions, Kits for workers In case of accidents Rule 50 In Information 1. on accident, Injury or death the Labor Office needs to be notified of such Incidents within seven days (this does not apply for minor injuries that can be addressed through first aid) Chapter 16 is on	
3	Child Labor (Prohibition and	Children under 14 should not be employed as laborer	

Sl. No.	Name of Policy / Law / Regulation	Applicability to Project	Remarks
	Regulation) Act, 1999		
4	Solid Waste Management Rule 2013	Rule 3 is on segregation of waste which includes harmful chemical waste segregation at the source by the generator	
5	Infectious Disease Act 1964	The Act deal with any infectious disease which may develop or spread on animal and human beings throughout Nepal. It establishes that the Government of Nepal may take necessary action to root out or prevent that disease and may issue necessary orders applicable to the general public or a group of any persons. The Government may designate any official and confer necessary powers to such official to make necessary arrangements in order to root out or prevent any infectious disease that has been developed or spread or is likely to spread on human beings. Without prejudice to the generality of sub-section (1) or (2), the Government of Nepal may issue necessary orders for the purpose of conducting examination of any animals, birds being transported on foot or by any means of conveyance or of any passengers and holding any passengers by the official designated for examination in quarantine.	All labor will be subject screening of basic health check up.
6	National Ambient Air Quality Standards 2012	Government of Nepal has published National Ambient Air Quality Standards in 2012. The NAAQS gives maximum concentration for major nine parameters including particulate matters and trace gases, heavy metal and others.	Limits of the ambient air quality parameters around construction site needs to follow as per NAAQS provided in Annex
7	National Standards for Sound Pressure Levels, 2012	National Limits of the sound pressure level Leq (dBA) for different areas for day and nighttime.	Construction Activities and Operation Phase of the Project needs to ensure abidance. Standard in Annex
8	Emission Standards for Diesel Generators, 2012	The emission standards for generators for four parameters of different capacity rage have been designated standards are in Annex	Construction work requiring usage of generator. Emission Standards for the Generators to be followed in Annex
9	Drinking Water Quality Standards, 2006	There are 31 parameters desirable limits prescribed by government to be followed	Construction camps to follow drinking water standards

Source: ADB's TA Consultant

2.5 International Agreements and Conventions

50. International agreements pertinent to the project components include multilateral environmental agreements (MEA) and conventions of the International Labor Organization (ILO) related to worker safety and welfare. Nepal is a party and signatory to several international and regional environmental

treaties, agreements, and conventions. Table 3 provides the key international agreements that Nepal is a signatory with potential applicability to the Project.

Table 3: List of Relevant International Agreements

#	Name	Date of Ratification	Applicability	Remarks
1	Convention on International Trade in Endangered Species of wild Fauna and Flora (CITES 1973)	Accession on 18 Jun 1975	Seeks to avoid poaching by construction workers especially in environmentally sensitive areas	
2	Convention on Biological Diversity (CBD, 1992)	1994		
3	Indigenous and Tribal Peoples Convention 1989 (No. 169) ILO Convention 169	August 22, 2007	To ensure no discrimination against indigenous or tribal people	
4	Convention 182 on The Worst Forms of Child Labor, 1999	January 03, 2002	Ensure prevention of child labor	
5	Basel Convention on The Control of Transboundary Movements of Hazardous Wastes and Their Disposal, 1989	Accession October 15, 1996	aims to reduce the amount of waste produced by signatories and regulate the international traffic in hazardous wastes including PCBs and asbestos which may be present in existing facilities	
6	Convention Concerning the Protection of the World Cultural and Natural Heritage Paris 1972	Acceptance June 20, 1978	ensure potential impacts on world cultural and natural heritage designated sites avoided. Archeological sites have been identified in the project location	
7	United Nations Framework Convention on Climate Change, 1992	May 2, 1994	The objective is to stabilize greenhouse gas concentrations “at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system.” It states that “such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner	
8	Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property 1972	June 23rd, 1976	The convention defines cultural property as property on religious or secular grounds designated by State of in terms of archeology, prehistory, history, literature, art or science and which belongs the eleven different categories. Property of artistic interest of	

#	Name	Date of Ratification	Applicability	Remarks
			category 7 have been further sub categorized into 4. Article 3 of the convention specifically categories import, export or transfer of ownership of cultural property effected contrary to the provisions adopted under the Convention by State Parties as illicit. Article 4 provides four criteria for categorization by State Parties to recognize as cultural heritage of the state. There are altogether 26 articles governing the convention. Project areas being close to and potential sites for Archeological Areas.	
9	Convention on Wetlands of International Importance specially as Waterfowl Habitat 1975	Accession December 17th 1987	The convention guides contracting parties to promote conservation of wetlands listed and wise its use. It directs the parties to inform if ecological character of listed wetland in its territory has changed is changing or will likely change from technological developments, pollution, or other human interference. Article 1 of the convention's sub article 1 defines wetlands as areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tides does not exceed six meters. Sub article 2 defines water fowls as birds ecologically dependent on wetlands. The project traverses north of Ramsar Site and through bird migratory route	
10	Kyoto Protocol to the United Nations Framework Convention on Climate Change, 1997	2005	to achieve stabilization of greenhouse gas (GHG) concentrations in the atmosphere at a level low enough to prevent dangerous anthropogenic interference with the climate system. SF6 is a GHG used in GIS as well as gas insulated switchgear	
11	Paris Agreement under the United Nations Framework	2016	Objective to limit global warming to well below 2, preferably to 1.5	

#	Name	Date of Ratification	Applicability	Remarks
	Convention on Climate Change,2015		degrees Celsius, compared to pre-industrial levels. To achieve this long-term temperature goal, countries aim to reach global peaking of greenhouse gas emissions. SF6 is a GHG used in GIS as well as gas insulated switchgear	
12	Stockholm Convention of Persistent Organic Pollutants (POPs) 1972	March 6, 2007	ensures the environmentally sound management and the disposal of POPs including PCBs. Nepal has started using PCB-free equipment but not legislated	Ensure PCB free material are used
13	ILO Asbestos Convention, 1986 (Convention No. C 162)	Yet to be ratified by Nepal but falls in ADB Prohibited investment activities of unbonded asbestos fibers in production, trade or use[1]	applies to all activities involving exposure of workers to asbestos in the course of work	
14	Convention on Migratory Species of Wild Animals Bonn, 1979	Signatory October 22, 2008	ensure potential impacts on any migratory species supported by the project area of influence assessed and managed. Rapti River Crossing is cu	

GHG = greenhouse gas, ILO = International Labor Organization, PCB = polychlorinated biphenyls

2.6 Clearances and Permissions Required

51. Clearances, Permissions and licenses to be obtained for the project by both the borrower (NEA) and the EPC contractors are given in **Error! Reference source not found.**. Clearances will need to be applied for early on as they can take more than one year to secure.

Table 4: List of Environmental Consents and Work Permits Required

#	Clearances / Permissions	Authority	Responsible Party	Status as of May 2024
1	Permission for Clearance of Trees from Forest	MoFE	NEA PMD,	Application to be submitted through MoEWRI. Submission made to MoEWRI. Tagging of trees for Lamahi SS area

[1] This does not apply to the purchase and use of bonded asbestos cement sheeting where the asbestos content is less than 20%.(ADB SPS 2009)

				conducted while for TL Is In process
2	Permission for entry inside the forest	Divisional Forest Office		
3	MoFE writes to DFO through Department of Forest for field level information of the project forest area Province Ministry is notified	District Forest Office, Divisional Forest Office and Provincial concerned Ministry		
4	On receiving information MoFE writes to project and seeks approval from Government of Nepal with number of tree information, with conditions. Post expiration of the development project with no management the protection will be done by GoN	Government of Nepal		
5	In conditions of no available site prescribed by DFO for stockpiling of felled timber logs or firewood outside forest from clearance obtain permission from provincial forestry director to be located within the forest area	Provincial Forestry Director		
6	In condition land obtaining facilitation committee recommends unavailability of land (In condition the project Is unable to provide land for project forest land obtaining facilitation committee role comes into play) for compensatory plantation permission is necessary by project to deposit cost of land purchase to be used by the project in forest. Monitoring is conducted by Department of Forest on compliance of agreement by the project	Department of Forest		
7	Deposited Fund for land purchase and cost for compensatory plantation ape per prevailing law, cost of fencing, transportation, forest guards for five years etc. is included in the cost	Department of Forest		

2.7 Environmental Standards and Guidelines

52. Nepal has a large set of specific standards that refer to emissions, effluent discharge, and noise standards, as well as standard to handle and dispose specific wastes ranging from sewage to hazardous wastes. The following summarizes these laws and standards along with other international best practice standards.

2.7.1 Air Quality and Emissions

53. National Standards – Nepal has a range of air quality and emissions standards as shown in the tables below.

Table 5: National Air Quality Standards

Parameters	Averaging Time	Ambient Concentration (maximum) µg/m^3
Total Suspended Particulates	Annual	-
	24-hours[a]	230
PM10	24-hours[a]	120
Sulphur Dioxide	Annual[b]	50
	24-hours[a]	70
Nitrogen Dioxide	Annual	40
	24-hours[a]	80
Carbon Monoxide	8 hours[a]	10,000
Lead	Annual[b]	0.5
Benzene	Annual[b]	5[e]
PM2.5	24-hours[a]	40
Ozone	8 hours[a]	157

Notes:

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

[b] In any specified place twice in one week continuously for 24 hours and in a week data taken for a minimum of 104 times yearly average is considered s above.

Table 6: Operational Diesel Generator Emission Standards[2]

Category (KW)	CO	HC+NOx	PM
KW<8	8	7.5	0.8
8≤KW<	6.6	7.5	0.8
19≤KW<	5.50	7.50	0.60

[2] Source: Emission Standard for Deisel Generator 2069

Category (KW)	CO	HC+NOx	PM
37≤KW<	5.00	4.70	0.40
75≤KW<	5.00	4.00	0.30
130≤KW<	3.5	4	0.2

Table 7: Imported Diesel Generator Emission Standards

Category (kW)	CO	HC+NOx	PM
kW<8	8	7.5	0.8
8<19	6.6	7.5	0.8
19<37	5.5	7.5	0.6
37<75	5	4.7	0.4
75<130	5	4	0.3
130<560	3.5	4	0.2

Table 8: Light and Over 2.5 Ton Commercial Vehicle Emission Standards

Limit Values, Grams per Kilometer			
Type of Vehicle	Mass of CO	Mass of HC	Mass of NOx
L CV (RM=<1305 Kg)	2.3	0.2	0.15
L CV (1305>RM< or =1760 Kg)	4.17	0.25	0.18
L CV (RM > 1760 Kg)	5.22	0.29	0.21

54. International Guidelines – The following table provides WHO recommended air quality guidelines (2021)

Table 9: World Heath Organization 2021 Ambient Air Quality Guidelines

Parameter	Averaging Period	Guideline Value (micrograms/m^3)
Sulphur Dioxide (SO_2)	24 Hour	40
Nitrogen Dioxide (NO_2)	24 Hour	25
	1 Year	10
Particulate Matter PM_{10}	24 Hour	45
	1 Year	15
Particulate Matter $PM_{2.5}$	24 Hour	15
	1 Year	5

Project Air Quality Standards

55. Any air quality monitoring during the construction phase will be undertaken against national standards, particularly given impacts are short term, although comparison will also be made to the more stringent WHO 2021 guidelines. This is based on the criteria adopted by the WBG Guidelines which state that:

'Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines.'[3]

[3] Environmental, Health and Safety Guidelines. Air Emissions and Ambient Air Quality. WBG. 2007

56. As noted above, Nepal has their own national legislated standards and as such they will be applied to the Project, though impact monitoring will also be compared against the WHO guidelines for information.

2.7.2 Water quality standards

57. The following tables show national drinking water standards and waste water discharge standards.

Table 10: National Drinking Water Quality Standards

S.N.	Parameters	Desirable Limits	Maximum Tolerable Limit
1	Colour, Hazen units, Max	10	15
2	Odour	Unobjectionable	
3	Taste	Agreeable	
4	Turbidity, NTU, Max	5 10	10
5	Total Dissolved Solids, mg/l, Max	500	1500 may be relaxed upto 3000
6	pH value	6.5 – 8.5	May be relaxed up to 5.5 on the lower and up to 9 on higher side.
7	Total Hardness (as CaCO3) mg/l, Max	250	may be extended upto 600
8	Calcium (as Ca), mg/l, Max	75	may be extended upto 200
9	Magnesium (as Mg), mg/l, Max	30	may be extended upto 100
10	Copper (as Cu), mg/l, Max	1 .05	may be extended upto 1.5
11	Iron (as Fe), mg/l, Max	0.3	may be extended upto 1.0
12	Manganese (as Mn), mg/l, Max	0.1	may be extended upto 0.5
13	Chlorides (as Cl), mg/l, Max	250	may be extended upto 1000
14	Sulphate, (as SO4), mg/l, Max	1502	May be extended upto 400 provided magnesium does not exceed 30
15	Nitrate (as NO3), mg/l, Max	45	No relaxation
16	Fluoride (as F), mg/l, Max	1.50.6 to 1.2	May be extended upto 1.5 if no alternate source available
17	Phenolic compounds, (as C6H5OH), mg/l, Max	0.001	May be relaxed upto 0.002
18	Mercury (as Hg), mg/l, Max	0.001	No relaxation
19	Cadmium (as Cd), mg/l, Max	0.01 0.01(PFA 0.003)	No relaxation
20	Selenium (as Se), mg/l, Max	0.01	No relaxation
21	Lead (as Pb), mg/l, Max	0.01 (WHO 0.01)	No relaxation
22	Arsenic (as As), mg/l, Max	0.05 (WHO 0.01)	No relaxation
23	Cyanide (as CN), mg/l, Max	0.05	No relaxation
24	Chromium (as Cr6+), mg/l, Max	0.05	No relaxation
25	Residual free Chlorine, (as Cl), mg/l, Min	0.2	
26	Ammonia, mg/l, Max	1.5	
27	Aluminum, mg/l, max	0.2 (0.05 – 0.2 EPA)	
28	Boron mg/l, max	0.3	
29	Nickel, mg/l, max	0.02	
30	Hydrogen sulphide, mg/l, max	0.1	
31	Zinc, mg/l, max	3	

Table 11: Generic Standard: Tolerance Limit for Industrial (Wastewater) Effluents Discharged into Inland Surface Waters and Public Sewers

#	Parameters	Industrial waste into Inland Surface Waters	Wastewater into inland Surface Waters from CWTP*	Industrial Effluents into Public Sewers*
1	TSS, mg/l	30-200	50	600
2	Particle size of TSS	Shall pass 850-micron Sieve	Shall pass 850-micron Sieve	
3	pH Value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
4	Temperature ^{o}C[1]	<40	<40	45
5	TDS, mg/L, max			2100
6	Color and Odor			
7	BOD for 5 days at 20 degree C, mg/L Max	30-100	50	400
8	Oils and grease, mg/L, Max, Max	10	10	50
9	Phenolic compounds, mg/	m1	1	10
10	Cyanides (as CN), mg/L, Max	0.2	0.2	2
11	Sulfides (as S), mg/L, Max	2	2	2
	Sulphates (SO_4), mg/L, Max			500
12	Radioactive materials: a. Alpha emitters, c/ml, Max	10^{-7}	10^{-7}	
	b. Beta emitters, c/ml, Max	10^{-8}	10^{-8}	
13	Insecticides	Absent	Absent	Absent
14	Total residual chlorine, mg/L	1	1	1000 as chlorides
15	Fluorides (as F), mg/L, Max	2	2	10
16	Arsenic (as AS), mg/L, Max	0.2	0.2	1
17	Cadmium (as, Cd), mg/L, Max	2	2	2
18	Hexavalent chromium (as Cr), mg/L, Max	0.1	0.1	2
19	Copper (as Cu), mg/L, Max	3	3	3
20	Lead (as Pb), mg/L, Max	0.1	0.1	0.1
21	Mercury (as Hg), mg/L, Max	0.01	0.01	0.01
22	Nickel (as Ni), mg/L, Max	3	3	3
23	Selenium (as Se), mg/L, Max	0.05	0.05	0.05

#	Parameters	Industrial waste into Inland Surface Waters	Wastewater into inland Surface Waters from CWTP*	Industrial Effluents into Public Sewers*
24	Zinc (as Zn), mg/L, Max	5	5	5
25	Sodium, %, max			
26	Ammoniacal nitrogen, mg/L, Max	50	50	50
27	COD, mg/L, Max	250	250	1000
28	Silver, mg/L, Max	0.1	0.1	0.1
29	Mineral Oils, mg/L, Max			10
30	Inhibition of nitrification test at 200ml/l			<50%

Source: MOEN, 2010.

Notes: CWTP= Combined Waste Water Treatment Plant; Under enforcement since BS 2058/1/17 (30 April 2001); *Under enforcement since BS 2060/3/9 (23 June 2003); [1] Shall not exceed 40°C in any section within 15 m downstream from the effluent outlet.

58. In addition to the above, the WBG provides guidelines values for treated sanitary sewage discharges. The following table provides these values with which the Project shall also comply, for example relating to any wastewater discharge from construction camps.

Table 12: WBG Indicative Values for Treated Sanitary Sewage Discharges

Pollutant	Unit	Guideline Value
pH	pH	6-9
Biological Oxygen Demand (BOD)	Mg/l	30
Chemical Oxygen Demand (COD)	Mg/l	125
Total Nitrogen	Mg/l	10
Total Phosphorus	Mg/l	2
Oil and Grease	Mg/l	10
Total Suspended Solids	Mg/l	50
Total Coliform Bacteria	MPN[A] / 100 ml	400

Project Water Quality Standards

59. Drinking water quality will be measured against national standards. Effluent discharge will comply with WBG standards which are more stringent than national standards.

2.7.3 Noise standards

60. National Standards - The national noise standard set by GoN Is 75 dB for Industrial area and 50 dBA for peaceful area. Details for six categories for day and night along with limits for different equipment are Table.

Table 13: Noise Standards

Area	Day	Night	Remarks a
Industrial	75	70	Passenger car at 65 miles per hour at 25 feet registers 77 dB
Commercial	65	55	50 dB(A) is typical of conversation in a restaurant or office
Urban Residential	55	50	50 dB(A) is typical of conversation at home, large electrical transformers at 100 feet

Area	Day	Night	Remarks a
Rural Residential Area	45	40	
Mixed Residential Area	63	55	
Peaceful Area	50	40	
Water Pump			Max: 65 dB
Diesel Generator			Max: 90 dB
Entertainment			Max: 70 dB

61. International Guidelines – To meet WBG EHS Guideline requirements noise impacts should not exceed the levels presented in Table 14 or result in a maximum increase in background levels of 3 dB at the nearest receptor location off site. These levels are applicable at individual receptors, based on type.

Table 14: WHO Noise Level Guidelines

Receptor	One-hour L_{aeq} (dBA)	
	Daytime 07.00-22.00	Night-time 22.00 – 07.00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

Source: WBG EHS Guidelines, 2007

62. Control room noise should follow best practice guidelines as set out in the WBG EHS Guidelines on Occupational Health and Safety (Table 2.3.1) where the average noise level within the control room shall not exceed 45-50 dB(A) during the length of the 8-hour working day.

Project Noise Standards

63. WHO standards shall be followed for residential receptors, except for nightime noise levels in rural areas, where national standards will be applied. Peaceful noise limits will be applied in areas close to sensitive receptors, such as PCR, schools and health facilities. Control room noise shall comply with WBG guidelines.

2.7.4 Vibration

64. International Guidelines – some of the most recognizable standards for structural vibration measurements are ISO 4866, British BS 7385-2, and German DIN 4150-3. The German DIN 4150-3 – Vibration in Buildings – Part 3: Effects on structures Standard provides short term and long-term limits [4] for vibration at the foundation for various structures. It is useful as it provides short term values corresponding to construction impacts. Since the international standard focuses more on measurement of vibration this is considered as the international best practice to be followed by the Project, it has been used in various other recent ADB environmental assessments.[5]

[4] short-term vibrations are defined as those that do not occur often enough to cause structural fatigue and do not produce resonance in the structure being evaluated and long-term vibrations are all the other types of vibration.
[5] For example, https://www.adb.org/projects/documents/geo-51257-001-eia-0

Table 15: Guideline Values for Vibration Velocity to be Used When Evaluating the Effects of Short-term and Long-term Vibration on Structures

Group	Type of structure	Guideline Values for Velocity (mm/s)				
		Short-term				Long-term
		At foundation			Uppermost Floor	Uppermost Floor
		Less than 10 Hz	10 Hz to 50 Hz	50 to 100 Hz	All frequencies	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	10
2	Residential dwellings and buildings of similar design and/or use	5 (105 dB)	5 to 15	15 to 20	15	5 (105 dB)
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3 (100.5 dB)	2 to 8	8 to 10	8	2.5 (99.0 dB)

Source: DIN 4150-3, Structural Vibration, Part 3: Effect of vibration on structures

65. DIN 4150-3 notes that "experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur. If damage nevertheless occurs, it is to be assumed that other causes are responsible. Exceeding the value in the table does not necessarily lead to damage".

Project Vibration Standards

66. German Standard DIN 4150-3 will be followed during the construction phase.

2.7.5 International Electromagnetic Field (EMF) Standards

67. WBG EHS guidelines for Electric Power Transmission and Distribution refer to International Commission on Non-Ionizing Radiation Protection (ICNIRP), which establish reference and exposure levels for the general public. They set exposure to electric field at 50 hertz as 5 kV/m and for magnetic fields 100 µT.[6] In the United Kingdom, the exposure limit is 360 µT [7] (reference level 100 µT) [8]

68. Typical ground level field levels from overhead HV power lines in the United Kingdom are illustrated in Table 16 and show that at 25 meters EMF levels for 275-400kV lines are well below ICNIRP exposure levels for both magnetic and electric fields but within 25 m electric field levels may be exceeded. The

[6] ICNIRP per WBG EHS Guidelines. ICNIRP has more recent 2010 and 2020 guidelines for limiting exposure to electromagnetic fields for low frequencies and up to 300 GHz respectively.
[7] Only where the time of exposure is significant
[8] https://www.energynetworks.org/assets/files/electricity/she/emfs/ENA%20training%20distribution%20EMFs%20v5.pdf

detailed design will need to ensure the EMF levels can be complied with at the nearest regularly occupied properties.

Table 16: Typical Ground-level Electric Field Levels from Overhead Power Lines (132 and 275-400kV)

Location	Magnetic Field (microteslas)		Electric Field (kV/m)	
	132kV	275-400kV	132kV	275-400kV
Maximum Field (under line)	40	100	4	11
Typical Field (under line)	0.5 – 2	5-10	1-2	3-5
Typical Field (25 meters to side)	0.05 – 0.2	1-2	0.1-0.2	0.2 – 0.5
Typical Field (100 meters to side)	0.01 – 0.04	0.05 – 0.1	0.002 – 0.02	0.01 – 0.04

Source: National Grid, 2012 (https://www.nationalgrid.com/sites/default/files/documents/13791-Electric%20and%20Magnetic%20Fields%20-%20The%20facts.pdf

69. Corresponding ICNIRP limits for general occupational exposure to electric and magnetic fields are significantly higher at 10 kV/m and 500µT, respectively, for 50 hertz. In the United Kingdom, the occupational exposure limits (high action level) are 6000 µT and 20 kV/m and 1000 µT and 10 kV/m (low action level). For trained employees, the minimum working clear hot stick distance for 2.1-15 kV is 0.6m, for 15.1 to 35 kV is 0.71m, and so on based on the WBG EHS guidelines.

2.8 Other Relevant Standards

2.8.1 General Safety Clearances

70. WBG EHS Guidelines for Electric Power Transmission and Distribution note that installation of power lines or other high voltage equipment above or adjacent to residential properties or other locations intended for highly frequent human occupancy, (e.g., schools or offices), should be avoided. In addition, the following national general safety clearance requirements for the Project shall be applied.

2.8.1.1 Clearance above Ground of the Lowest Conductor of Overhead Lines

71. The lowest conductor of the transmission line will maintain a 6.1m clearance from the ground, this will be 7m on road crossings, 3.5m with communication line and other powerline crossings. for 400 or 230kV TL laying Is permitted above fence, garage, cottage. However It should be above 3m.

2.8.1.2 Horizontal and Vertical Clearances above Buildings

72. In addition to maintaining a 46m of RoW by the Transmission line corridor a minimum of a little over 5.89m horizontal clearance will be maintained with houses or trees from the conductor.

73. Any line being built around the Airport will need to construct as per decision made by the chief of Airport concerned.

2.8.1.3 Spans

74. The nominal span between tower will be maintained at 400m

2.8.2 Other General Safety Requirements

75. Other general safety requirements Include such as workers working at elevated place or electric poles need to work only using safety belts for protection, clear display In Nepali language of procedures

required to be taken as a first aid measure when effected by electric currents need to be displayed In licensee's plant, work on live line of electricity needs to be done only using Insulated gloves, cutoff of electric lines during Inspection, repair or any other works (however, technically If can be done without so It can be carried out In live wire as well), Board Indicating warning sign In Nepali language needs to be hung on poles over 400V and If not possible at every place minimum nearby entrance It needs to be hung. Other safety rules from Electricity Rule Indicate towards high standard of equipment to be used, safety from lightning.

2.9 International Best Practice

76. WBG EHS General Guidelines (30 April 2007) will be applicable for the Project, especially Section 4 on Construction and Decommissioning. In addition, the WBG EHS Guidelines for Electric Power Transmission and Distribution (30 April 2007) also need to be considered while designing the substations and power lines. It requires consideration of terrestrial and aquatic habitat alteration, electric and magnetic fields, hazardous materials, occupational health and safety and community health and safety. The project is required to comply with these guidelines regarding assessment of potential impacts and management measures, performance indicators and monitoring guidelines. NEA shall follow the WBG EHS Guidelines for this project and shall also ensure that all appointed EPC Contractors and their subcontractors follow them.

2.10 Asian Development Bank Safeguard Policy Statement 2009

77. ADB has three safeguard principles and requirements (environment, involuntary resettlement and indigenous peoples) under its Safeguard Policy Statement 2009 that seek to avoid, minimize, or mitigate adverse impacts of projects on the environment and affected people. The Project requires the application of involuntary resettlement and Indigenous Peoples safeguard requirements.

78. ADB's prohibited investment activities list will also apply. Thus, any use of CFCs, PCBs, and asbestos containing materials will be prohibited. In relation to child labor, considering capacity for supervision, no under 18s will be permitted to work on the construction site or operational areas due to the hazardous nature of work involved.

<u>Safeguard Requirements 1: Environment</u>

79. The objectives are to ensure the environmental soundness and sustainability of projects, and to support the integration of environmental considerations into the project decision-making process. Environmental safeguards are triggered if a project is likely to have potential environmental risks and impacts. Eleven 'Policy Principles' have been adopted as part of the ADBs Safeguard Policy Statement (SPS 2009). These are as follows with a note on the gap analysis compared to national requirements:

80. Use a screening process for each proposed project, as early as possible, to determine the appropriate extent and type of environmental assessment so that appropriate studies are undertaken commensurate with the significance of potential impacts and risks. (The Project was screened by the ADB and classified as a Category A project).

81. Conduct an environmental assessment for the proposed project to identify potential direct, indirect, cumulative, and induced impacts and risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues),

and physical cultural resources in the context of the project's area of influence. Assess potential transboundary and global impacts, including climate change. Use strategic environmental assessment where appropriate. (The herewith provides the environmental assessment for the Project in accordance with ADB's Safeguard Policy Statement 2009 and having cognizance of national environment, health and safety laws and regulations. Transboundary impacts are not applicable).

82. Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and document the rationale for selecting the particular alternative proposed. Also consider the no project alternative. (Alternatives have been considered in this IEE, including the 'no project' alternative).

83. Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts by means of environmental planning and management. Prepare an environmental management plan (EMP) that includes the proposed mitigation measures, environmental monitoring and reporting requirements, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators. Key considerations for EMP preparation include mitigation of potential adverse impacts to the level of no significant harm to third parties, and the polluter pays principle. (An EMP has been prepared for the Project in accordance with ADB's Safeguard Policy Statement 2009 and having cognizance of national environment, health and safety laws and regulations).

84. Carry out meaningful consultation with affected people and facilitate their informed participation. Ensure women's participation in consultation. Involve stakeholders, including affected people and concerned nongovernment organizations, early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address issues related to environmental assessment. Establish a grievance redress mechanism to receive and facilitate resolution of the affected people's concerns and grievances regarding the project's environmental performance. (Meaningful consultations were held to discuss environmental issues. The findings of the consultations (and a description of the Project grievance redress mechanism) are presented in this EIA).

85. Disclose a draft environmental assessment (including the EMP) in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. Disclose the final environmental assessment, and its updates if any, to affected people and other stakeholders. (This EIA and its EMP will be disclosed on the ADB website, they will also be locally disclosed by NEA on their website and at the construction site offices).

86. Implement the EMP and monitor its effectiveness. Document monitoring results, including the development and implementation of corrective actions, and disclose monitoring reports. (The EIA and its EMP outline a plan to monitor the implementation of the EMP and the institutional responsibilities for monitoring and reporting throughout the Project lifecycle).

87. Do not implement project activities in areas of critical habitats, unless (i) there are no measurable adverse impacts on the critical habitat that could impair its ability to function, (ii) there is no reduction in the population of any recognized endangered or critically endangered species, and (iii) any lesser impacts are mitigated. If a project is located within a legally protected area, implement additional

programs to promote and enhance the conservation aims of the protected area. In an area of natural habitats, there must be no significant conversion or degradation, unless (i) alternatives are not available, (ii) the overall benefits from the project substantially outweigh the environmental costs, and (iii) any conversion or degradation is appropriately mitigated. Use a precautionary approach to the use, development, and management of renewable natural resources. (Biodiversity and, in some cases, critical habitat areas are found outside the legally protected area system of Nepal wherein some endangered or critically endangered species may be present. Nepali regulations have no provisions for protecting biodiversity from power line in this event as such. However, the EIA includes a biodiversity assessment including consideration of natural and critical habitats and legally protected areas to ensure that this principle is complied with).

88. Apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges, including direct and indirect greenhouse gases emissions, waste generation, and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phase-outs. Purchase, use, and manage pesticides based on integrated pest management approaches and reduce reliance on synthetic chemical pesticides (measures to prevent pollution from project works are embedded throughout the EIA and will be implemented through the EMP)

89. Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities. (Both the Safeguard Policy Statement 2009 and Nepali regulations require safe work areas, the use of safety equipment and personal protective equipment etc. However, the enforcement of national requirements can be weak. The EIA and its EMP outline the requirement for specific occupational and community health and safety plans, monitoring and supervision).

90. Conserve physical cultural resources and avoid destroying or damaging them by using field-based surveys that employ qualified and experienced experts during environmental assessment. Provide for the use of "chance find" procedures that include a pre-approved management and conservation approach for materials that may be discovered during project implementation. (The EIA includes detailed assessment of cultural heritage to ensure that this principle is complied with).

<u>Safeguard Requirements 2: Involuntary Resettlement.</u>

91. The objectives are to avoid involuntary resettlement wherever possible; to minimize involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups. The safeguard requirements underscore the requirements for undertaking the social impact assessment and resettlement planning process, preparing social impact assessment reports and resettlement planning documents, exploring negotiated land acquisition, disclosing information and engaging in consultations, establishing a grievance mechanism, and resettlement monitoring and reporting.

92. The involuntary resettlement requirements apply to full or partial, permanent or temporary physical displacement (relocation, loss of residential land, or loss of shelter) and economic displacement (loss of land, assets, access to assets, income sources, or means of livelihoods) resulting from (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas. Resettlement is considered involuntary when displaced individuals or communities do not have the right to refuse land acquisition that results in displacement. (A Resettlement and Indigenous People Plan (RIPP) has been prepared for the Project according to the requirements of ADB and is summarized in this EIA).

Safeguard Requirements 3: Indigenous Peoples.

93. The objective is to design and implement projects in a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the Indigenous Peoples themselves so that they (i) receive culturally appropriate social and economic benefits, (ii) do not suffer adverse impacts as a result of projects, and (iii) can participate actively in projects that affect them. Indigenous People are present in the Project area and a RIPP has been prepared for the Project).

94. To achieve the desired results, safeguard requirements are built into the process which needs to be realized during the processing and implementation of the projects that ADB shall finance.

95. Table 17 presents a comparison and gap analysis of ADB's SPS 2009 and Nepali Requirements.

Table 17: ADB SPS 2009 and Government of Nepal Environmental Requirments Gap Analysis

Project Stage	Nepal Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
Screening and Categorization	• Environmental Protection Rules 2020 has defined thresholds for environmental assessment under 3 categories: Brief Environmental Study, IEE and EIA. It has defined the roles of the provincial government and the local government as well in the process of environmental assessment of development projects.	• As per ADB's Safeguard Policy Statement (2009) screening and categorization is required for all projects • Assigns categories based on potential impacts into either: i. Category A - EIA required (significant irreversible, diverse, or unprecedented adverse environmental impacts) ii. Category B – IEE required iii. Category C – no environmental assessment required but a review of environmental implications iv. Category FI – Environmental and Social Management System required	• Based on EMR Powerline and Substation not passing through National Park, Wildlife Reserve and Hunting Reserve can do environmental assessment through IEE and hence IEE has been carried out under Government of Nepal requirements. Screening gap on archeological Sites to be considered • ADB's Safeguard Policy Statement 2009 the project traverses through Important Birds and Biodiversity Areas, Key Biodiversity Areas and alignment realigned to avoid Archeological Sites and hence have been categorized as A requiring EIA.
Environmental Assessment	• IEE is required for Transmission Line of 400kV and 400kV Substation in Chure Conservation Area	• Identify potential impacts on physical, biological, physical cultural resources and socioeconomic aspects in the context of project's area of influence (i.e., primary site and related facilities, associated facilities etc.) • Assess potential transboundary and global impacts, including climate change.	• Environmental Assessment on national requirements to include Archeological Experts for Assessment from early phase of the project. Inclusion on details of nesting colonies of critically endangered species to be located and assessed. Scope of Bird Expert inputs In sensitive sites as IBA to be Increased. Migratory nature of birds Included and Important national corridors considered in the national IEE. • ADB SPS requirements fulfillment is done with the EIA.
Analysis of Alternatives	• Analysis of Alternatives is conducted considering design, sites considering factors as social, topographical, stability (being In areas of chure conservation area), road accessibility, distance from existing Infrastructure of transmission line, proposed railway lines, avoidance of known	• Category A (projects with significant impacts) are required to carry out alternative analysis. • Alternatives to the project's location, design, and technology are to be examined and rationale for selecting the project	• Gap in earlier screening of Archeological Site, IBAs' and KBA incorporated to reroute certain sections of the transmission line.

Project Stage	Nepal Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
	Archeological sites of Greater Lumbini Area, upcoming 220kV Transmission Lines, recommendations from Airports'.	location, design, and technology to be documented. • Also "no project" alternative must be assessed.	
Environmental Planning and Management	• Environmental Management and Planning Included in the IEE	• Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts • Key considerations include mitigation of potential adverse impacts to the level of "no significant harm to third parties", the polluter pays principle, the precautionary approach, and adaptive management. • Prepare EMP addressing the potential impacts and risks identified by the environmental assessment which should include the proposed mitigation measures, environmental monitoring and reporting requirements, emergency response procedures, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators.	• Gaps in EPR not requiring Biodiversity Impact Assessment for IBAs' and KBA. Site specific recommendation of bird collision mitigation measures and arrangement of diverters. • As a ADB safeguard compliance HIA and BIA along with international best practice for bird movement assessment including mitigation measures for bird collision with power line included.
Meaningful Consultation	• Consultations were conducted during the IEE preparation process	• Meaningful consultation starts early and continues during implementation phase. It is undertaken in a conducive atmosphere and is inclusive of gender, vulnerable and indigenous groups such that the project incorporates all relevant views and concerns of affected persons and other stakeholders.	• Minor gap with further consultation Including NGO's and conservation agencies carried out.
Information Disclosure	• Information disclosure carried out during the preparation of IEE through public notice, local newspapers, public hearings, FM radio broadcasts.	• ADB will post in its website the following: a. Draft IEE prior to appraisal b. Final or updated IEE upon receipt c. Environmental monitoring report submitted by borrowers upon receipt • Local disclosure is also required	• Minor Gaps and ADB SPS safeguards requirements to fill in such as disclosure in ADB's website

Project Stage	Nepal Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
Grievance Redress Mechanism (GRM)	• IEE mentions implementation of community Grievance Redress Mechanism to address concerns from vulnerable group in community. NEA as such does not have GRM mechanism for such purpose. They have hotline for power cuts complaints (functional) and website (less functional).	• Establish GRM to facilitate resolution of grievances or complaints received in the project	• Major Gap exists and GRM to be established as per ADB SPS 2009
Monitoring and Reporting	• EPA requires Ministry and Department can carry out monitoring and inspection, Likewise Provincial Government or local level may as well carryout similar activities.	• Borrowers are required to prepare and regularly submit periodic monitoring reports on the progress of EMP implementation to ADB for review and disclosure • Prepare and implement corrective action plan if non-compliance is identified	• Major Gap exists in monitoring and monitoring measures will be carried out in accordance to ADB SPS 2009
Biodiversity	• Forest Act and Forest Rules has made provision of compensation for forest and forest land occupied by development projects as an offset for tree loss. Entry onto the forest for construction works are limited to the certain season of the year and declaration of special protection zone and wildlife corridors are ensured In national acts and well as provincial acts. • National Park and Wildlife Conservation Act protects and prevents hunting of protected species, • Control of International Trade of Endangered Wild Fauna and Flora Act prohibits purchase, sell, use, plantation, rear, captive breeding, transport, import or export threatened or vulnerable flora and fauna • Wildlife Friendly Infrastructure Construction Guidelines directs at development of infrastructure to consider incorporating best practices to mitigate adverse impact on wildlife	• ADB's Safeguard Policy Statement 2009 requires that the borrower assess the significance of project impacts and risks on biodiversity and natural resources as an integral part of the environmental assessment process. • It also requires that the assessment focus on the major threats to biodiversity including destruction of habitat and introduction of invasive alien species, and on the use of natural resources in an unsustainable manner • Borrowers are required to avoid, minimize, or mitigate potentially adverse impacts and risks and, as a last resort, propose compensatory measures, such as biodiversity offsets, to achieve no net loss or a net gain of biodiversity. • ADB's Safeguard Policy Statement 2009 also lays down procedures for implementing projects in natural habitats, critical habitats, and Legally Protected Areas	• Critical Habitat are found outside protected areas in areas that may not have strict monitoring and conservation initiatives hence major gaps major persists and to comply through ADB SPS 2009 EIA has been prepared considering biological Impacts.

Project Stage	Nepal Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
Pollution	• The Environment Protection Act has made living in clean and healthy environment a fundamental right and directs to provide victim with compensation for damage caused by environmental pollution. • The National Ambient Air Quality Standard have provided nine environmental parameters that standard. • Noise quality standards for different types of environments have been specified to be maintained day and night. • Water Quality Standards for Effluent from Industry to surface water, drinking water quality standards have been designated • Acid and Hazardous Chemical Act have been enacted to control purchase, transport, storge and disposal of hazardous substances., Occupational Health and Safety on handling such materials are also mentioned. • Nepal Vehicle Mass Emission Standards are in place to control tail pipe emission. • Solid Waste Management Act on management and disposal of solid waste generated.	• Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges, including direct and indirect greenhouse gases emissions, waste generation, and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phaseouts. • Refers to WBG EHS Guidelines for international good practice standards and measures for pollution control and prevention. If national regulations differ, more stringent will usually be followed. If less stringent levels are appropriate in view of specific project circumstances, provide full and detailed justification.	• The Air quality standards for WHO is more stringent than national standards. • The noise standard is similar to WHO • National Regulation do not have specific provisions for ensuring EMF exposure levels. • No specific provision for soil pollution levels and specific soil quality assessment guidelines • As a compliance for ADB SPS 2009 EIA has been prepared to address pollution
Health and Safety	• Labor Rule, Acid and Other Hazardous Chemical Act, Electricity Rules are some regulatory requirements that have directly expressed directions on health and safety measures.	• Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. • Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities. • Refers to WBG EHS Guidelines for the occupational health and safety guidelines to be followed	• Health and Safety standards reflect that of international practice. However gaps on EMF exposure levels and prevention are observed

Project Stage	Nepal Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
Physical Cultural Resources	• Ancient Monument Preservation Act (DoA is given authority in protection of cultural heritage), Local Administration Act (Chief District Officer) is also given responsibility for heritage conservation and management.	• ADB's Safeguard Policy Statement (2009) states that the borrower is responsible for siting and designing the project to avoid significant damage to physical cultural resources. It requires that such resources that may have direct, indirect, cumulative, and induced impacts are identified and assessed by qualified and experienced experts using field-based surveys. If such resources are impacted consultations with affected communities shall take place to identify the importance and to incorporate the views of the affected communities besides consultations with relevant national or local regulatory agencies. Appropriate mitigation measures ranging from avoidance to full site protection to selective mitigation, including salvage and documentation be provided in case of impacts. • For projects that are located where physical cultural resources are expected to be found as per the environmental assessment, procedures for chance finds shall be included in the EMP and such finds shall not be disturbed until assessed by a competent specialist • Movement of physical cultural resources shall be done only when no alternatives exist, overall benefits of the project substantially outweigh the anticipated cultural heritage loss and the removal is in accordance with relevant national and international laws and uses the best available techniques	• As a compliance for ADB SPS 2009 EIA has been prepared

96. The project will follow national as well as international good practice guidelines related to environment, health and safety including those set out in the:

- IFC Environmental, Health, and Safety General Guidelines, 30 April 2007
- IFC Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution, April 2007
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for Limiting Exposure to time-varying Electric, Magnetic, and Electromagnetic Fields (UP to 300 GHz)
- International Labor Organization, Safety and Health in Construction, 2022.

III. DESCRIPTION OF THE PROJECT

3.1 Project Location & Description

97. The proposed NBTL and substation is situated in Nepal's western region, specifically within the Lumbini Province. It spans 160 km, commencing from Tower No 16 at Sunwal in Nawalparasi-West District and concluding at Lamahi SS in Dang District.

98. For the section between New Butwal Substation and Tower 16, a multi-circuit towers being constructed by MCA Nepal will be utilized. The geographic scope of the NBTL encompasses the municipalities of Nawalparasi Werst, Rupandehi, Kapilvastu, Arghakhanchi, and Dang district within the Lumbini Province.

3.2 Project Components

99. The Project comprises two components:

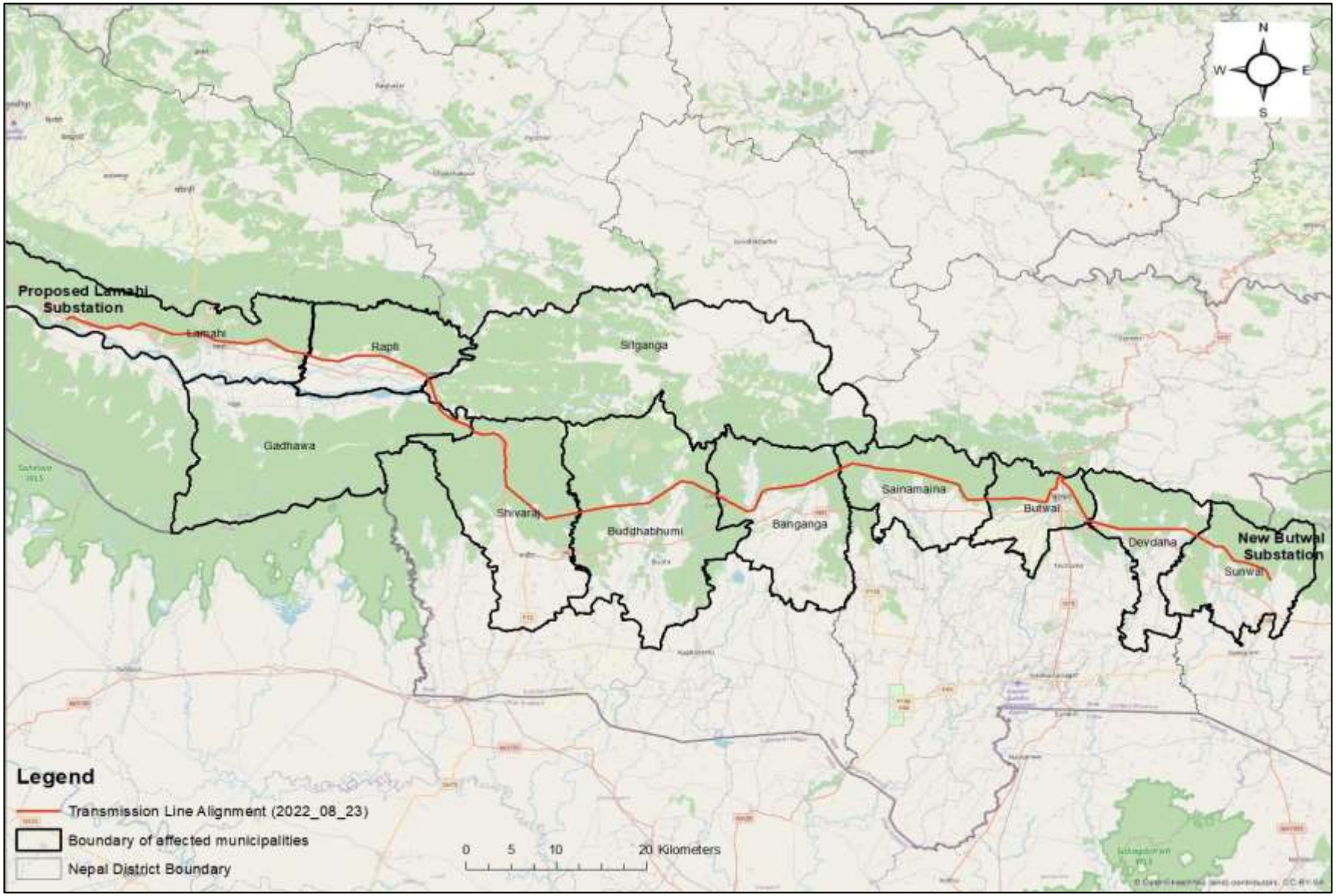
c) **Component 1: Transmission line** – New Butwal to Lamahi - The 400 kV (quad bundle) transmission line (NBTL) is proposed to be built in Nepal's western region. The total length of NBTL is about 160 km, which is distributed in Lumbini Province. It starts from the tower No. 16 of the multi circuit transmission line from New Butwal Sub-Station located at Nawalparasi–West District; then the NBTL passes through Rupandehi, Kapilvastu and adjacent to the existing Motipur SS and ends at proposed Lamahi SS at the Dang District. Component 1 will comprise 2 lots:

- New Butwal – Motipur (69km)
- Motipur – Lahami (92km)

d) **Component 2: Substation** - The proposed Lamahi SS is situated in ward No. 9 of Lamahi Urban Municipality in the Dang District. The proposed land for the substation is 11.00 ha. On the northern part of the substation compound, 12-line bays are proposed along the 400 kV TL corridor. Additionally, 8-line bays are on the southern parts along the 220 kV TL corridor, and 12-line bays on the eastern parts along the 132 kV TL corridor. The Lamahi - Kohalpur 132 kV TL is currently passing above the Lamahi SS. To facilitate a LILO arrangement, a double-circuit entry will be established on the eastern side. The civil and building works for the project include substation land grading, equipment foundation and oil pit, control building, water supply and drainage, and site boundary wall construction. Lamahi SS has a new GIS substation with a voltage level of 400/220/132/33/11 kV.

Figure 1: Project Location

Source: NEA



3.3 Contracting Arrangements

100. An Engineering Procurement and Construction (EPC) Contractor will be selected through an international competitive bidding process, separate EPC Contractors will be engaged for Component 1 and Component 2. The EPC Contractor will undertake the detailed design, carry out civil works, supply and install equipment. NEA will operate NBTL and Lamahi SS. Table 18 summarizes the Project contract packages and their status in terms of bid and tender dates.

Table 18: Project Contracting Arrangements

Sub-component / Package	General Description	Tender Status	Notes
Component 1			
Lot 1	Design, procurement and construction of 69km of TL from New Butwal – Motipur	Not yet tendered	Bid documents in draft
Lot 2	Design, procurement and construction of 92km of TL from Motipur – Lamahi SS	Not yet tendered	Bid documents in draft
Component 2			
Substation	Design, procurement and construction of Lamahi SS	Not yet tendered	Bid documents in draft

Source: NEA

3.4 Transmission Line

101. The salient features of the project have been illustrated in the table below:

Table 19: Salient Features of the Project (Source – Feasibility Study)

Name of the Project	New Butwal – Lamahi 400 kV Transmission Line Project
Province	Lumbini
Districts	Nawalparasi West, Rupandehi, Kapilvastu, Arghakhanchi, Dang
Municipality/Rural municipality	1. Nawalparasi West Sunwal (13,11,4,7,6). 2. Rupandehi Devdaha (5,6,7,9,10), Butwal (7,6,4,3,1,2,13,12), Sainamaina (1,2,3,5,6,9,10). 3. Kapilvastu Banganga (1,2,7,8,9), Buddha Bhumi (1,3,9), Shivraj (3,1,9). 4. Dang Gadhwa (1), Rapti (1,2,4,8,5), Lamahi (1,3,4,5,6,7,8,9). 5. Arghakhanchi Sitganga (8)
Metropolitan/Sub-metropolitan City	Butwal
Voltage Level of Transmission Line	400 kV

Length	160.858 km
Circuit	Double Circuit/Multi Circuit
Right of Way	46 m; 23 on either side from center line
Nominal Span	400 m
Maximum Deviation Angle	60 degrees
Minimum Deviation Angle	0 degree
Elevation Range of TL Route	116m -543m
Maximum Frequency (Hz)	50 Hz ±2.5 %
Number of Angle Points	
0–2-degree, DA	198
2–15-degree, DB	144
15–30-degree, DC	22
30-60 degree, DD	64
QD	13
Tower	
Tower Number	441
Land Area for Tower Pad	20 Hectares
Land Area for Substation	21
Number of Angle Tower Points	230
Type of Tower	Steel Lattice Self Supporting
Tower Height	
Height of Tower	65-90 m
Below Ground	3.5 m
Foundation Type	Pile, Pad and Chimney
Conductor Name	Moose (Quad Conductor per Phase)
Minimum Ground Clearance	
Minimum Ground Clearance from treetop	6.5 m
Normal ground for pedestrian, residential areas, river, and other areas	9.5 m
Minimum ground clearance for major highways, roads, and streets	12.5 m
Power Carrying Capacity of Transmission Line	2000 MW at N-1 contingency 4000 MW without contingency
Land Requirement	Right of way (ROW):740 ha (Including 20 ha Tower Pad) Substation: 21 ha (permanent) Temporary: 10 ha
Insulator	Long Rod Composite Insulator
OPGW	48 Core on a single peak
Earth Wire	7/3.66 Steel wire
Major Rivers	Tinau, Banganga, and West Rapti
Dimension of Each Tower Foundation	DA - 14m*14m to 18m*18m DB - 18m*18m to 24m*24m DC - 19m*19m to 25m*25m DD - 20m*20m to 26m*26m QD- 22m*22m to 29m*29m
Mean Span	369 meters
Minimum Span	116 meters
Maximum Span	723 meters
Total number of Towers	DA – 198 DB – 144

	DC – 22 DD – 64 QD-13 Total Number of Towers – 441
Design Temperature	Minimum Temperature - -5 ºC Everyday temperature – 32 ºC Conductor Maximum Temperature – 80 ºC Earth wire Maximum Temperature – 53 ºC
Wind Speed	The basic wind speed considered is 47 m/sec.

3.4.1 NBTL Design

102. The 400 kV towers are designed for Quad Moose ACSR with a span of 4 00 m RL2 (879.38N/m^2). The calculated wind pressure is as per the IS 802-2015 and CBIP India Manual for the DA, DB, DC, DD and QDD towers with unequal /Body/ leg extensions provision (Single Line Sketches enclosed) up to +9 m BE. A total of 436 towers [9]are proposed along the 160 km alignment of which.

- 216 towers are of DA type,
- 135 towers are of DB type,
- 26 towers are of DC type,
- 49 towers are of DD types, and
- 13 towers are of QDD types.

103. Tower Height and Conductor Clearance – Much of the alignment passes through forest areas, dominated by Sal trees which have an average 20m height. It is required that conductors lowest point at max temperature shall be 20 m above tree height with required clearance of 5.5 m above the trees to avoid cutting of the trees along the route. Accordingly tower heights are derived as detailed below.

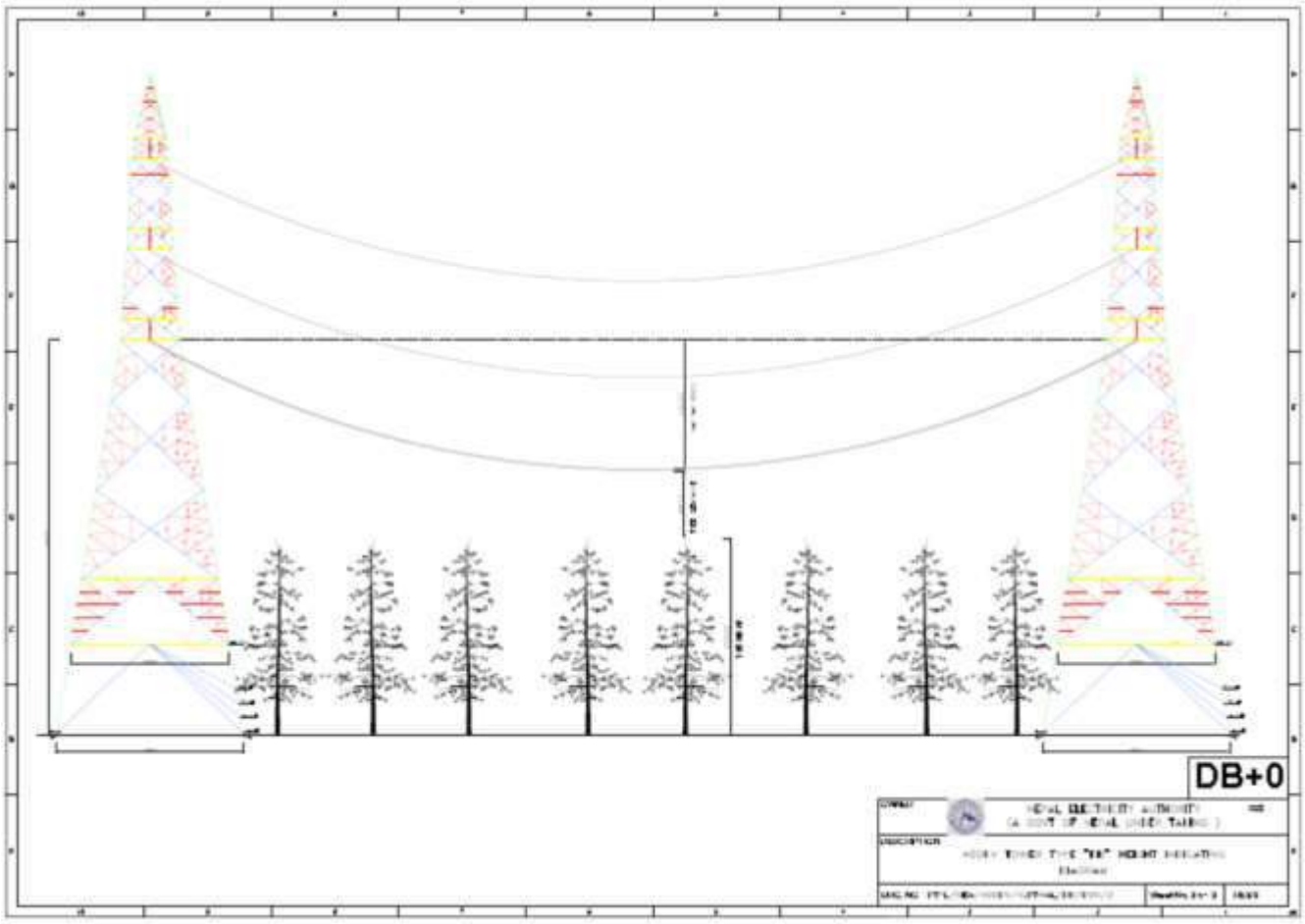
Table 20: Conductor Heights

Tree Height	20 m
Clearance over tree	5.5 m
Maximum sag at 80° temperature	13.020 m
Extra clearance for growth of tree between trimmings	1.205 m
Total height of conductor attachment point	**40.025 m**

104. Based on the above and the varying topography of the route the tallest tower reaches the height of 90 m, whereas the shortest tower's height is 64 m. The majority of towers have an average height of 70 m.

[9] The number of towers could change based on the detailed design completed by the EPC Contractor. Although changes are not expected to be significant.

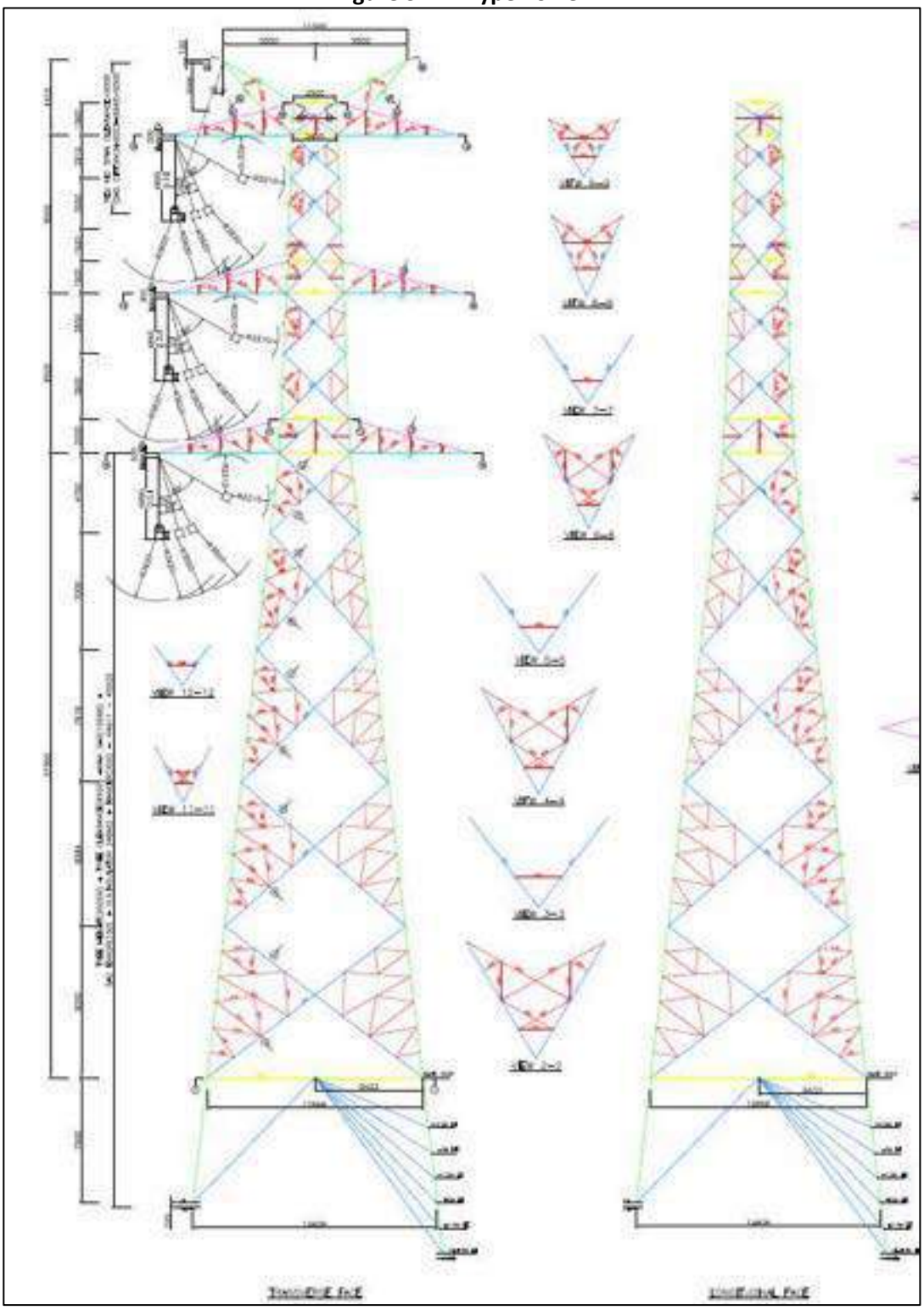
Figure 2: 400kV tower type "DB" height indicating diagram



Source: NEA

105. For the tower stability, differential leg extensions are designed and will be provided in unstable locations to ensure safety and stability of the structure. The total foundations will be embedded into soil and excavation works required.

Figure 3: DA Type Tower



106. The size of a tower's base plays a crucial role in ensuring stability, structural integrity, and functionality. The base area of a tower varies due to factors such as type of tower, its height, and location. The smallest tower base area designed in this project is about 214 m^2, and the largest is 528 m^2. On average, the tower bases occupy an area of 360 – 430 m^2. The total area required for the proposed 436 towers is 13.68 ha.

3.4.2 TL Manpower

107. Approximately 160 expatriate and national skilled workers will be required for the construction of the project. The details of this are provided in the table below:

Table 21: Manpower Requirement

#	Position Title	Nationality	Peak Number	Number of Days at Site
1	Project Manager	Expatriate	1	810
2	Deputy Project	Expatriate	3	600
3	Chief Electrical	Expatriate	3	350
4	Chief Mechanical	Expatriate	3	350
5	Civil Engineer	Expatriate	3	350
6	Crane Operators	Expatriate/Nepali	3	350
7	Quantity Surveyors	Expatriate/Nepali	3	90
8	Installation Foreman	Expatriate	3	350
9	Stringing Machine	Expatriate	6	300
10	Formwork Foreman	Expatriate/Nepali	3	300
11	Steel Reinforcement	Expatriate/Nepali	3	300
12	Electric Welder	Nepali	4	300
13	Driver	Nepali	8	600
14	Foreman	Nepali	3	350
15	Steel reinforcement	Nepali	24	300
16	Formwork worker	Nepali	24	300
17	Concrete worker	Nepali	12	300
18	Tiler	Nepali	12	300
19	General Worker	Nepali	40	
	Total		161	

Source – NEA Feasibility Study

3.4.3 Construction Materials

108. The project requires a range of materials for construction of its structures, which might be reused and ultimately will require disposal. These data are summarized in the table below:

Table 22: Construction Material Requirement

#	Excavation details	Quantity
1	Excavation in dry soil (normal soil)	143,310 m^3
2	Excavation in wet soil	199,729 m^3
3	Dry fissure rock and hard rock	69,283 m^3
4	Benching (all kinds of soil except fissured and hard rock)	9,600 m^3
5	Dry fissure	12,800 m^3
6	Hard rock	1000 m^3
	Concreting	
1	M20 concrete	77,932 m^3
2	M10 concrete	14,345 m^3
3	M30 concrete	1,646 m^3
	Rebar	
1	Reinforcement	7,129 Mt
2	Structural steel (Tower parts)	27,427.34 Mt
3	Random Rubble Machinery (cm 1:5)	11,700 m^3
4	Stone bound in galvanizing wire netting (Gabion structure)	11,700 m^3

Source – NEA Feasibility Study

Table 23: Equipment Required

Equipment (Description)	Technical characteristics (Minimum Capacity)	Year Manufacture (not before)	Quantity (Minimum)
Lorry	10t 2x4 wheel drive	2019	7
Lorry	10t 4x4 wheel drive	2019	5
Lorry	18t 2x4 wheel drive 350HP	2019	5
Excavator tractor	CAT 320 1m^3 (type)	2018	3
Foundation gang and tools	Discharge capacity 2501	2018	3
Mobile crane	60t	2016	2
Car pickup	4x4x	2019	5
Car utility	4x4 8V	2019	2
Tower erection gang tools and plants	Line pull 45kN	2018	3
Stringing machine	Pull force 180kN	2018	3
Stringing gang tools and plant	Oil pressure 100mpa working pressure 125t	2016	3
Mobile crane	15t4x4 wheel drive	2018	3
Crawled mini dumper	1000kg capacity	2016	3
Truck mounted crane	15t	2016	2
Electrical tool box	N>A>	2019	10
Mechanical tool box	N>A>	2019	10
Oil tester	AC 0/80kV	2018	3
Communication device	N.A.	2020	6

Source – NEA Feasibility Study

3.4.4 Project Accessibility

109. Presently the closest airports marked from the proposed transmission line are Gautam Buddha International airport at approx. 21km in Rupandehi district and Tarigaun airport at approx. 23 km in Dang district.

110. Most of the NBTL alignment lies close and along the East-West and Prithvi highway. There could be some instances where temporary access roads need to be built for the transport of equipment and materials for construction of tower pads and towers. In addition, to transport equipment and construction materials in inaccessible sites, transport via helicopter shall be used.

3.4.5 Land Requirements

111. The project will require land for different purposes. The primary land requirement is for establishment of RoW, which is 23 m on both sides from the center of the alignment, 46 m in total from the centerline. In addition to it, the land will also be required for establishment of Lamahi SS proposed substations. The total land requirement for the project is approximately 742 ha, majority of 95.47 % of which falls in the forested land, whereas only about 9 ha falls in cultivated land. However, it should be noted that the land use of RoW will not be changed, yet restrictions in its use will be applied to maintain the safety. The following table shows the land requirement for the RoW.

Table 24: Land requirement for the project

Project structure	Land use type	Government owned area [ha]	Privately owned area [ha]
	Cultivated land	0.00	4.72

Project structure	Land use type	Government owned area [ha]	Privately owned area [ha]
RoW and Towers	Forest	708.22	0.00
	Rivers	16.57	0.00
	Settlement	0.00	2.59
	Others	6.34	0.00
Substation (Lamahi)	Forest / pasture land	11.00	0.00
Total		742.13	7.31

3.4.6 Construction Planning

112. The process of erecting a transmission line involves several sequential steps. It begins with a "check survey" to assess the site condition and plan accordingly. Excavation take place to create a suitable foundation for the towers. The next step involves the "setting of stubs" or the installation of the initial section of the tower.

113. Afterwards, "casting of foundation" and "backfilling" are carried out to ensure stability and structural integrity. The "erection of towers" follows, where the towers are assembled and erected in their designated locations. "Stringing of conductor" and "ground wire/OPGW" are then performed, connecting the conductors and ground wire or optical ground wire (OPGW) to the towers.

114. The next stage involves the "installation of tower hardware" and conductors and ground wire/OPGW accessories. This includes the attachment of various components and accessories necessary for the proper functioning and support of the conductors and grounding system.

115. Final checking and testing are conducted to ensure that the transmission line is functioning correctly and meets safety standards. Once all checks and tests are completed, the line is commissioned, signifying its readiness for operation.

3.4.7 Crossings

116. The crossing of roads, powerlines, telecommunication lines, railway tracks, and other infrastructural elements is governed by statutory regulations. These regulations outline the specific guidelines and requirements that must be followed to ensure safe and efficient crossings. These guidelines are put in place to minimize any potential risks or disruptions caused by the intersection of these different types of infrastructures.

117. ***Road crossing -*** To ensure the safe and efficient crossing of roads, including major national highways, the tower conductors will be equipped with double tension insulator strings. This specific type of insulator arrangement is chosen for its ability to effectively handle the electrical tension and maintain the integrity of the transmission line. By using double tension insulator strings at these critical road crossings, the transmission infrastructure can withstand the various forces and environmental factors encountered in such locations, minimizing the risk of electrical disruptions, and ensuring a reliable and stable transmission of power.

118. ***Power line crossing -*** Whenever possible, the angle of crossing between power lines shall be maintained at 90 degrees and it should not be lower than 75 degrees. To facilitate these crossings, suspension/tension towers with standard extensions will be utilized.

119. In cases where the line being constructed needs to cross an important line that cannot easily be shut down, a combination of suspension towers with required extensions and dead-end towers will be used. This combination will allow safe crossing while minimizing disruption to the existing line.

120. For optimal clearance between power crossing lines at the point of crossing, the crossing line will be positioned to pass over the crossed line as close to the middle as possible. This positioning maximizes the vertical clearance between the power lines and reduces the risk of interference or contact between them.

121. ***Telecommunication crossing -*** The angle of crossing between power and telecommunication lines is ideally aimed to be as close to 90 degrees as possible. However, in exceptional circumstances where it is difficult to achieve this ideal angle, a deviation of up to 30 degrees may be permitted. In cases where the angle of crossing falls below 60 degrees, the matter will be referred to the authority responsible for the telecommunication system for further consideration.

122. To ensure increased vertical clearance between the wires within the crossing span, the power line support will be positioned as close to the telecommunication line as feasible. This arrangement helps to minimize the risk of interference or contact between the power and telecommunication lines. The entire crossing process will adhere to the guidelines outlined in the Code of Practice for Crossing Power and Telecommunication Lines. These guidelines provide comprehensive instructions and standards to ensure safe and efficient crossings between power and telecommunication infrastructure.

123. ***Railway crossing -*** When it comes to railway crossings, angle/dead end type towers will be used. These towers are specifically designed to accommodate the crossing of power lines over railway tracks in a safe and efficient manner. The construction of the railway crossing will adhere to the "Regulations for Electrical Line Crossings with Railway Tracks". These regulations provide specific guidelines and standards that must be followed during the construction process to ensure the safety and integrity of both the power lines and the railway tracks.

124. ***River crossings -*** When it comes to major river crossings, suspension towers with double suspension strings will be utilized. These towers are specifically designed to provide the necessary support and stability for power lines when crossing large rivers. The anchor towers located on either side of the main river crossing will be of the dead-end type. These towers serve as stable points of attachment and ensure the proper tensioning of the power lines. In the case of navigable rivers, the clearance required by the Navigation Authority will be considered during the crossing design and construction process. This will ensure that the power lines do not obstruct the navigation routes and maintain the necessary clearance for vessels to pass safely. Currently, this project does not cross any navigable rivers.

125. For non-navigable rivers, the clearance required for the crossing will be calculated based on the highest flood level (HFL). This approach takes into consideration the potential rise in water levels during flood events and ensures that the power lines remain at a safe distance above the water surface.

126. ***Airport and air routes -*** The transmission line located in the vicinity of an airport or crossing air routes must comply with the requirements set by the Civil Aviation Authority of Nepal (CAAN). Furthermore, the requirements stated in section 11.3.6.2 of the Nepal Electricity Authority (Measures relating to Safety and Electricity Supply) Regulations, 2010 which specify necessary vertical and horizontal clearance shall also be met. It is essential to obtain clearance from CAAN before constructing the NBTL to ensure that it meets the necessary safety standards and does not pose any risks or obstructions to air traffic. Adhering to CAAN's

regulations and obtaining their clearance is crucial to ensure the smooth and safe operation of both transmission line and air traffic in the surrounding area. Following the approval of the national IEE terms of reference by the DoED, the project had coordinated with CAAN and obtained clearance for the project.

3.4.8 Tower Construction

127. The erection of towers shall take place on foundations at least 10 days after the concrete has been poured or once it has gained sufficient strength. The erection process follows the provided erection drawings supplied by the manufacturers to ensure a smooth and efficient installation. To facilitate the assembly of tower parts during the erection operations, each member is appropriately marked in the factory, corresponding to a number indicated in the erection drawing. During the process, care should be taken to prevent any damage to the steel and to avoid injuring the galvanization. Additionally, no member should be subjected to excessive stress during the erection, ensuring the structural integrity of the towers. The erection of steel transmission towers can be accomplished using four main methods, which are described as follows:

128. ***Build-up method or piecemeal method***: This method involves assembling the tower piece by piece on-site. The tower components, such as sections, braces, and cross-arms, are transported to the site and systematically joined together to form the complete tower structure.

129. ***Section method***: In this method, prefabricated tower sections are transported to the site and lifted into position using cranes or other lifting equipment. The sections are then bolted or welded together to create the final tower structure.

130. ***Ground assembly method***: With the ground assembly method, the tower sections are pre-assembled horizontally on the ground or a specially prepared assembly area. Once the tower sections are fully assembled, they are lifted and positioned into their final upright position using cranes or other lifting equipment.

131. ***Helicopter method***: The helicopter method involves using helicopters to transport and lift tower components into place. This method is typically used in remote or inaccessible locations where other methods are not feasible. Helicopters are used to transport the tower sections or components individually and position them in their designated locations.

132. These four methods provide flexibility and options for erecting steel transmission towers based on factors such as site conditions, accessibility, and project requirements. The selection of the appropriate method depends on various factors, including the project scope, available resources, and logistical considerations and shall be proposed by the EPC Contractor.

133. ***Earthing:*** Following the casting of the tower foundation, each tower must be properly grounded. To achieve this, an earth strip will be securely attached to the stub during the concreting of the chimney. The earth strip will then be extended horizontally below ground level. In typical situations, the earth strip will be positioned on the No. 1 stub leg. The No. 1 stub leg is the leg that includes step bolts for convenient access and maintenance purposes. By implementing this grounding procedure, the towers will be effectively grounded to ensure electrical safety and proper functioning.

3.4.9 Conductor Stringing

134. Suspension towers will be equipped with suspension insulator strings, while angle and dead-end towers will have tension insulator strings. These insulator strings will be fixed to the tower cross arm tip just before the conductor stringing process. It is important to note that damaged insulators and fittings should not be used in the assemblies.

135. Prior to hoisting, all insulators must be cleaned in a manner that ensures the surface is not spoiled, injured, or scratched. However, the use of oil for cleaning purposes is strictly prohibited. Security clips will be positioned on the insulators before hoisting to ensure their secure attachment.

136. In cases where required, arcing horns or guard rings will be placed along the line for suspension insulator string assemblies, while tension insulator string assemblies will have arcing horns or guard rings facing upwards. These additional components contribute to the safe and reliable operation of the insulator strings.

3.4.10 Transport and Access Roads

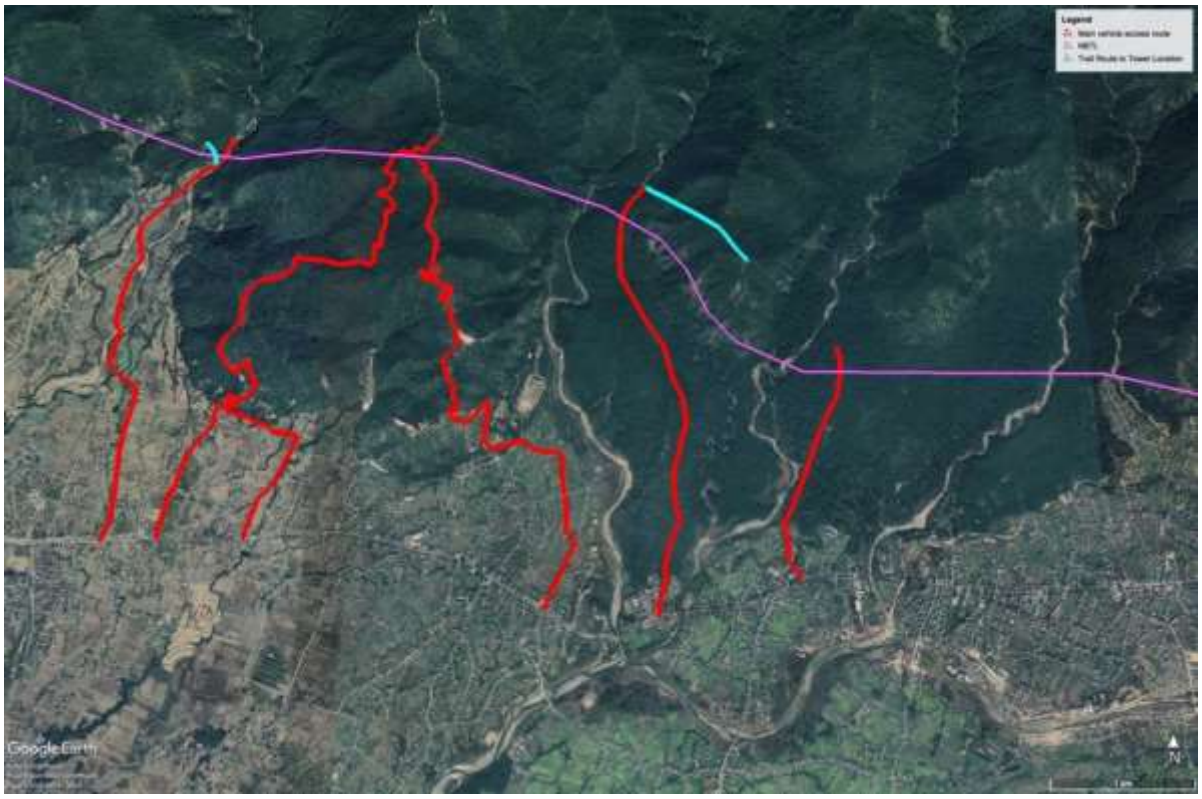
137. The project area benefits from a well-developed road network, facilitating access to the majority of tower locations and RoW using existing roads. Although the existing road coverage is favorable, some specific sites might require short extensions, approximately 200 m, for access. The project's approach is to minimize new road construction and instead prioritize material transportation. Additionally, the project includes provisions for using helicopters to transport materials.

138. Trucks will be used to deliver one or two towers per truck, depending on their weight. It is preferable to have a station with a loading bay for easier handling. The towers should be kept separate in parts, allowing direct delivery from the bay to the tower site. Tower sets are assembled in sections, with each section carefully marked. Panels within each section are also marked to facilitate erection. Upon unloading, the tower sets should be checked and placed in a suitable position on the bay for easy pickup as complete units.

139. If the steelwork is delivered in bundles, careful checking is even more crucial. Two methods can be used: laying out the steelwork in members or laying it out in towers. The latter method offers advantages such as easy identification of shortages and efficient loading to specific positions. Bolts, washers, nuts, and small parts should be labeled and placed in bags corresponding to the tower they are intended for. Handling of long corner angles should be done with care to avoid bending and damaging the galvanizing.

140. All transportation vehicles will be suitable for the purpose and free from any chemical substances. Tower members must be loaded and transported in a manner that prevents bending or damage to sharp-bent members. Potential access routes around key sites identified to date are shown in the following figures.

Figure 4: Potential Access Routes Around Sainamina

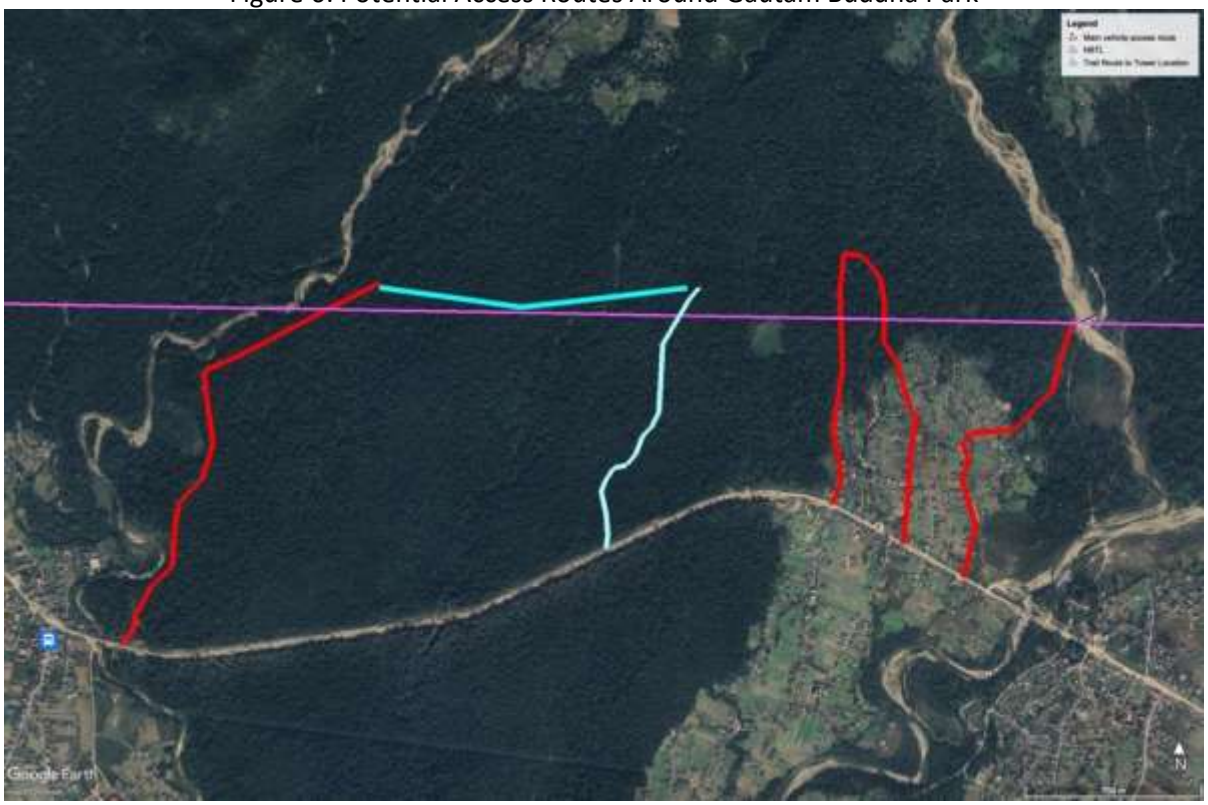


Source: NEA / Google Earth

Figure 5: Potential Access Routes Around Sen Park / Manimukunda Sen Park/ Phulbari Archaeological site

Source: NEA / Google Earth

Figure 6: Potential Access Routes Around Gautam Buddha Park



Source: NEA / Google Earth

3.4.11 Spoil Disposal and Fill

141. During the excavation process for the overhead tower foundations, there will be a generation of spoil or excavated materials. These spoils will primarily be utilized as filling materials within the tower locations, serving a dual purpose of disposal and support. Additionally, any excess materials that is not required at the tower locations will be transported to substations, with a specific focus on the Lamahi SS. This substation requires a significant amount of filling materials to achieve a level surface.

3.5 Lamahi Substation

3.5.1 Design

142. Lamahi SS is located on an area of approximately 11 hectares of land currently occupied by community forest and grazing land. The land has a gentle slope from south to north. Cuts will be set into slopes to provide stable flat areas of equipment and buildings.

Figure 7: Proposed Layout – Lamahi SS

Source: NEA

143. Nearest residential receptors are 60m to the west of the SS, although the western portion of the site will comprise admin buildings, control room, etc, with the nearest electrical equipment sited more than 250m from the nearest property.

144. The proposed Lamahi Substation is situated in ward No. 9 of Lamahi Urban Municipality in the Dang District. Lamahi substation is proposed Gas Insulated Switchgear (GIS) substation with a voltage level of 400/220/132/33/11 kV. The transformer rating for the Lamahi substation is 400/220kV, 500 MVA, 3-Ph - 2 no's; 220/132kV, 315 MVA, 3-Ph - 2 no's; 132/33kV, 63 MVA, 3-Ph - 2 no's; 33/11kV, 24 MVA, 3-Ph - 2 nos.

145. The purposed GIS substation is incorporate with 6-line bays of 400 kV TL, 2-line bays of 220 kV TL and 6-line bays of 132 kV TL. The civil and building works for the project include substation land grading, equipment foundation and oil pit, one control building, one pumphouse building, five residential building, 3 GIS Buildings each for 400kV, 220 kV and 132 kV, two indoor switchyard building each for 33 kV and 11 kV voltage level. water supply and drainage, site boundary wall construction.

3.5.2 Construction and Operation

146. When the design of the substations is finalized and approved, the construction activities commence with the clearing of obstructions and vegetation. The boundary wall of the substation property is fenced to avoid unauthorized entry into the site. Post award the EPC contractor shall set up temporary construction facilities including material storage areas and camps for workers as laid out in the Environment Management Plan.

147. Construction and installation works will be undertaken by dedicated teams consisting of specialized units. The following tables provide the estimate manpower and equipment requirements for the various stages of construction. Construction time is approximately 30 months.

Table 25: Estimated Manpower and Equipment – Substation (Construction)

#	Activity	Equipment	Manpower	Timescale
1	Surveying the site	• 2 Pick-up trucks	4 people	2 week
2	Clearing and grading activities	• Grader • Bulldozer (20t) • Pick-up truck	4-8 people	3 weeks
3	Transporting materials to the site	• 2 Pick-up truck • 2 Lorry (4 axle)	8-10 people	3 weeks
4	Construction of substation buildings	• 2 pick-up trucks • 2 lorries (4 axle) • 1 mobile crane • Pneumatic Tools	10-15 people	6 months
5	Installation of electrical equipment	• 2 pick -up trucks • 1 mobile crane • 2 lorries (4 axle)	10 people	4 months
6	Cleanup and restoration of affected areas	• Bulldozer (20t) • Backhoe (8t)	6 people	1 month

148. During the operation and maintenance phase, regular activities that will be implemented include routine monitoring and inspection by NEA staff to check the condition and integrity of transformers and switchgear. Maintenance activities will include replacement of parts and equipment repairs.

3.6 Construction Camps

149. Construction camps (including equipment and materials storage areas) will be established for some of the Project sub-activities. The location of the camps will be determined by the EPC Contractor and no specific location for any camp site has been provided to date by NEA, nor any specific plans for the number of camps required to cover the Project. However, siting of any camp will consider the sensitive site restrictions provided in this EIA, e.g., not locating within 50m of a water course or within 500m of residential areas or within protected areas or IBA/KBAs.

150. Some locations will need to carefully consider the topography of the sites and the potential to be affected by landslides, especially in the foothills of Chure. These issues, and those relating to water use, waste management, etc., and the requirements for the preparation of camp management plans prior to the start of construction are discussed further in the impact assessment section of this EIA.

3.7 Cost and Schedule

151. The total investment cost of the project is estimated at $250 million (of which $200 million will be for NBTL and $50 million for the Lamahi SS), including physical and non-physical components. The actual completion of the NBTL is expected to be completed within 3.5 years and 2.5 years for the SS.

Table 26: Proposed Project Schedule

Description	Indicative Timeframe	
	Component 1	Component 2
Bidding Documents	Q3, 2024	Q3, 2024

Description	Indicative Timeframe	
	Component 1	Component 2
Procurement	Q3, 2024	Q3, 2024
Construction Commencement	Q1, 2025	Q1, 2025
Project Completion	Q3, 2028 (42 months construction phase)	Q4, 2027 (30 months construction phase)
Defects Liability Period	2 years (for both towers and conductors)	1 Year (with possibility of 1 year extension)

Source: NEA

3.8 Associated Facilities

152. No associated facilities have been identified. Motipur SS is planned for construction the future, but there is no fixed date as to when this activity will commence. Land acquisition is underway and NEA have indicated that construction may happen within the next 2-5 years. Source of funds is to be determined. NBTL has been designed to pass through the proposed site of Motipur SS so that the line can be tapped in the future. However, in its current form NBTL can operate without Motipur SS meaning that it is not an associated facility of NBTL.

3.9 Prohibited Items and Activities

153. The following items will be prohibited:

- PCBs will not be permitted for use in any equipment in substations. Equipment purchased for use on the Project to be accompanied by a letter from the manufacturer and material safety data sheet for insulating oil used confirming that it is guaranteed PCB free and labelled as PCB free.
- Processes, equipment, and systems are not to use chlorofluorocarbons (CFCs), including halon.
- No asbestos containing materials of any type will be used in the design and construction of project facilities.
- Use of herbicides or burning to clear vegetation is strictly prohibited.
- No forced or child labor to be employed in construction with the minimum age for employment on construction site to be 18 given hazardous nature of works involved.

154. Further, the Project shall not engage in any activities described on the ADB Prohibited Investment Activities List in Appendix 5 of ADB's SPS (2009).

IV. ANALYSIS OF ALTERNATIVES

4.1 General

155. One of the objectives of an EIA is to investigate alternatives to the Project. In relation to a proposed activity "alternative" means different ways of meeting the general purposes and requirements of the proposed activity. The following section provides an assessment of the 'no action' alternative, alternative locations, alternative substation and switchgear technologies, alternative power line types etc.

4.2 'No Project' Alternative

156. If the proposed project is not implemented then there will be no project induced loss/effect on vegetation, cultivated area and other environmental and socio-economic impacts, including potential impacts to internationally important biodiversity areas and special status species within them.

157. However, such a no project alternative would result in a heavy deficit of energy in the western part of the country which will restrict economic growth of the region. Furthermore, the transmission line will also benefit the upcoming hydropower projects by providing a viable medium to evacuate their energy. It also adversely affects the power exchange with India since this line is proposed to transmit the imported power to the central and eastern part of the country and thus causes adverse impact on the economy of the country.

158. Besides, the construction of the proposed project will also reduce system loss and provide reliable power to the load centers of Nepal. In the longer term, this project will also be helpful for the expansion of the rural electrification program. Similarly, the socio-economic conditions of the local people are likely to be increased through employment opportunities and income generation activities associated not just with construction works, but through the provision of reliable electricity supply across the region.

4.3 Alternative NBTL Locations

4.3.1 NBTL – Initial Routing Assessment

159. Several alternative routes for NBTL were examined at Project outset, and comparative studies were conducted based on the following guidelines:

- Accessibility of the route.
- Placement of towers on geological stable ground.
- Overall number of angle points and towers.
- Avoidance of conflicting development activities.
- Minimization of impact on highly productive or costly RoW land.
- Limited river crossings, interference with national highways, and overhead power and telecommunication lines.
- Reduction of impact on settlement areas and densely populated regions to minimize disruption to affected communities.

160. Taking these guidelines into careful consideration, several alignments had to be modified due to ongoing development activities, such as the construction of cable cars, proposed railway, etc. Adjustments were also made to tower alignments to minimize impact on settlement areas. Furthermore, the TL alignment routes were altered to minimize adverse effects on the environment, reduce the number of river crossings, mitigate interference with national highways, and avoid environmentally sensitive and protected areas. After thorough evaluation and adherence to the stated guidelines, a preferred route was selected. The following describes this assessment process.

161. It is also important to note that NBTL will form part of the east-west 400kV backbone across the country and forms part of this corridor, accordingly the routes assessed all fall within the broad east-west corridor as outlined in the Transmission System Development Plan of Nepal, prepared by MEWRI in 2018, see Figure 8.

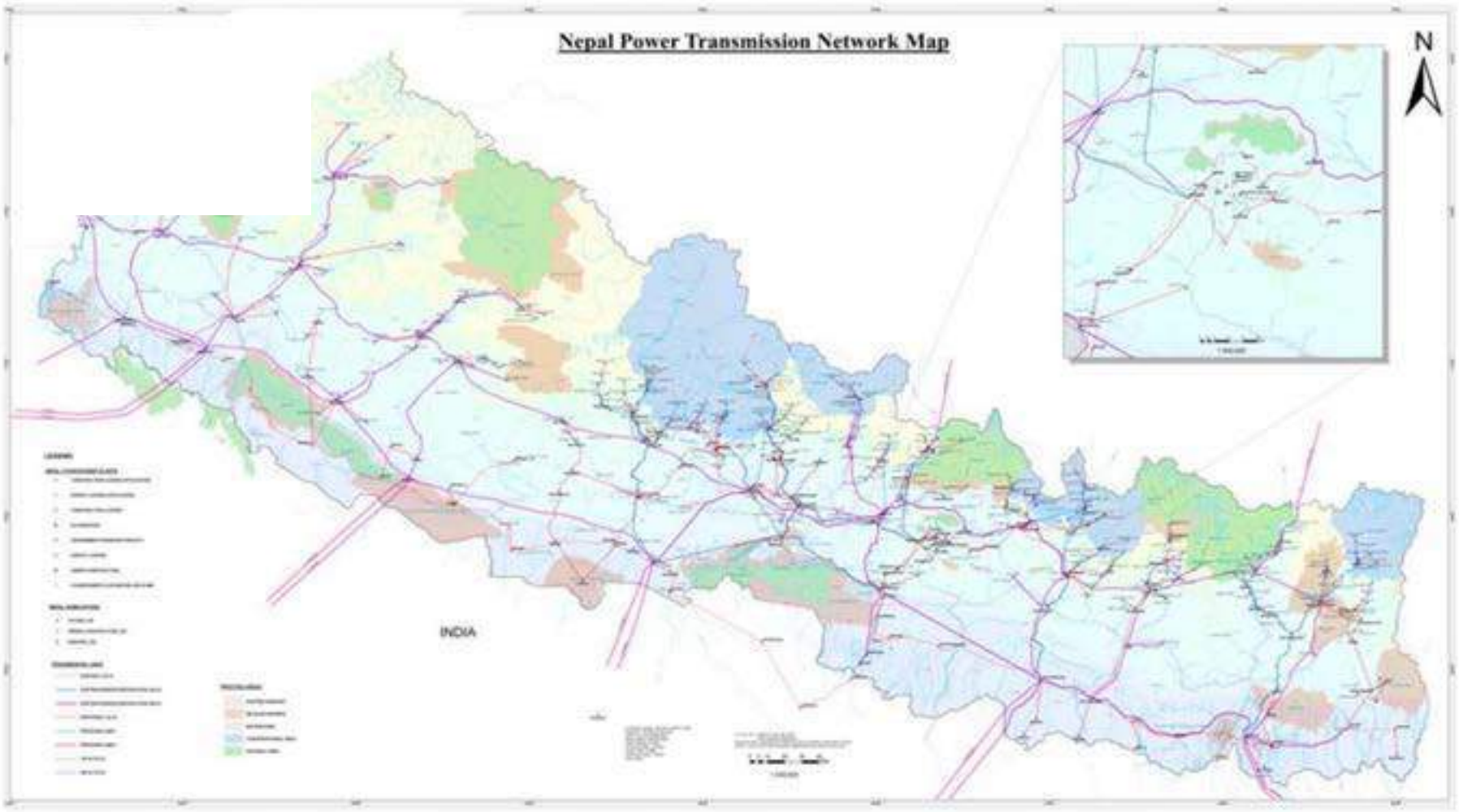
Route Types

162. Three alternative routes have been studied for NBTL.

- Alternate 1, passing mainly through forested areas.
- Alternate 2, which offers a middle alignment between the foothills of the Chure range and the Terai plain.
- Alternate 3, crossing cultivated land and settlements.

163. These three alternatives are illustrated in the series of maps below, Figure 9 to Figure 19.

Figure 8: Proposed Transmission Network, 2040



Source: Transmission System Development Plan of Nepal, MEWRI, 2018

Figure 9: Alternatives routes assessed

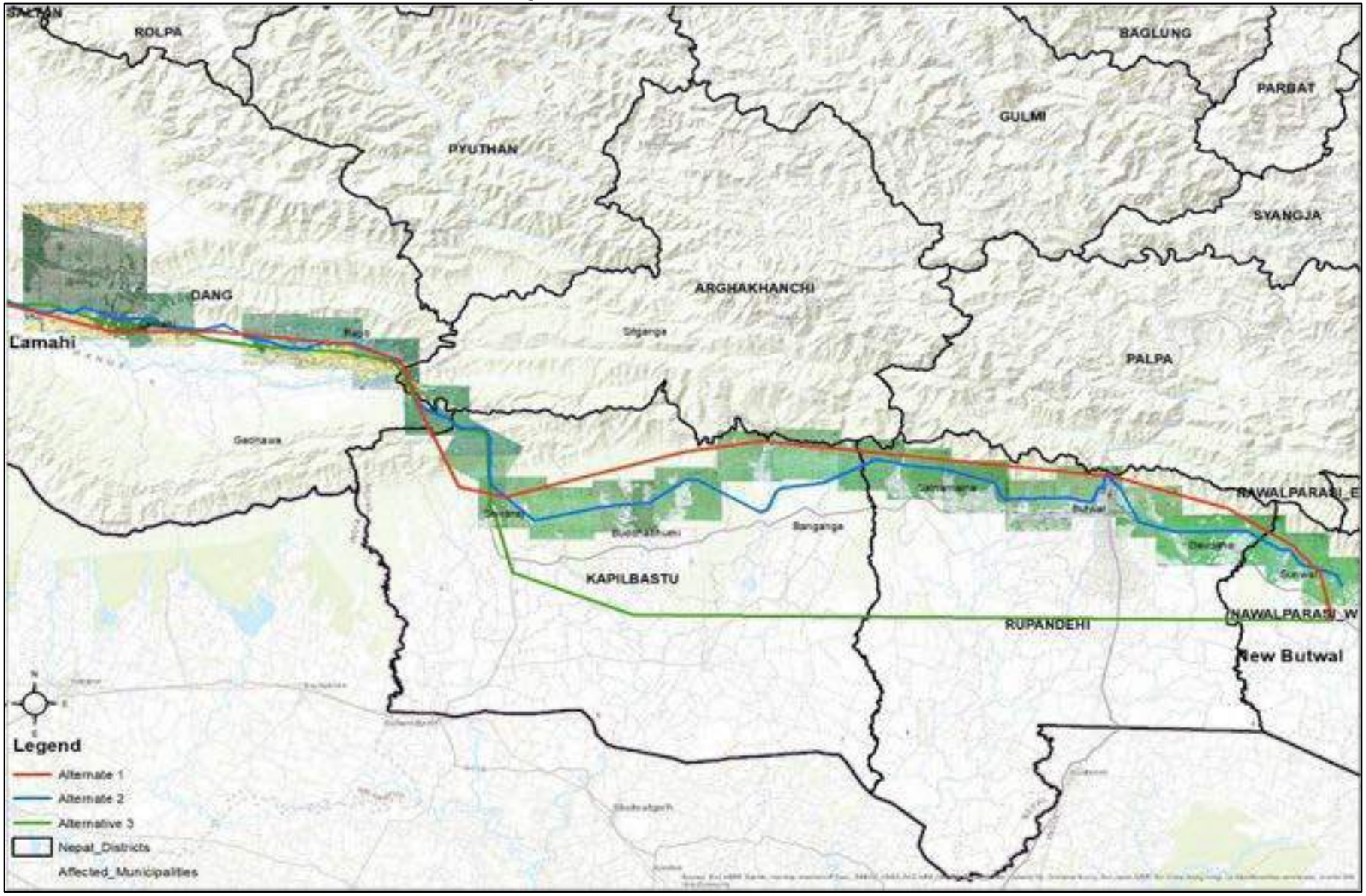


Figure 10: Details Maps of Alternatives (A)

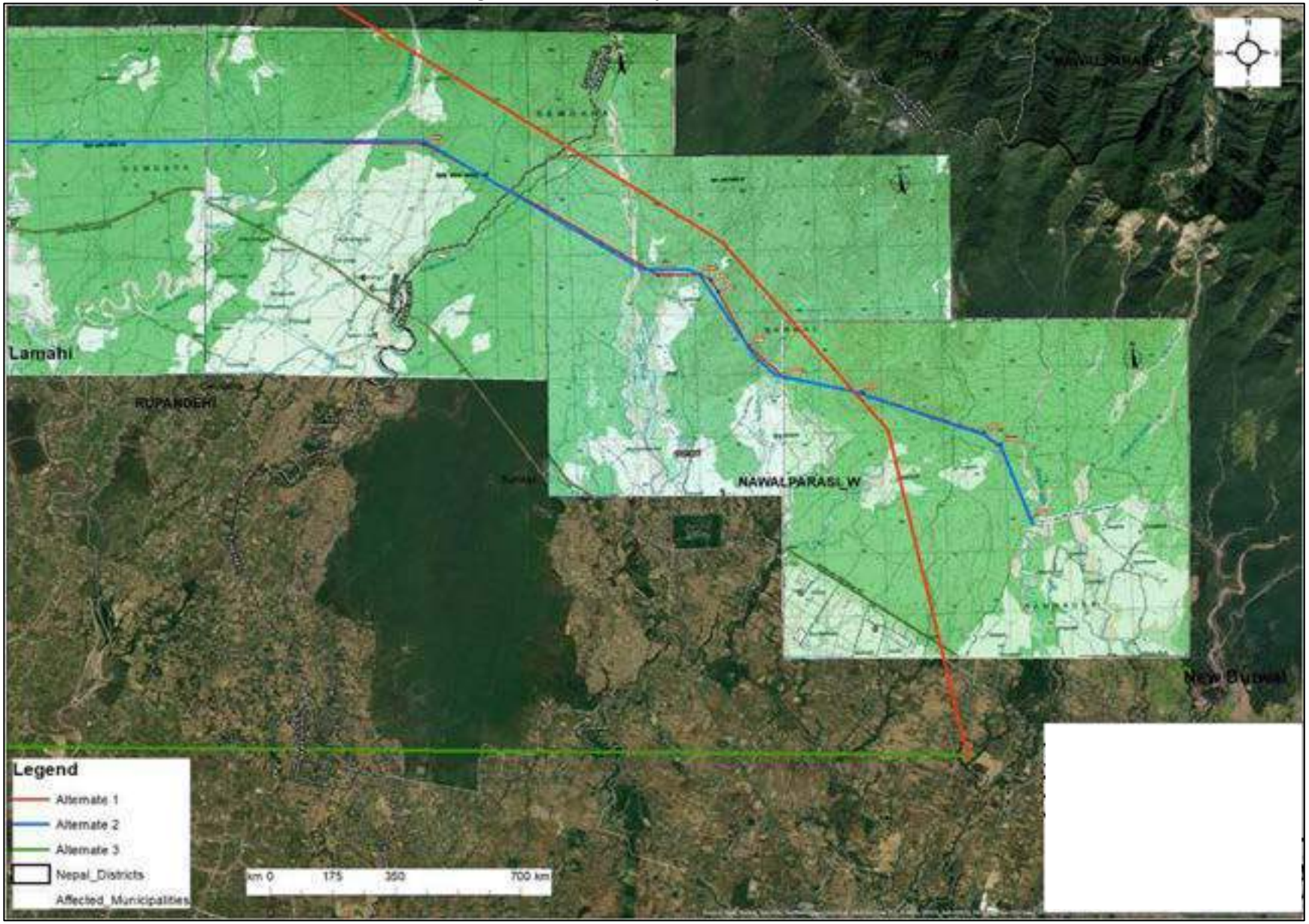


Figure 11: Details Maps of Alternatives (B)

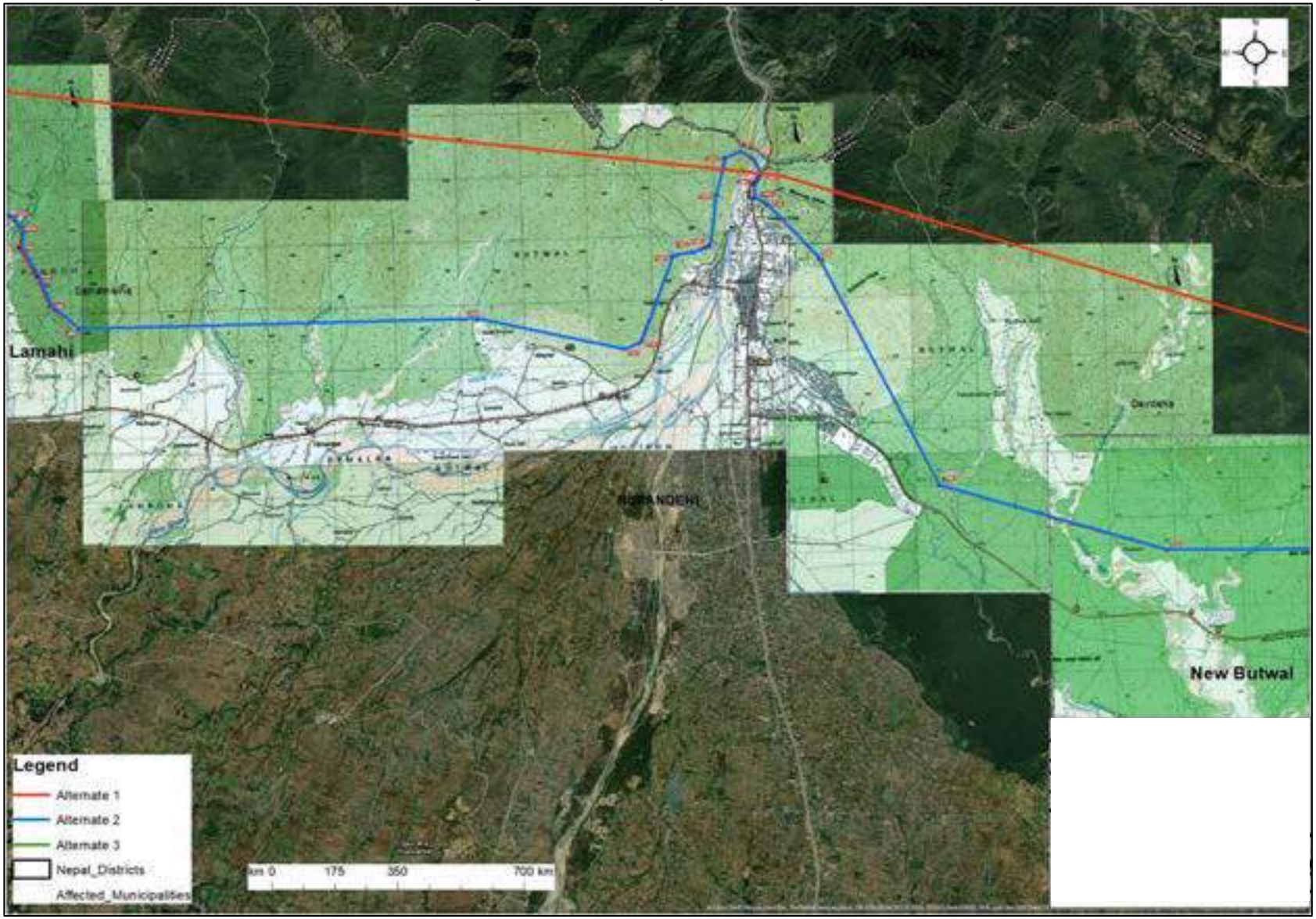


Figure 12: Details Maps of Alternatives (C)

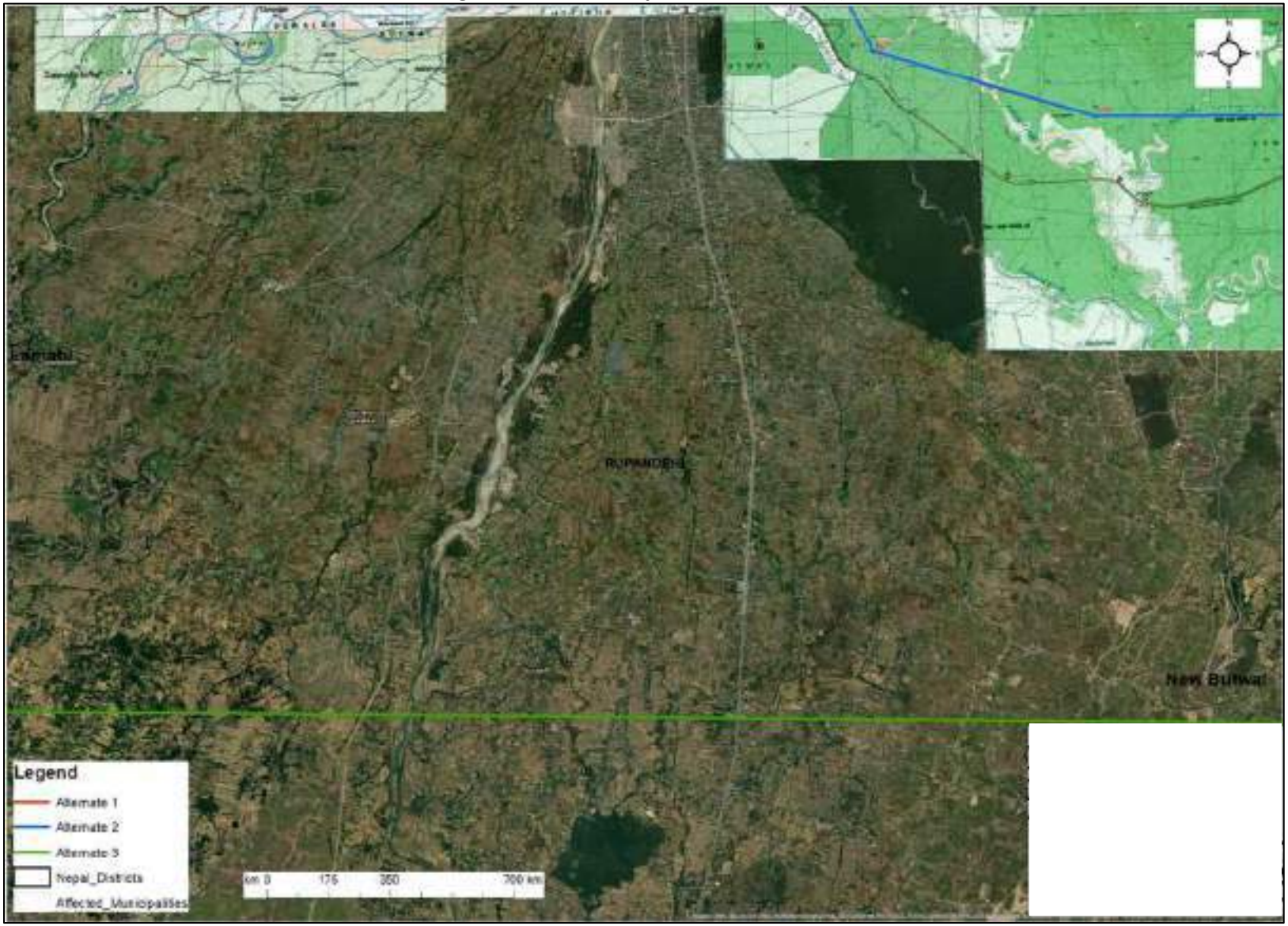


Figure 13: Details Maps of Alternatives (D)

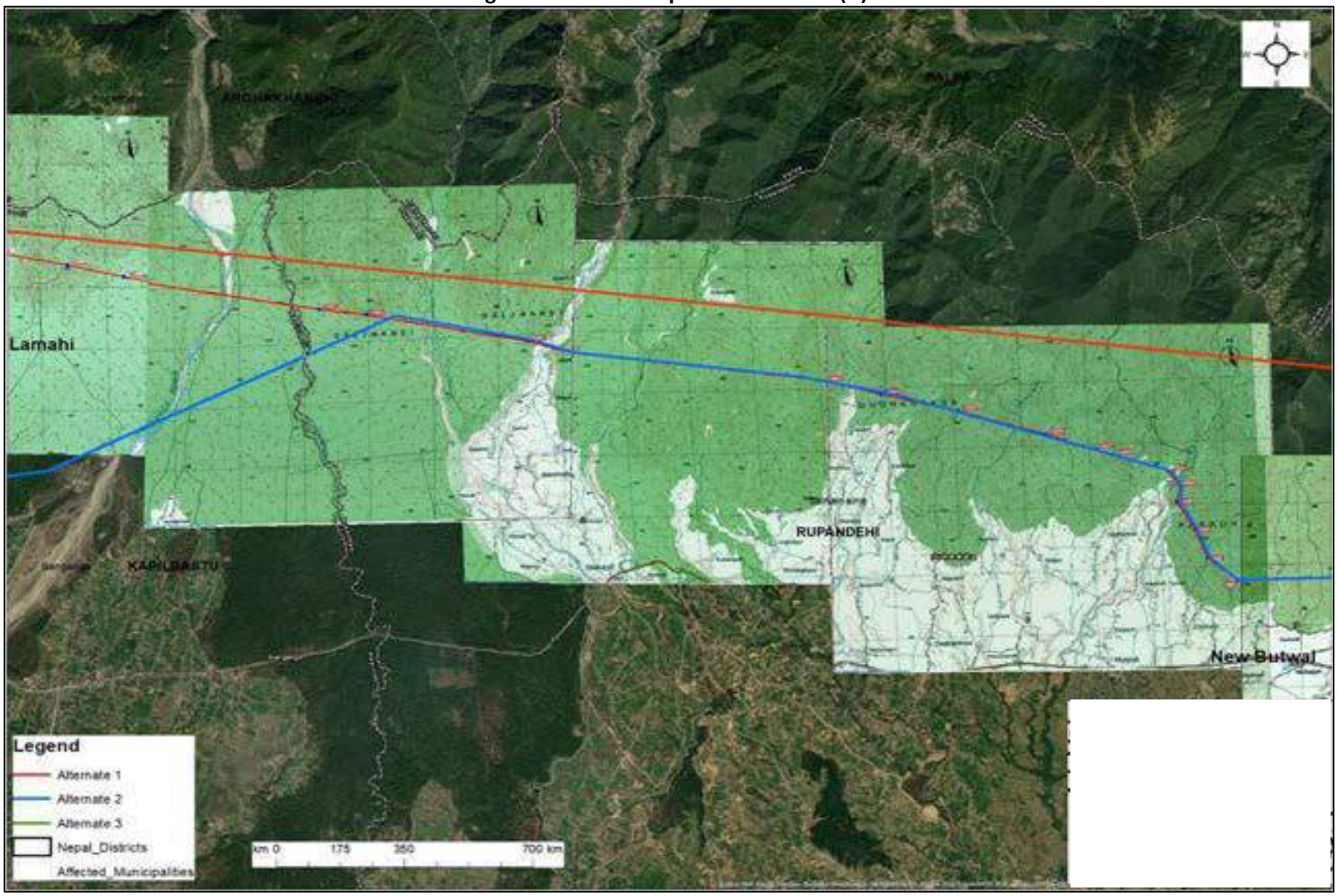


Figure 14: Details Maps of Alternatives (E)

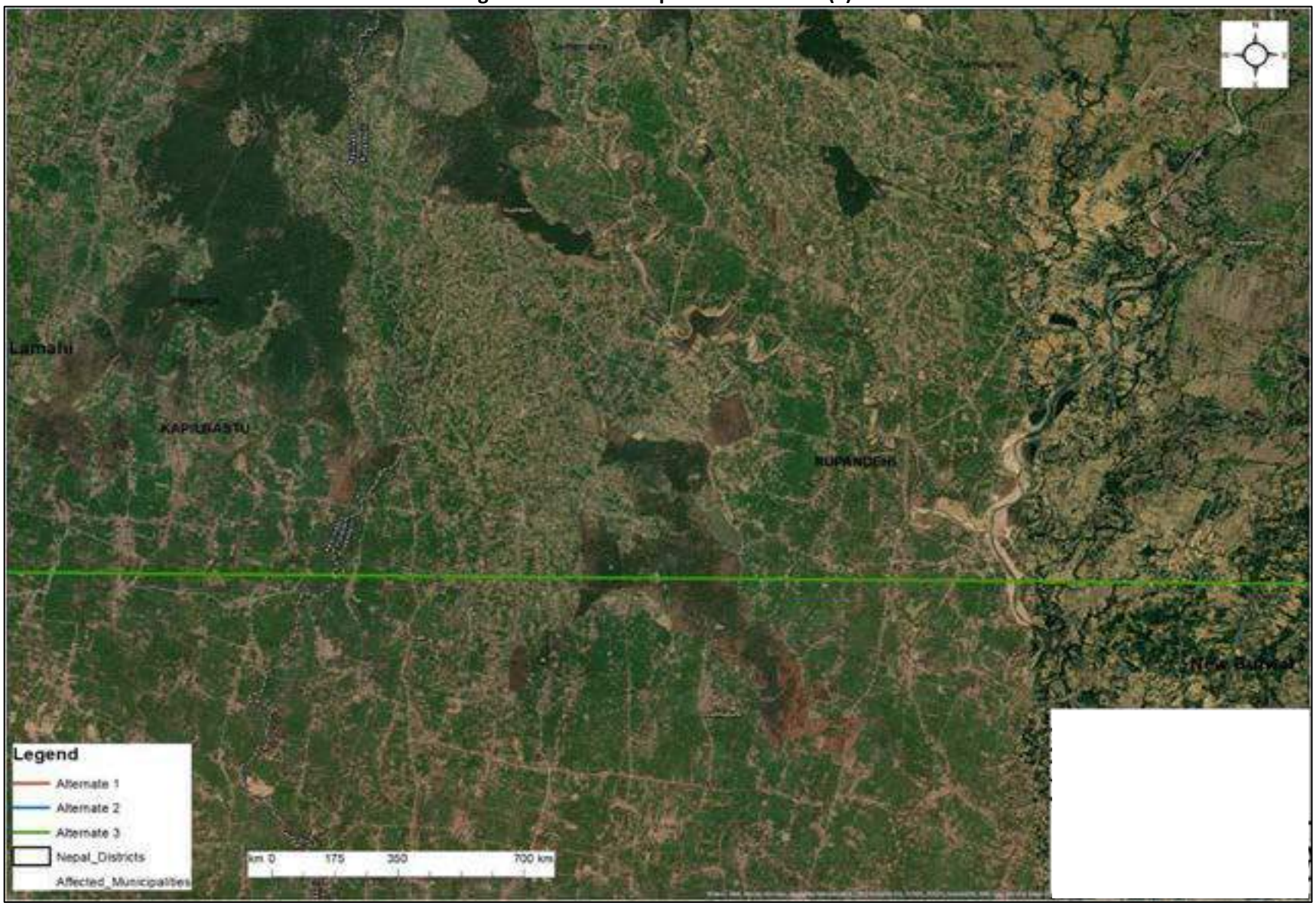


Figure 15: Details Maps of Alternatives (F)

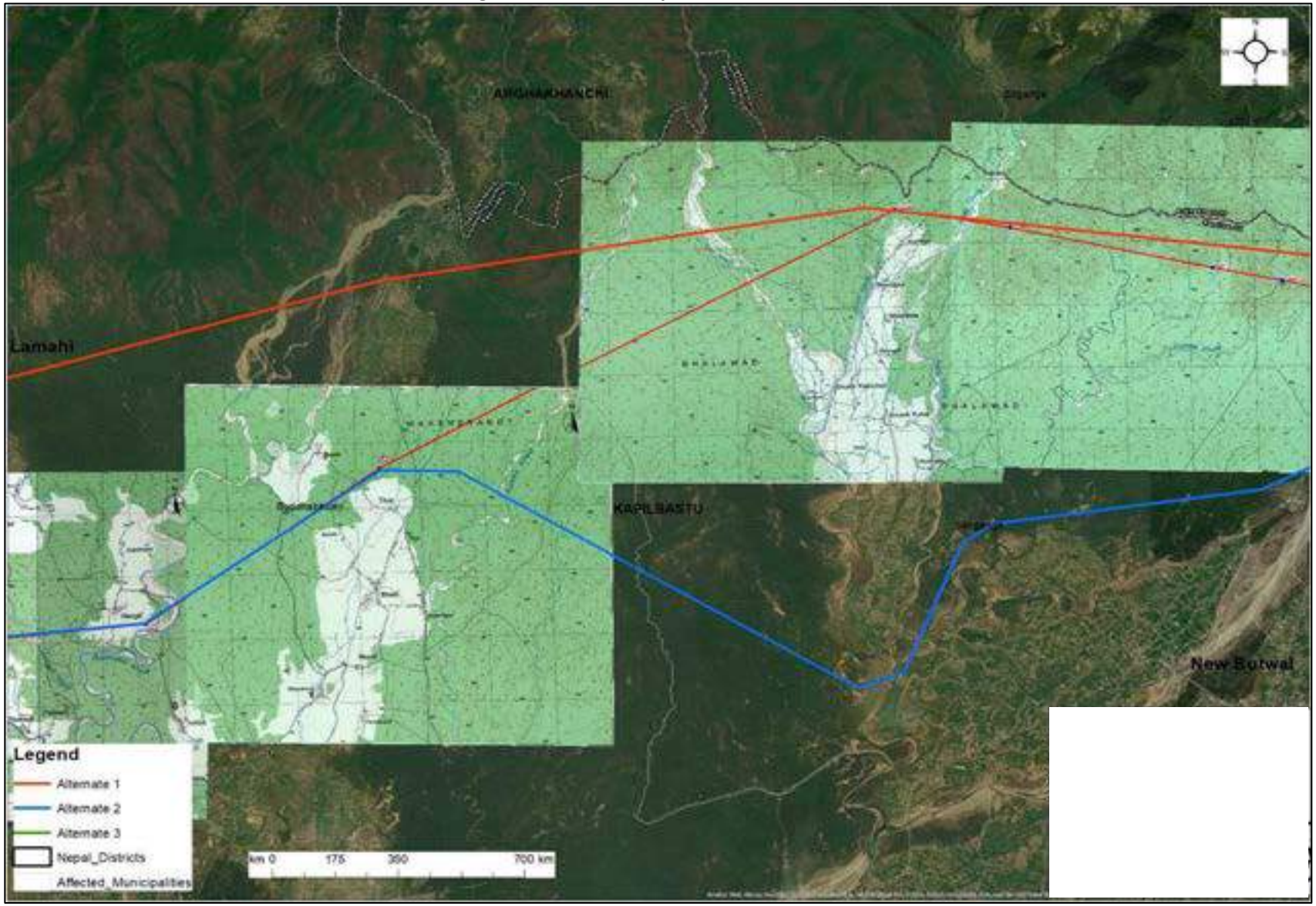


Figure 16: Details Maps of Alternatives (G)

Figure 17: Details Maps of Alternatives (H)

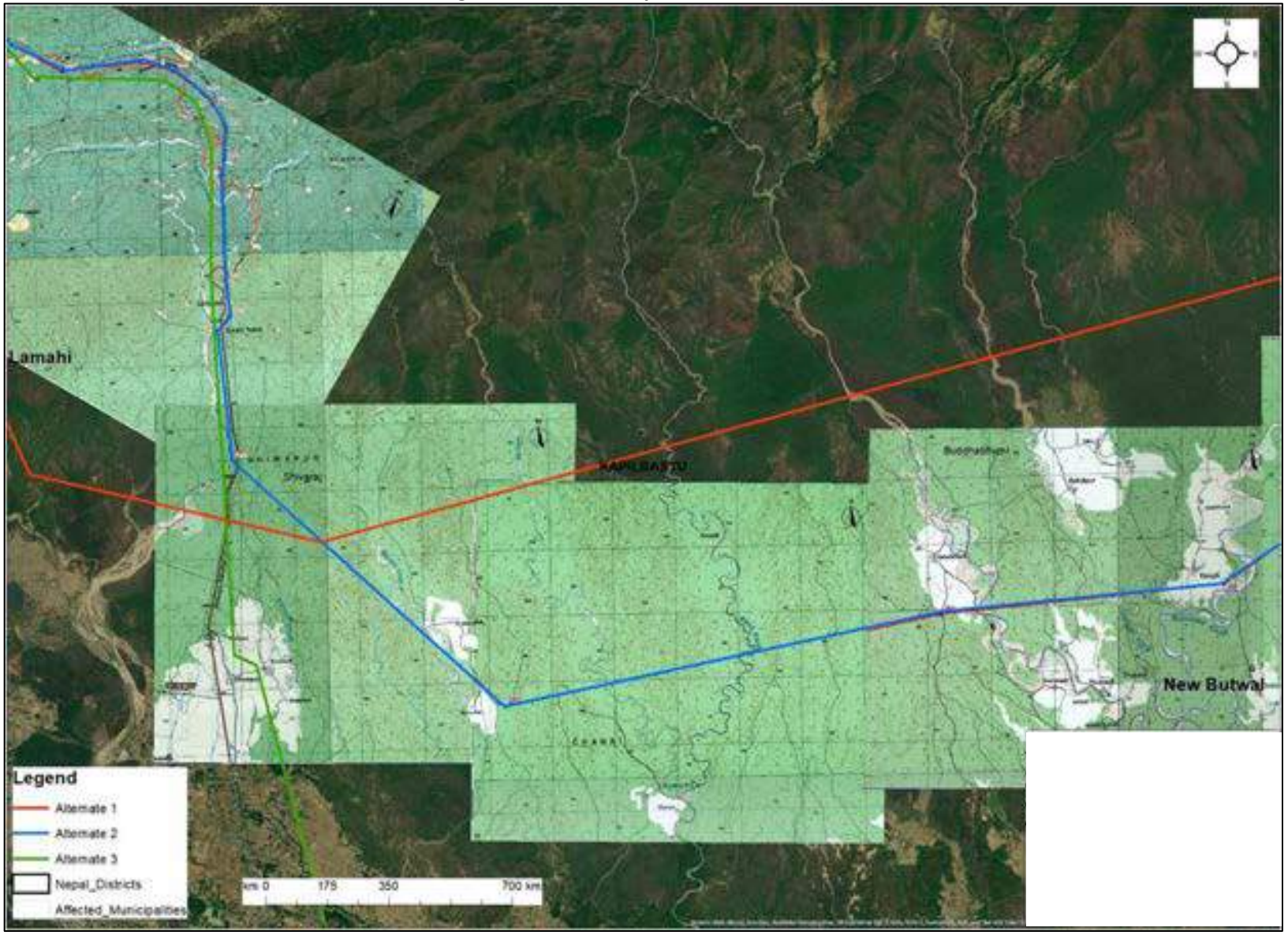


Figure 18: Details Maps of Alternatives (I)

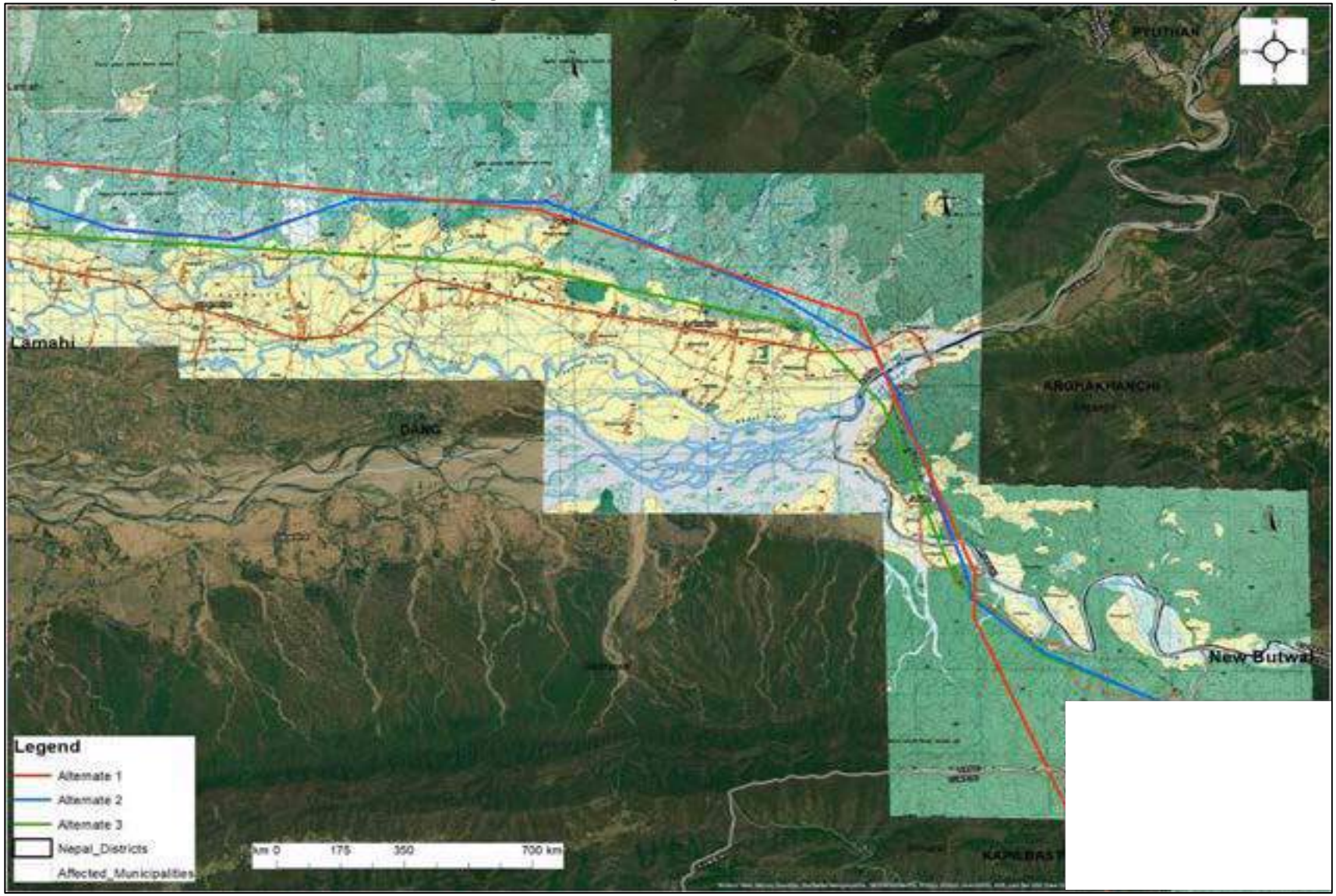
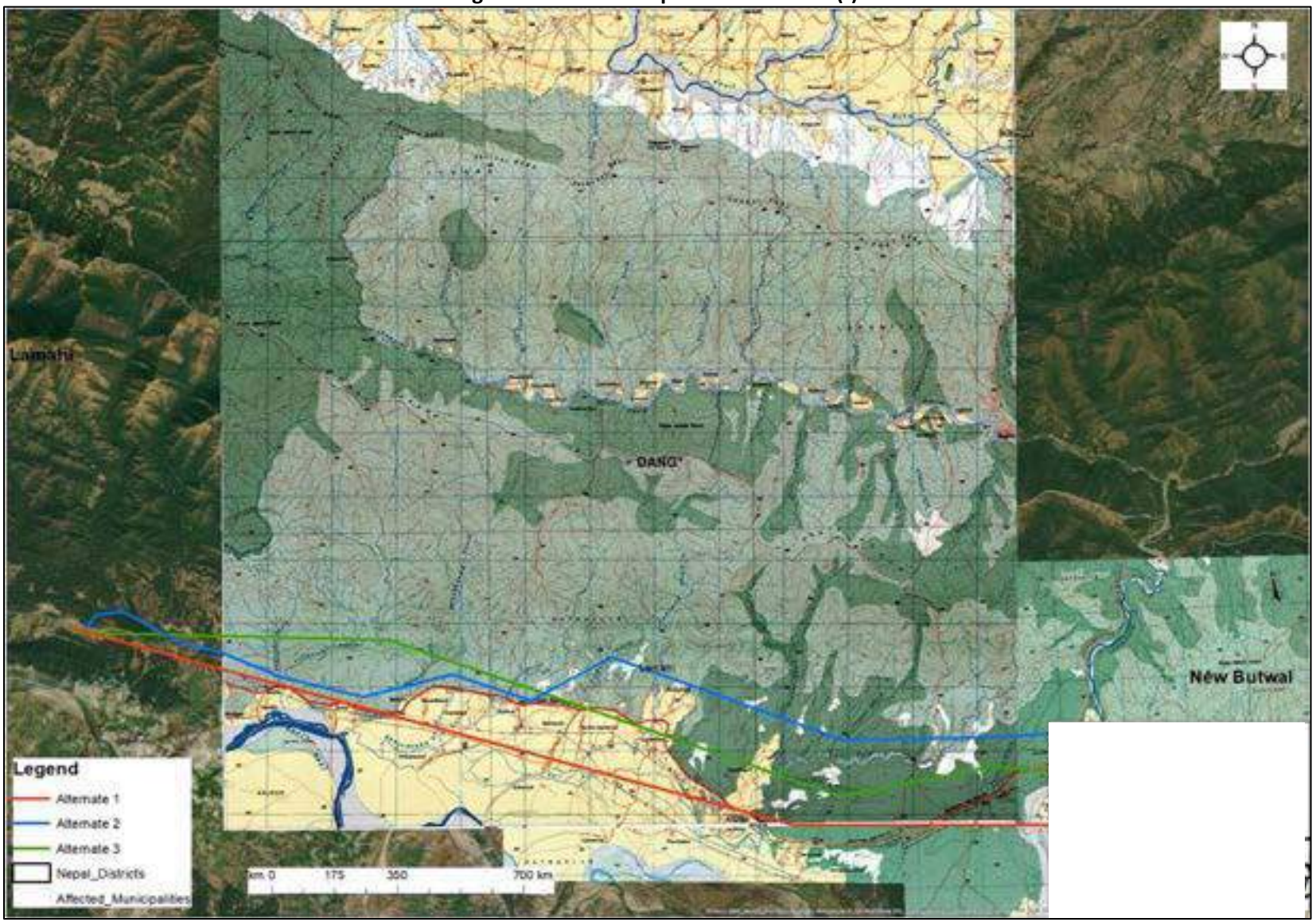


Figure 19: Details Maps of Alternatives (J)



Environmental and Social Consideration Alternatives to the project

164. Extensive studies have been conducted to determine the transmission line routes while avoiding the crossing of protected areas, such as national parks, near the project areas. In situations where it is necessary to pass through forests with the transmission lines, a significant number of trees must be cleared to create a Right of Way (RoW). Additionally, trees need to be cut for the construction of access roads, which can increase the risk of landslides along the RoW.

165. The flat areas located south and north of the mountain range are sparsely populated. These areas primarily consist of scattered houses surrounded by cultivated land growing rice or low-lying crops. Orchards or similar crops that could be affected by the installation of conductors are not present. Construction activities will be carefully planned during the off-season (dry period) to minimize unnecessary damage and disturbances, thereby reducing the overall impact on the project area.

166. Various alternatives for tower locations were considered and analyzed based on their social and environmental significance. A pairwise comparison method was adopted for the comparison, considering 28 environmental and social factors and 11 project implementation actions (both during the construction and operation phases). Positive and negative impacts associated with different project alternatives were identified through this analysis. Each impact was evaluated based on six attributes: sign, magnitude, spatial extent, duration, reversibility, and frequency. The score for each alternative was determined by assigning weights to individual environmental and social impact components, which were used to calculate a weighted value for each positive and negative impact. The existing environmental and social conditions that may be affected by these actions are defined in the table below.

Table 27: Environmental and social factors

#	Parameter	Impacts
1	Terrain	Land instability and erosion
2	Change in Land use	Project components to alter the land use pattern
3	Rivers and water quality	Impact on current water sources
4	Air quality	Change in air quality
5	Noise	Increase in noise level
6	Solid waste	Generation of disposal of solid and construction waste
7	Climate	Impact on Climate

#	Parameter	Impacts
8	Electromagnetic field	Health issues, interference to radio and telecom signals
9		Electrocution effect on wildlife and bird
10	Forest resources	Forest Fragmentation
11		Loss of forest resources including NTFP and ethno-botanically important plants
12		Risk of forest fire
13	Wildlife	Loss of wildlife and their habitat including species of conservation significance
14	Avifauna	Bird habitat fragmentation
15		Impact in sensitive/critical habitat at west-Rapti river valley
16	Protected Area	Impact on protected area
17	Physical displacement	Land Acquisition for both permanent and temporary usage
18	Economic displacement	Impact on livelihood
19	Physical Infrastructures	Increased stress on community infrastructures such as health care, school, drinking water, solid waste management
20	Access to natural resources	Use of local water supply and NTFP products
21	Health and safety risks	Community health and safety risks; Communicable diseases
22	Aesthetic and Natural Beauty	Impacts to visual resources due to changes between the existing landscape and project activities
23	Agricultural Resources	Loss of crops within the project area.
24	Vulnerable groups	Impacts on gender, indigenous and disadvantaged or vulnerable groups

#	Parameter	Impacts
25	Enhancement in conservation of local wildlife	Biodiversity conservation awareness programs will enhance the knowledge of the local community and decrease their reliance on the local resources (due to job creation by the project).
26	Creation of new ecological niche and fire line	Clearance of vegetation for the ROW will create a no tree zone which will serve as a fire line as well as provide enough light and space for the emergence of new plant species.
27	Improvement of Socio-Economic Status	Strengthened economic activities by business and employment opportunities
28	Expansion of Electrification	Strengthen the capacity of electricity grid in the west

Table 28: Actions which might impact environmental and social factors

Impacting Actions	
Construction Phase	Construction works for tower alignment
	Use of local water sources
	Clearance of forest vegetation
	Acquisition of Land and Structure
	Influx of workers and site camps
	Generation of waste
	Acquisition of agricultural and commercial land
Operation Phase	Installation of GIS Substation
	Vegetation height control
	Generation of Electromagnetic field

Impacting Actions	
	Generation of Electricity

167. The Matrix of Identification of Impacts, a combination of environmental and social factors along with the impacting actions, has been utilized to assess the effects of different alternatives. This matrix provides a comprehensive overview of the positive and negative impacts associated with each alternative. The following matrix outlines the identified impacts for the different alternatives:

Table 29: Matrix of Identification of Impacts for Alternative 1

Environmental Components	Impact	Impacting Actions										
		Construction Phase								Operation Phase		
		1	2	3	4	5	6	7	8	9	10	11
		Construction works for tower alignment	Use of local water sources	Clearance of forest vegetation	Acquisition of Land and Structure	Influx of workers and site camps	Generation of waste	Acquisition of agricultural and commercial land	Installation of GIS Substation	Vegetation height control	Generation of Electromagnetic field	Generation of Electricity
Terrain	Land instability and erosion											
Change in Land use	Project components to alter the land use pattern											
Rivers and water quality	Impact on current water sources											

Air quality	Change in air quality											
Noise	Increase in noise level											
Solid waste	Generation of disposal of solid and construction waste											
Climate	Impact on Climate											
Electromagnetic field	Health issues, interference to radio and telecom signals											
	Electrocution effect on wildlife and bird											
Forest resources	Forest Fragmentation											
	Loss of forest resources including NTFP and ethno botanically important plants											
	Risk of forest fire											
Wildlife	Loss of wildlife and their habitat including species of conservation significance											
Avifauna	Bird habitat fragmentation											

	Impact in sensitive/critical habitat at west-Rapti river valley											
Protected Area	Impact on protected area											
Physical displacement	Land Acquisition for both permanent and temporary usage											
Economic displacement	Impact on livelihood											
Physical Infrastructures	Increased stress on community infrastructures such as health care, school, drinking water, solid waste management											
Access to natural resources	Use of local water supply and NTFP products											
Health and safety risks	Community health and safety risks; Communicable diseases											
Aesthetic and Natural Beauty	Impacts to visual resources due to changes between the existing landscape and project activities											
Agricultural Resources	Loss of crops within the project area.											
Vulnerable groups	Impacts on gender, indigenous and disadvantaged or vulnerable groups											

Enhancement in conservation of local wildlife	Biodiversity conservation awareness programs will enhance the knowledge of the local community and decrease their reliance on the local resources (due to job creation by the project).												
Creation of new ecological niche and fire line	Clearance of vegetation for the ROW will create a no tree zone which will serve as a fire line as well as provide enough light and space for the emergence of new plant species.												
Improvement of Socio-Economic Status	Strengthened economic activities by business and employment opportunities												
Expansion of Electrification	Strengthen the capacity of electricity grid in the west												

Description of Environmental and Social Factors

168. The list of the environmental and social factors which could be impacted during the different project phases is given below.

169. **Land instability and erosion:** The earthwork involving clearance of vegetation for the excavation of tower foundations during the construction phase is expected to destabilize the land and exacerbate soil erosion. The tower foundations will be placed on the stable grounds with minimum landslide risk. But the removal of trees for the alignment of transmission lines will generate spoil which may cause soil erosion, land degradation, and landslides. The highest impact of this alternative will be on Alternative 1, as 45% of the structures are based on moderate to steep slopes compared with the other two alternatives. The towers for other alternatives will be constructed on a gentle to flat slope. The analysis of land stability of the three alternatives has been mentioned in the table below:

Table 30: Land Stability of the alternatives

	Alternate 1		Alternate 2		Alternate 3	
	[km]	[%]	[km]	[%]	[km]	[%]
Flat to gentle slope	82	55	112	70	139	92
Moderate slope	21	14	19	12	6	4
Steep slope	43	28	26	17	5	4
Extremely Steep slope	5	3	2	1	0	0
Grand Total	150	100	160	100	150	100

170. This impact is temporary and reversible for all alternatives.

171. **Land use change:** The project components such as tower pads, substations will require permanent acquisition of land. The project will also need to acquire the land under RoW except for the temporary areas that will be acquired by camps. However, in the RoW, the land use pattern of cultivated land will not be changed since cultivation is allowed. This impact is temporary and reversible for all alternatives.

172. **Impacts to River and Water Quality**: Construction activities, such as site clearance, excavation, and the movement of vehicles along earthen roads are likely to result in sediment laden runoff because of water sprinkling for dust management or during rainstorms. Similarly, the risks will increase during the rainy season as pollution will be picked up in rainwater. Hence the construction will be carried out during the dry season. Also, the water resources of the project area can be affected by changes in quantity and quality with knock-on effects on human health if used for drinking water or similar, and aquatic ecology where sensitive flora and fauna are supported. NBTL alignment crosses several rivers, most of which are seasonal. The maximum impact for the river and its water quality might be for Alternative 2, followed by alternative 3 and the alternative 1, as it comprises the maximum land area covered by the river (river with and crossings).

Table 31: No of River crossings in Different Alternatives

Criteria	Unit	TL Alternate 1	TL Alternate 2	TL Alternate 3
Number of river crossings	No	7.0	9.0	8.0

173. Similarly, the storage of fuel, oil and chemicals including transformer oil will be required, which will be done within substations or in the temporarily rented land. Accident spills or leaks e.g., while refueling activities; might get into the surface water runoff or percolate through the soil to groundwater. Impacts will be of low magnitude. Also, wastewater from the toilets, washrooms, kitchen *etc.* might be discharged into the local water bodies without treatment. The untreated sanitary wastewater might also cause water pollution. The impacts are expected to be temporary and reversible for all the alternatives.

174. **Air Quality**: Air quality is impacted during all the construction phases and is mainly due to dust and pollutant emissions from the construction activities and exhaust emissions generated by the operation of construction vehicles, equipment, and machinery. This impact is temporary and reversible for all alternatives. The highest probable impact of this project activity will be on Alternative 3 as the number of houses that may suffer due to construction works are the highest in this alignment. The table below clearly illustrated the distinction of impacts among the three alternatives.

Table 32: Comparison of different criteria on all Alternatives

#	Criteria	Unit	NBTL Alternate 1	NBTL Alternate 2	NBTL Alternate 3
1	Length of the Transmission Line	km	150.5	160.0	151.0
2	Land instability, slides, and erosion due to construction of the tower (i.e., percent of alignment in the sloppy land)	%	45.0	30.0	8.0
3	Air quality and noise (number of houses that may suffer from air and noise pollution due to construction works. Houses located within 1 km buffer from the TL)	Nos	3,177.0	4,647.0	7,725.0
4	Loss of forest area to the TL alignment and RoW [ha]	ha	611.9	714.6	236.4
5	Physical displacement of families	Nos	125.0	39.0	275.0
6	Acquisition and/or restricted use of private land for RoW/ cultivated land	ha	50.1	11.6	438.2

175. **Noise**: Noise will be generated during land clearance and/or the cutting of trees in the RoW. It will also occur during the construction of tower foundations and substations. New project components involving noisy activities are mostly located in rural locations, so relatively few individual human receptors will be

moderately affected and in the main impacts on ambient noise levels. In the forest areas only excavations for tower foundations are needed so unless drilling and blasting for foundations and pile driving is needed, noise impacts on ecological receptors will only be minor adverse. This impact is temporary and reversible for all alternatives.

176. **Solid waste and construction wastes:** Solid waste from the workforce is expected to be generated during the construction phase. Since the project does not require a large number of workforces to be mobilized at the same time, the waste generated will be limited. The waste generated from the camps will be of organic nature, which are biodegradable and non-hazardous and will be managed by the local waste management system. The impact here is temporary and can be reversible for all the alternatives.

177. **Climate change:** This impact is considered equal for all the alternatives as the project will be using Gas insulated substations (GIS) types for the substation. Sulfur Hexafluoride (SF6) gas is used in the GIS of the substations, which is a potent greenhouse gas contributing to climate change.

178. **Electro-magnetic field effects:** Overhead lines produce both electric and magnetic fields. Electric fields are created by differences in voltage. The strength of the electric field is measured in kilovolts per meter (kV/m). Any electrical wire that is charged will produce an associated electric field. Such fields exist even when there is no current flowing. Health concerns over exposure to EMF are often raised when a new transmission line or substation is proposed. However, despite all the studies that have been carried out over the past 30 years, there is still no persuasive evidence that the fields pose any significant health risks. Upgradation of existing power lines is unlikely to increase EMF, but new lines may induce new EMF and will traverse some populated areas. However, issues regarding wildlife and bird collision due to electrocution is probable. Also there might be some disturbances to television and mobile phone reception. The impact is permanent and continuous for all the alternatives.

179. **Loss of forest resources:** The NBTL alignment is 160 km in length with 46 m ROW. The project alignment covers a significant area of land of which approximately 90.38% is covered by the Community Forest in its entire length. Likewise, National Forest area covers about 5.76 %, Collaborative Forest and Religious Forest cover 1.93 % each. Similarly, vegetation clearance is expected to fragment the continuum of different types of forests and its distributions, which might reduce integrated ecosystem function diminishing ecosystem service derived from these forests. Likewise, the fragmentation will also affect wildlife and avian fauna mobility and their other habitat functions.

180. Moreover, there is a probable chance of loss of biodiversity and ground vegetation including NTFPs and ethno-botanically important plants due to clearance of vegetation at the Transmission Line placement sites and camp sites. This impact is highest for Alternative 2 followed by Alternative 1 and then Alternative 3.

Table 33: Land use data for the project impacts on all alternatives

Areas	Component	Alternate 1			Alternate 2			Alternate 3		
		Length [km]	Area [ha]	Area [%]	Length [km]	Area [ha]	Area [%]	Length [km]	Area [ha]	Area [%]
Settlement Area	Social	5.6	25.7	3.7	0.1	0.5	0.1	3.1	14.3	2.0

Areas	Component	Alternate 1			Alternate 2			Alternate 3		
		Length [km]	Area [ha]	Area [%]	Length [km]	Area [ha]	Area [%]	Length [km]	Area [ha]	Area [%]
Cultivated land	Agriculture	10.9	50.1	7.2	2.5	11.6	1.6	95.3	438.2	62.9
Forest	Forest	133.0	611.9	87.4	155.4	708	97.3	51.4	236.4	34.0
Rivers	Hydro	1.9	8.8	1.3	1.6	7.4	1.0	1.2	5.6	0.8
Others		0.7	3.3	0.5	0.1	0.5	0.1	0.4	1.8	0.3
Total		152.1	699.8	100.0	159.7	734.6	100.0	151.4	696.3	100.0

181. ***Wildlife:*** The linear clearance of vegetation (46m wide) at the NBTL placement sites, camp sites and other construction related disturbance will cause vegetation loss and forest fragmentation which will affect wildlife habitat to some extent. Similarly, loss of wildlife due to illegal hunting, forest fires are also probably with the loss of rare, endangered and threatened species of herpetofauna and mammal with conservation significance. However, this adverse impact will decrease once the construction work is completed. The loss of habitat is considered a direct long-term impact to wildlife of the project areas. Due to habitat fragmentation, the normal movement of fauna from one part of the forest to the other will be affected. This will be of significance in those forest areas where the 46m wide RoW will be maintained during the operation phase. Likewise, significant fragmentation impacts on Critical Habitat Qualifying species are unlikely as normal practice is to allow scrub and small trees to reestablish within power line rights of way, facilitating movement of all priority terrestrial species. The NBTL route does not pass through a high congregation of these wild animals, this impact is minimal. The local herpetofauna and mammals will face anthropogenic and operation noise nuisance related disturbances. Since this disturbance is occasional, the impact is temporary and is reversible and can be mitigated with necessary precautions.

182. ***Avifauna:*** The removal of trees to clear NBTL is expected to fragment habitat continuum for the birds, which is expected to restrict roosting and/or foraging activities of the birds. Furthermore, the construction activities with usage of heavy machinery, vehicles, wiring will also disturb the birds. However, since NBTL construction does not require extensive and concentrated construction activities, we are expecting the magnitude of such disturbance will be minimal. Similarly, the impact in sensitive/critical habitat at West-Rapti River Valley where Bhaluwang, Dang is one of the bird sensitive/critical habitat sites, through which the NBTL alignment passes through. The site was also noted as the congregator site for the Vultures, Ruddy Shelduck, Black kite and Steppe eagle. Thus, impact in this part is considered to be permanent and continuous for all the alternatives. Furthermore, electrocution of bird species is prominent where such risk is greatest for birds of prey, which regularly perch on transmission towers and similar infrastructure. For the prevention of accidental collision of birds with the conductor, bird diverter (colored/contrast marker devices) will be installed on the earth wire to make it visible to birds from a long distance. Also, once the NBTL wire and towers are installed, the possibility of the bird collision with the wires will increase. The overall impact is the same for all the alternatives.

183. ***Acquisition of Land and Structure***: The project will have to acquire private properties, land and structures permanently for construction of the project components. The total land to be required for the NBTL including its ROW and tower pad is about 742 ha, out of which 728.3 ha is required for the transmission line (RoW) whereas remaining 13.7 ha land is required for the construction of the tower pad. This impact shall be mitigated by adequate compensation of the property losses. Clear distinction among the alternatives illustrated in the table below shows the highest impact for the acquisition of land and structures in alternative 3 as the alternative comprises the highest physical displacement among the other two.

Table 34: No. of houses impacted by the alternatives

Description	Alternate 1	Alternate 2	Alternate 3
Houses within 1 km buffer zone of the TL (1+1 = 2 km)	3,177	4,647	7,725

184. **Economic displacement:** The loss of cultivated land will impact the local economy who are dependent on agriculture. The alignment has avoided the cultivated land but the significant losses will be caused around the tower construction. However, the sudden cash inflow into the hands of the local community through cash compensation and wages from the project may also change the expenditure pattern of the people residing in the project area. This impact shall be mitigated by adequate compensation of the property losses. The loss of agricultural land is also observed to be the highest for Alternative 3 when compared with the other two (as mentioned in the table above), making alternative 3 the least favorable of all.

185. **Infrastructures:** The project will employ workers, who might migrate to the project area accompanied by their families. The increased impact on the health facilities is likely to adversely affect their ability to service the local community, especially during the rainy season when water-borne infections like cholera, dengue and typhoid are reported. Similarly, conflict regarding the use of local water supply might arise along with the problem of local solid waste management systems which might thus create health and sanitation situations. This will be an irreversible impact that shall be adequately mitigated and has the same impact for all the three alternatives.

186. **Access to natural resources:** The construction of the project will impact the existing water resources and loss of crops which will provoke problems for the local people in accessing their natural resources. This will be an irreversible impact that shall be adequately mitigated.

187. **Health and safety risks**: Construction workers are likely to face occupational health hazards ranging from minor or major injuries due to lack of health and safety requirements while working at construction sites, handling machines and equipment, driving vehicles, working at heights, working with electricity, *etc*. In addition, improper health policies at work sites may lead to an outbreak of different diseases in the surrounding communities/public. In undertaking H&S risk assessment and planning, adequate attention is to be given to the risks associated with COVID-19 pandemic and other communicable diseases. This will be an irreversible impact for all the alternatives that shall be adequately mitigated.

188. **Aesthetics:** Impacts to visual resources are assessed in terms of changes between the existing landscape and project activities. The existence of the tower and transmission line will likely create aesthetic impact. This impact is permanent and irreversible for all the alternatives. However, the height of the forest can be maintained and cultivation of crops in the RoW will be carried out which might minimize the level of impact for the alignment.

189. **Agricultural Resources:** The loss of cultivated land would have a significant impact on the local people who are dependent on agriculture. However, the alignment has avoided the cultivated land as much as possible. Significant losses of arable, productive, valuable agricultural land will be caused around the tower construction. This impact shall be mitigated by adequate compensation of the property losses. This impact is the highest for alternative 3 where the cultivated land is influenced the most followed by alternative 1 and then alternative 2. (Refer to table above)

190. **Vulnerable groups:** Impact on vulnerable groups is transversal to all the main construction activities and economic and physical displacement. The vulnerable groups most impacted are in alternative 3 followed by alternative 1 and then 2 as the settlement areas are highest in the same. The acquisition and/or restricted use of private land for RoW/ cultivated land has been evaluated to be highest in alternative 3 with approximately 275 households being displaced which comprises people of the vulnerable groups as well. (No of vulnerable HHs to be included if possible)

Definition of the Impacting Actions

191. The following actions have been identified as the ones which could impact the environmental and social factors. These actions are divided into project phases during the construction and operation phase.

192. Construction Phase

- Construction works for tower alignment: The construction of the tower alignment and the RoW directly influences the clearance of land for the project initiation.
- Use of local water sources: Construction works might release sediments to the rivers bodies including spillage of oil/grease. The impacting action includes rise of sediments during construction activities and the leakages of oil grease to the nearby local water sources.
- Clearance of forest vegetation: This impacting action includes the felling of trees and vegetation for the tower and tower pad construction and the trees available in the RoW.
- Acquisition of Land and Structure: This impacting action includes the acquisition of land for the clearing of the areas connected with permanent and temporary activities for the project.
- Influx of workers and site camps: This action includes the inflow of workers required for the project and impacting on the infrastructures and development of the sites for the project.
- Generation of waste: This impacting action includes the increase in the load in and around the project area with the added workforce which might lead to the exploitation of local resources and mismanagement of the disposal areas.
- Acquisition of agricultural and commercial land: This impacting action includes the acquisition of agricultural land for the clearing of the areas connected with permanent and temporary works for the project.

193. Operation and Maintenance Phase:

- Installation of GIS Substation: This action includes the use of SF6 for the operation of the GIS in the substation for the transmission line.
- Vegetation height control: this action includes the clearing and maintaining of the tree height under the transmission line for the RoW.
- Generation of Electromagnetic field: This action includes the generation of electromagnetic field which might coincide with the communication lines and cause interference with the signal.
- Generation of Electricity: This action includes the transmission of electricity which will lead to the development and expansion of the project area.

Definition of the Importance of the Impacts

194. The importance of the impact on an environmental and social factor is calculated using defined attributes: sign, magnitude, spatial extension, duration, reversibility, and frequency.

195. The mentioned attributes are defined as follows:

- Sign: this attribute defines the nature of the impact (beneficial or harmful).
- Magnitude: this attribute defines magnitude of the incidence of the impacting action on the considered environmental or social actor. Its intensity is classified as low, medium and high.
- Spatial Extent: this attribute represents the extension of the affected area in relation to the project components. The spatial extension is classified as site specific, local, and regional.
- Duration: this attribute refers to the time lap between the beginning of the impacting actions and the end of the relevant impacting effect. The time of occurrence is classified as short term, medium term, and long term.
- Reversibility: this attribute refers to the possibility of restoring the affected factor and, if possible, the time lap necessary for the restoration. The reversibility is classified as short term, medium term and irreversible.
- Frequency: this attribute refers to the frequency of occurrence of the impact. The frequency is classified as infrequent, frequent and continuous.

196. The importance of an impact is calculated, per each action impacting an environmental and social factor, with the following equation:

$$I_{ij} = Si \cdot (MA_{ij} + SE_{ij} + DU_{ij} + PE_{ij} + RV_{ij} + FR_{ij})$$

197. The scores are given as indicated in Table below:

Table 35: Attributes for the definition of the importance of an impact, with related scores.

Attributes	Description		Score
Sign (Si)	+	Positive	+1
	-	Negative	-1
Magnitude (MA)	L	Low	1
	M	Medium	2
	H	High	6
Spatial Extension (SE)	SS	Site Specific	1
	Lo	Local	2

Attributes	Description		Score
	Re	Regional	6
Duration (DU)	S	Short Term	0.5
	M	Medium Term	1
	L	Long Term	2
Reversibility (RE)	S	Short Term	1
	M	Long Term	2
	I	Irreversible	6
Frequency (FR)	I	Infrequent, aperiodic, discontinuous	0.5
	F	Frequent	1
	C	Continuous	2

198. The attributes for the definition of the importance of the impacts on environmental and social factors, as reported in Table above, were evaluated in relative terms among the different project Alternatives, according to the estimation of the impact. In fact, the intensity and spatial extension of some of the impacts were defined in quantitative terms according to the available data, documentation, and calculations. Whenever the quantification of the impacts was deemed difficult, the impacts were evaluated according to the Consultant's judgment.

199. The impacts of the transmission line on the existing environmental and social factors, i.e., forest areas, physical and economic displacement, religious sites, infrastructures etc., have been quantified based on the topographic maps at 1:25,000 scale and subsequently verified during the site visits.

200. Similarly, the score to each Alternative is a weightage assigned to the environmental and social impact components. The weighted value is calculated for each positive and negative impact where the considered environmental and social factors, or impact categories, have been defined by applying the pairwise review method. A comparative matrix was elaborated while putting both in rows and columns the considered impact categories as well as assigning to each element *aij* the ratio between the rankings of the corresponding impact in row i and the ranking of the impact in column *j*. This is a Multi Criteria decision making method that relies on judgements of experts to derive priority scales. For every single entry was divided by the sum of entries of the corresponding column whose sum of the elements of each column vector is 100. The pairwise comparisons are made ranking the factors importance in the decision-making process, i.e., in the selection of the most preferable project alternative. In this analysis each impact category is compared with all the other categories in ascending order of importance, according to the

judgment of a team of environmental and social experts. The weightage derived has been illustrated in the table below.

Table 36: Weightage of the impact categories

#	IMPACT CATEGORY	EXPLANATION	WEIGHT
1	Terrain	Land instability and erosion	2.4
2	Change in Land use	Project components to alter the land use pattern	2.6
3	Rivers and water quality	Impact on current water sources	2.1
4	Air quality	Change in air quality	1.6
5	Noise	Increase in noise level	1.1
6	Solid waste	Generation of disposal of solid and construction waste	1.6
7	Climate	Impact on Climate	0.3
8	Electromagnetic field	Health issues, interference to radio and telecom signals	0.8
9		Electrocution effect on wildlife and bird	3.7
10	Forest resources	Forest Fragmentation	7.1
11		Loss of forest resources including NTFP and ethno botanically important plants	6.3
12		Risk of forest fire	3.4
13	Wildlife	Loss of wildlife and their habitat including species of conservation significance	6.1
14	Avifauna	Bird habitat fragmentation	5.8
15		Impact in sensitive/critical habitat at west-Rapti river valley	4.2
16	Protected Area	Impact on protected area	5.8

#	IMPACT CATEGORY	EXPLANATION	WEIGHT
17	Physical displacement	Land Acquisition for both permanent and temporary usage	6.1
18	Economic displacement	Impact on livelihood	4.5
19	Physical Infrastructures	Increased stress on community infrastructures such as health care, school, drinking water, solid waste management	2.1
20	Access to natural resources	Use of local water supply and NTFP products	2.9
21	Health and safety risks	Community health and safety risks; Communicable diseases	0.3
22	Aesthetic and Natural Beauty	Impacts to visual resources due to changes between the existing landscape and project activities	1.1
23	Agricultural Resources	Loss of crops within the project area.	4.8
24	Vulnerable groups	Impacts on gender, indigenous and disadvantaged or vulnerable groups	6.1
25	Enhancement in conservation of local wildlife	Biodiversity conservation awareness programs will enhance the knowledge of the local community and decrease their reliance on the local resources (due to job creation by the project).	4.5
26	Creation of new ecological niche and fire line	Clearance of vegetation for the ROW will create a no tree zone which will serve as a fire line as well as provide enough light and space for the emergence of new plant species.	4.0
27	Improvement of Socio-Economic Status	Strengthened economic activities by business and employment opportunities	4.5
28	Expansion of Electrification	Strengthen the capacity of electricity grid in the west	4.2

Matrices of Importance

201. The matrix, which includes the importance of the impact of all the actions on the environmental and social factors, is called the Matrix of Importance. The following Table is the matrix of importance defined for Alternative A1. The negative impacts are highlighted in red while the positive impacts in green. Empty cells represent positive or negative impacts with little relevancy or no impact at all.

Table 37: Matrix of importance for alternative A1

#	Parameter	Impact	Attributes for Alternatives						
			Sign	Magnitude	Spatial Extent	Duration	Reversibility	Frequency	Weighted Score
1	Terrain	Land instability and erosion	-	H	SS	ST	S	I	-21.4
2	Change in Land use	Project components to alter the land use pattern	-	H	R	LT	M	I	-43.7
3	Rivers and water quality	Impact on current water sources	-	H	L	ST	M	I	-23.3
4	Air quality	Change in air quality	-	L	SS	ST	S	F	-7.1
5	Noise	Increase in noise level	-	L	SS	ST	S	I	-4.2
6	Solid waste	Generation of disposal of solid and construction waste	-	L	SS	ST	S	I	-6.3
7	Climate	Impact on Climate	-	L	R	LT	I	C	-4.5
8	Electromagnetic field	Health issues, interference to radio and telecom signals	-	L	SS	LT	I	C	-9.5
9		Electrocution effect on wildlife and bird	-	L	L	LT	I	C	-48.1
10	Forest resources	Forest Fragmentation	-	M	SS	LT	M	I	-53.6
11		Loss of forest resources including NTFP and ethno botanically important plants	-	M	SS	LT	I	F	-76.2
12		Risk of forest fire	-	M	L	MT	M	F	-27.5
13	Wildlife	Loss of wildlife and their habitat including species of conservation significance	-	M	SS	LT	M	C	-54.8
14	Avifauna	Bird habitat fragmentation	-	M	L	LT	I	C	-81.5

#	Parameter	Impact	Attributes for Alternatives						
			Sign	Magnitude	Spatial Extent	Duration	Reversibility	Frequency	Weighted Score
15		Impact in sensitive/critical habitat at west-Rapti river valley	-	H	R	LT	I	C	-93.1
16	Protected Area	Impact on protected area	-	L	R	LT	I	C	-98.9
17	Physical displacement	Land Acquisition for both permanent and temporary usage	-	M	SS	LT	I	I	-70.0
18	Economic displacement	Impact on livelihood	-	M	SS	MT	I	F	-49.5
19	Physical Infrastructures	Increased stress on community infrastructures such as health care, school, drinking water, solid waste management	-	L	L	ST	S	I	-10.6
20	Access to natural resources	Use of local water supply and NTFP products	-	L	SS	ST	M	F	-16.0
21	Health and safety risks	Community health and safety risks; Communicable diseases	-	M	SS	ST	M	F	-1.7
22	Aesthetic and Natural Beauty	Impacts to visual resources due to changes between the existing landscape and project activities	-	L	L	MT	M	C	-9.5
23	Agricultural Resources	Loss of crops within the project area.	-	M	SS	MT	I	F	-52.4
24	Vulnerable groups	Impacts on gender, indigenous and disadvantaged or vulnerable groups	-	M	SS	ST	M	C	-45.6

#	Parameter	Impact	Attributes for Alternatives						
			Sign	Magnitude	Spatial Extent	Duration	Reversibility	Frequency	Weighted Score
25	Enhancement in conservation of local wildlife	Biodiversity conservation awareness programs will enhance the knowledge of the local community and decrease their reliance on the local resources (due to job creation by the project).	+	L	SS	MT	M	C	31.5
26	Creation of new ecological niche and fire line	Clearance of vegetation for the ROW will create a no tree zone which will serve as a fire line as well as provide enough light and space for the emergence of new plant species.	+	L	SS	MT	M	C	27.8
27	Improvement of Socio-Economic Status	Strengthened economic activities by business and employment opportunities	+	M	L	MT	S	C	36.0
28	Expansion of Electrification	Strengthen the capacity of electricity grid in the west	+	L	R	LT	I	C	72.0
									-741.9

Table 38: Matrix of importance for alternative A2

#	Parameter	Impact	Sign	Magnitude	Spatial Extent	Duration	Reversibility	Frequency	Weighted Score
1	Terrain	Land instability and erosion	-	L	SS	ST	S	I	-9.5
2	Change in Land use	Project components to alter the land use pattern	-	H	R	LT	S	I	-41.0

#	Parameter	Impact	Sign	Magnitude	Spatial Extent	Duration	Reversibility	Frequency	Weighted Score
3	Rivers and water quality	Impact on current water sources	-	M	L	ST	S	I	-12.7
4	Air quality	Change in air quality	-	L	SS	ST	S	F	-7.1
5	Noise	Increase in noise level	-	L	SS	ST	S	I	-4.2
6	Solid waste	Generation of disposal of solid and construction waste	-	L	SS	ST	S	I	-6.3
7	Climate	Impact on Climate	-	L	R	LT	I	C	-4.5
8	Electromagnetic field	Health issues, interference to radio and telecom signals	-	L	SS	LT	I	C	-9.5
9		Electrocution effect on wildlife and bird	-	L	L	LT	I	C	-48.1
10	Forest resources	Forest Fragmentation	-	H	SS	LT	M	I	-82.1
11		Loss of forest resources including NTFP and ethno botanically important plants	-	H	SS	LT	M	F	-76.2
12		Risk of forest fire	-	L	L	MT	M	F	-24.1
13	Wildlife	Loss of wildlife and their habitat including species of conservation significance	-	M	SS	LT	M	C	-54.8
14	Avifauna	Bird habitat fragmentation	-	L	L	LT	I	C	-75.7

#	Parameter	Impact	Sign	Magnitude	Spatial Extent	Duration	Reversibility	Frequency	Weighted Score
15		Impact in sensitive/critical habitat at west-Rapti river valley	-	H	R	LT	I	C	-93.1
16	Protected Area	Impact on protected area	-	L	R	LT	I	C	-98.9
17	Physical displacement	Land Acquisition for both permanent and temporary usage	-	L	SS	LT	I	I	-63.9
18	Economic displacement	Impact on livelihood	-	L	SS	MT	I	F	-45.0
19	Physical Infrastructures	Increased stress on community infrastructures such as health care, school, drinking water, solid waste management	-	L	L	ST	S	I	-10.6
20	Access to natural resources	Use of local water supply and NTFP products	-	L	SS	ST	S	F	-13.1
21	Health and safety risks	Community health and safety risks; Communicable diseases	-	L	SS	ST	S	F	-1.2
22	Aesthetic and Natural Beauty	Impacts to visual resources due to changes between the existing landscape and project activities	-	L	L	ST	M	C	-8.5
23	Agricultural Resources	Loss of crops within the project area.	-	L	SS	ST	I	F	-45.2
24	Vulnerable groups	Impacts on gender, indigenous and disadvantaged or vulnerable groups	-	L	SS	ST	M	C	-39.6

#	Parameter	Impact	Sign	Magnitude	Spatial Extent	Duration	Reversibility	Frequency	Weighted Score
25	Enhancement in conservation of local wildlife	Biodiversity conservation awareness programs will enhance the knowledge of the local community and decrease their reliance on the local resources (due to job creation by the project).	+	H	L	LT	M	C	63.0
26	Creation of new ecological niche and fire line	Clearance of vegetation for the ROW will create a no tree zone which will serve as a fire line as well as provide enough light and space for the emergence of new plant species.	+	H	SS	LT	I	C	67.5
27	Improvement of Socio-Economic Status	Strengthened economic activities by business and employment opportunities	+	H	L	LT	I	C	81.0
28	Expansion of Electrification	Strengthen the capacity of electricity grid in the west	+	M	R	LT	I	C	76.2
									-587.4

Table 39: Matrix of importance for alternative A3

#	Parameter	Impact	Attributes 3						
			Sign	Magnitude	Spatial Extent	Duration	Reversibility	Frequency	Weighted Score
1	Terrain	Land instability and erosion	-	M	SS	ST	S	I	-11.9

#	Parameter	Impact	Attributes 3						
			Sign	Magnitude	Spatial Extent	Duration	Reversibility	Frequency	Weighted Score
2	Change in Land use	Project components to alter the land use pattern	-	H	R	LT	S	I	-41.0
3	Rivers and water quality	Impact on current water sources	-	L	L	ST	S	I	-10.6
4	Air quality	Change in air quality	-	H	SS	ST	S	F	-15.1
5	Noise	Increase in noise level	-	H	SS	ST	S	I	-9.5
6	Solid waste	Generation of disposal of solid and construction waste	-	H	SS	ST	S	I	-14.3
7	Climate	Impact on Climate	-	L	R	LT	I	C	-4.5
8	Electromagnetic field	Health issues, interference to radio and telecom signals	-	L	SS	LT	I	C	-9.5
9		Electrocution effect on wildlife and bird	-	L	L	LT	I	C	-48.1
10	Forest resources	Forest Fragmentation	-	M	SS	LT	M	I	-53.6
11		Loss of forest resources including NTFP and ethno botanically important plants	-	M	SS	LT	M	F	-50.8
12		Risk of forest fire	-	L	L	MT	M	F	-24.1
13	Wildlife	Loss of wildlife and their habitat including species of conservation significance	-	L	SS	LT	M	C	-48.7
14	Avifauna	Bird habitat fragmentation	-	L	L	LT	I	C	-75.7
15		Impact in sensitive/critical habitat at west-Rapti river valley	-	H	R	LT	I	C	-93.1

#	Parameter	Impact	Attributes 3						
			Sign	Magnitude	Spatial Extent	Duration	Reversibility	Frequency	Weighted Score
16	Protected Area	Impact on protected area	-	L	R	LT	I	C	-98.9
17	Physical displacement	Land Acquisition for both permanent and temporary usage	-	H	SS	LT	I	I	-94.3
18	Economic displacement	Impact on livelihood	-	H	SS	MT	I	F	-67.5
19	Physical Infrastructures	Increased stress on community infrastructures such as health care, school, drinking water, solid waste management	-	M	SS	ST	S	I	-10.6
20	Access to natural resources	Use of local water supply and NTFP products	-	L	SS	ST	S	F	-13.1
21	Health and safety risks	Community health and safety risks; Communicable diseases	-	L	SS	ST	M	F	-1.5
22	Aesthetic and Natural Beauty	Impacts to visual resources due to changes between the existing landscape and project activities	-	L	SS	MT	M	C	-8.5
23	Agricultural Resources	Loss of crops within the project area.	-	H	SS	ST	I	F	-69.0
24	Vulnerable groups	Impacts on gender, indigenous and disadvantaged or vulnerable groups	-	H	SS	ST	M	C	-70.0
25	Enhancement in conservation of local wildlife	Biodiversity conservation awareness programs will enhance the knowledge of the local community and decrease their reliance on the local resources (due to job creation by the project).	+	M	L	LT	M	C	45.0

#	Parameter	Impact	Attributes 3						
			Sign	Magnitude	Spatial Extent	Duration	Reversibility	Frequency	Weighted Score
26	Creation of new ecological niche and fire line	Clearance of vegetation for the ROW will create a no tree zone which will serve as a fire line as well as provide enough light and space for the emergence of new plant species.	+	L	SS	LT	I	C	47.6
27	Improvement of Socio-Economic Status	Strengthened economic activities by business and employment opportunities	+	M	L	LT	I	C	63.0
28	Expansion of Electrification	Strengthen the capacity of electricity grid in the west	+	M	R	LT	I	C	76.2
									-712.0

4.3.2 Comparison of Alternatives

202. The comparison of alternatives has been based on the most important components of the project such as the land stability, vegetation loss, loss of settlement areas and cultivated areas. The ranking from the pairwise comparisons has further supported the decision taken for the above-mentioned project activities for the selection of the most preferable project Alternative.

203. The final weightage of all the alternatives has been elaborated in the table below.

Table 40: Weighted sum of impacts for the different alternatives

S#	Parameter	Impact		Attributes 1		Attributes 2		Attributes 3	
			Weighted Score	Positive Impact	Negative impact	Positive Impact	Negative impact	Positive Impact	Negative impact
1	Terrain	Land instability and erosion	2.38		-21.4		-9.5		-11.9
2	Change in Land use	Project components to alter the land use pattern	2.65		-43.7		-41.0		-41.0
3	Rivers and water quality	Impact on current water sources	2.12		-23.3		-12.7		-10.6
4	Air quality	Change in air quality	1.59		-7.1		-7.1		-15.1
5	Noise	Increase in noise level	1.06		-4.2		-4.2		-9.5
6	Solid waste	Generation of disposal of solid and construction waste	1.59		-6.3		-6.3		-14.3
7	Climate	Impact on Climate	0.26		-4.5		-4.5		-4.5
8	Electromagnetic field	Health issues, interference to radio and telecom signals	0.79		-9.5		-9.5		-9.5
9		Electrocution effect on wildlife and bird	3.70		-48.1		-48.1		-48.1
10	Forest resources	Forest Fragmentation	7.14		-53.6		-82.1		-53.6
11		Loss of forest resources including NTFP and ethno	6.35		-76.2		-76.2		-50.8

S#	Parameter	Impact		Attributes 1		Attributes 2		Attributes 3	
			Weighted Score	Positive Impact	Negative impact	Positive Impact	Negative impact	Positive Impact	Negative impact
		botanically important plants							
12		Risk of forest fire	3.44		-27.5		-24.1		-24.1
13	Wildlife	Loss of wildlife and their habitat including species of conservation significance	6.08		-54.8		-54.8		-48.7
14	Avifauna	Bird habitat fragmentation	5.82		-81.5		-75.7		-75.7
15		Impact in sensitive/critical habitat at west-Rapti river valley	4.23		-93.1		-93.1		-93.1
16	Protected Area	Impact on protected area	5.82		-98.9		-98.9		-98.9
17	Physical displacement	Land Acquisition for both permanent and temporary usage	6.08		-70.0		-63.9		-94.3
18	Economic displacement	Impact on livelihood	4.50		-49.5		-45.0		-67.5
19	Physical Infrastructures	Increased stress on community infrastructures such as health care, school, drinking water, solid waste management	2.12		-10.6		-10.6		-10.6

S#	Parameter	Impact		Attributes 1		Attributes 2		Attributes 3	
			Weighted Score	Positive Impact	Negative impact	Positive Impact	Negative impact	Positive Impact	Negative impact
20	Access to natural resources	Use of local water supply and NTFP products	2.91		-16.0		-13.1		-13.1
21	Health and safety risks	Community health and safety risks; Communicable diseases	0.26		-1.7		-1.2		-1.5
22	Aesthetic and Natural Beauty	Impacts to visual resources due to changes between the existing landscape and project activities	1.06		-9.5		-8.5		-8.5
23	Agricultural Resources	Loss of crops within the project area.	4.76		-52.4		-45.2		-69.0
24	Vulnerable groups	Impacts on gender, indigenous and disadvantaged or vulnerable groups	6.08		-45.6		-39.6		-70.0
25	Enhancement in conservation of local wildlife	Biodiversity conservation awareness programs will enhance the knowledge of the local community and decrease their reliance on the local resources (due to job creation by the project).	4.50	31.5		63.0		45.0	

S#	Parameter	Impact		Attributes 1		Attributes 2		Attributes 3	
			Weighted Score	Positive Impact	Negative impact	Positive Impact	Negative impact	Positive Impact	Negative impact
26	Creation of new ecological niche and fire line	Clearance of vegetation for the ROW will create a no tree zone which will serve as a fire line as well as provide enough light and space for the emergence of new plant species.	3.97	27.8		67.5		47.6	
27	Improvement of Socio-Economic Status	Strengthened economic activities by business and employment opportunities	4.50	36.0		81.0		63.0	
28	Expansion of Electrification	Strengthen the capacity of electricity grid in the west	4.23	72.0		76.2		76.2	
				167.2	-909.1	287.6	-875.0	231.7	-943.8

204. The study for Alternative 1 showed high risk for the tower construction as it would lie along the Chure region with steep and unstable land. Almost 45% of the towers will be situated in the steep slopes which might impact the project. The alternative has the least number of river crossings but physical displacement and acquisition of private land for the tower and RoW is comparatively high when compared to the alternative 2.

205. For Alternative 3, in terms of stability of the tower structures it is the best route as the alignment passes through the terai lands where the slopes are not steep and are stable. However, since the transmission line for this alternative pass through the terai land, the acquisition of land (438.2 ha) is envisaged to be the highest among all three alternatives (A1: 50.1 ha and A2: 11.6 ha). Similarly, the transmission line alignment and ROW also influences the cultivated lands. This alternative induces many cumulative impacts to the communities living along the transmission line. Loss of settlement area, cultivable land and decrease in productivity of land in this alternative will trigger the economic and livelihood of the people residing. Furthermore, there are also people from the indigenous and vulnerable communities residing in this alignment, hence the alternative was discarded.

206. The Alternative 2 has been chosen for the project as the final route of the transmission line. The stability of land for the construction of towers is distributed among both the flat lands and the Chure. However, with proper mitigation measures, the slope stability can be managed and maintained. The tree loss in this alternative is considerable when compared with the other two alternatives. However, the project has considered to raise the tower height which will reduce the number of trees felled from 100% to 15%. Furthermore, as shown in Table above, the alternative 2 scores the lowest accumulated value of weighted impact (i.e., -587.4), mainly because of the reduced acquisition of the land for the project components with further lessened impact on the Vulnerable and indigenous communities in respect with the other solutions where the acquisition of land and the impact on these vulnerable communities are much more. The other alternatives rank from lower to higher impact in the following order: A1 (weighted score -741.9) and A3 (-712.0).

4.3.3 HV Power Lines – Minor Alignment Changes

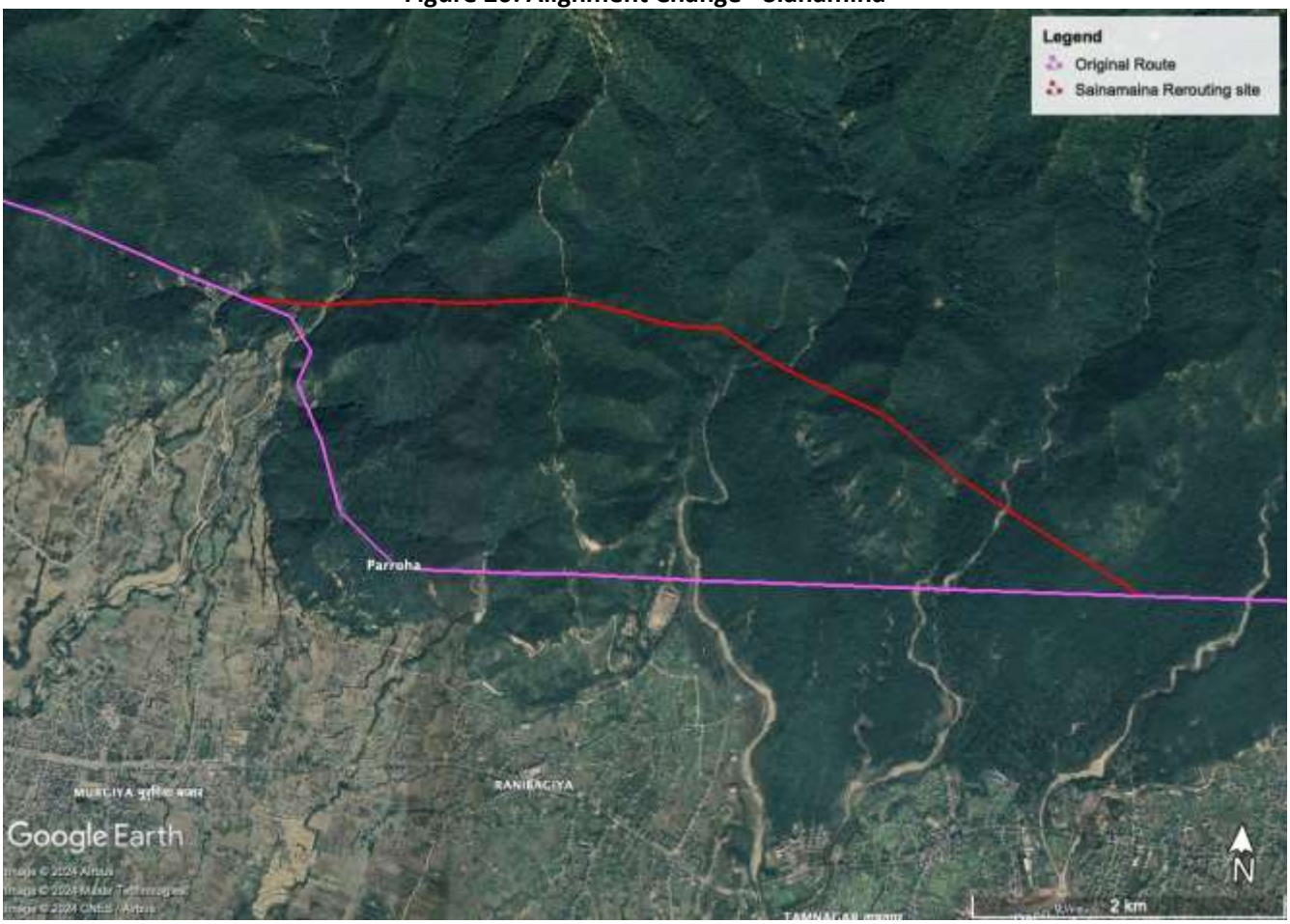
207. Following on from the alignment selection, a number of minor alignment changes to the selected alignment have adopted based on the findings of the impact assessment. Broadly speaking these alignment changes related specifically to potential impacts on biodiversity and cultural heritage. The following two sub-sections provide details relating to these alternatives.

Cultural Heritage Alignment Changes

208. Based on the Projects assessment of cultural heritage five sites have been identified where alignment changes have been made.

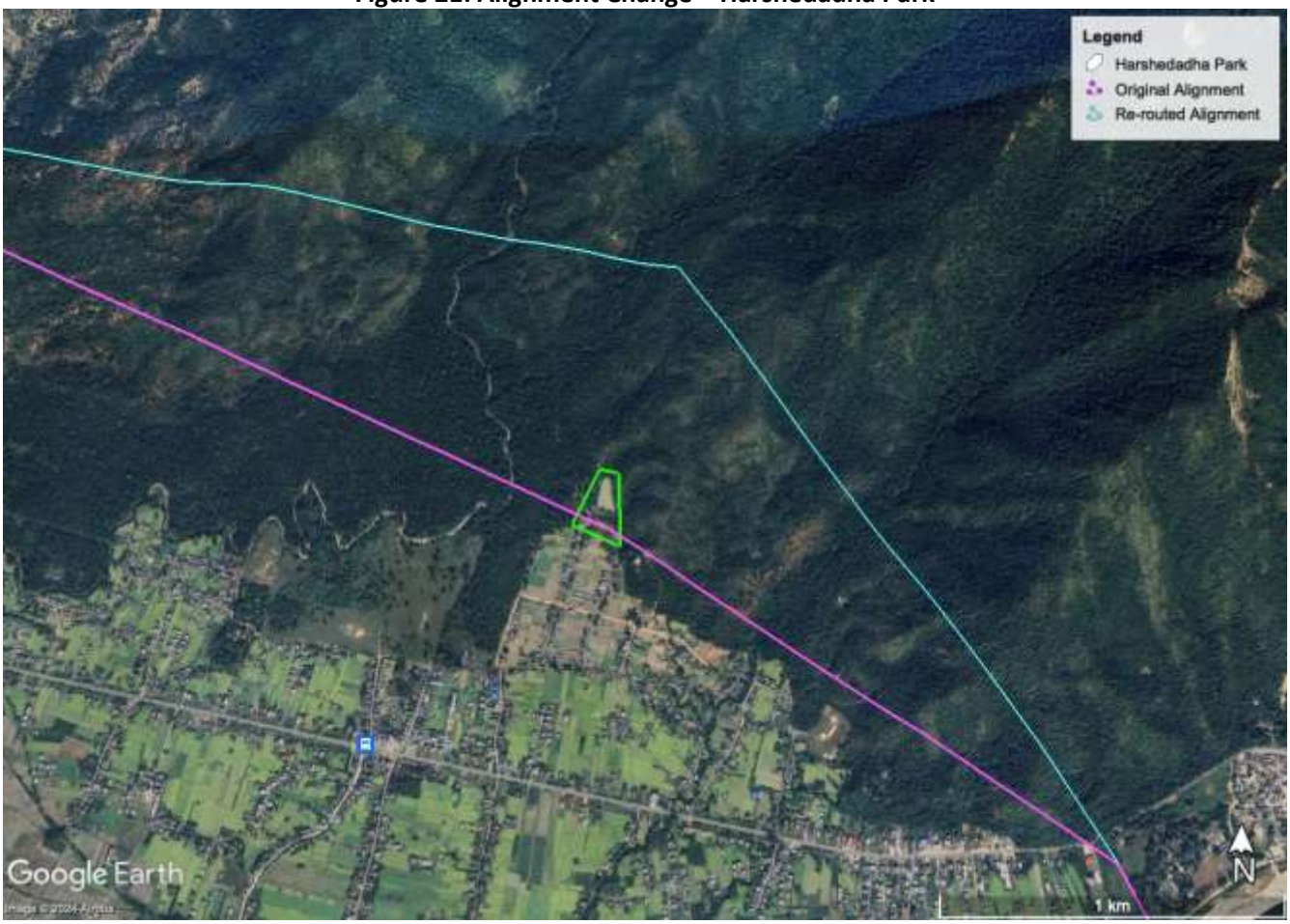
209. **Sainamina** - This site has been recorded as an archaeological site in various reports and is included in an inventory prepared by UNESCO / Tokyo University Team that also identified visible and potential areas. Site visits revealed bricks and pottery shards along the alignment of the TL and the location where the foundation of a tower would have been located (1). Further field walking (observing the surface) was carried out within the 'potential zone' to the north, where no archaeological vestiges were found (2). Observations were also carried out across the stream to the north, where the new alignment of the NBTL has been proposed (3). No surface archaeology was found in this area. Based on the findings of the survey, and recommendations of a heritage impact assessment carried out by the Department of Archaeology the planned alignment has been moved north of the stream as shown in Figure 20.

Figure 20: Alignment Change - Sianamina



210. **Harshedadha Park -** The site consists of a park area with a shine dedicated to Kalika. The small temple was built around 1994-1995 (2051/52 BS). The park has been recently established through the Municipality, and the pond was also built possibly between the past two decades. Recommendations from the community were made to move the alignment to the north. Alignment changes have been made to bypass this site to the north, a further 800m to avoid the park and move further north of a vulture feeding site.

Figure 21: Alignment Change – Harshedadha Park

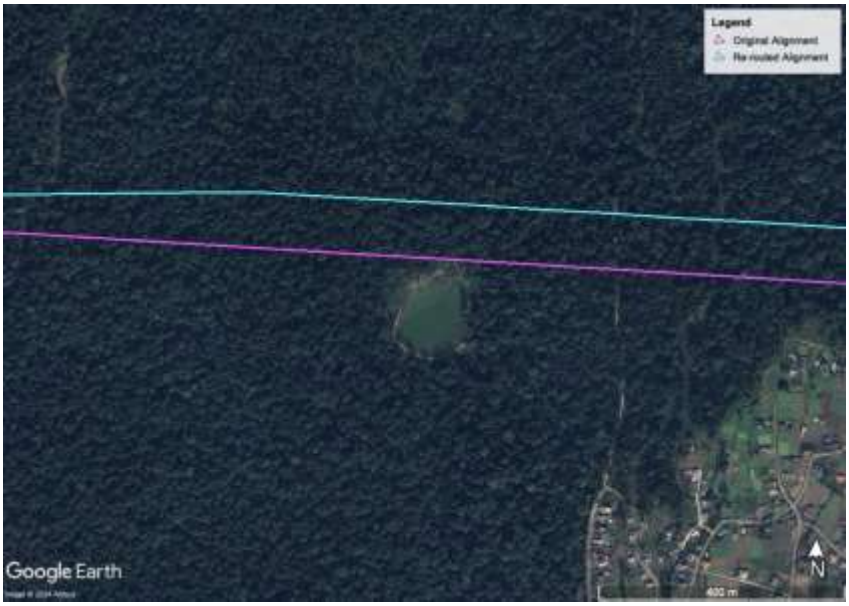


211. **Manimukunda Sen Park -** This site has been recorded as an archaeological site in various reports and is included in an inventory prepared by UNESCO / Tokyo University Team that also identified a potential area. The remains of the palace of king Manimukunda Sen from the 16th century CE is located within the park, but away from the proposed TL alignment (1). The park extends up the hill, and several new structures have recently been built near the NBTL alignment (2). The alignment of the TL does not impact any historic or archaeological site. However, the Manimukunda Sen Park is run by a committee which has plans to expand the park. Accordingly, the alignment has been shifted approximately 20m north to stay further from the park.

Figure 22: Alignment around Maniukunda Sen Park

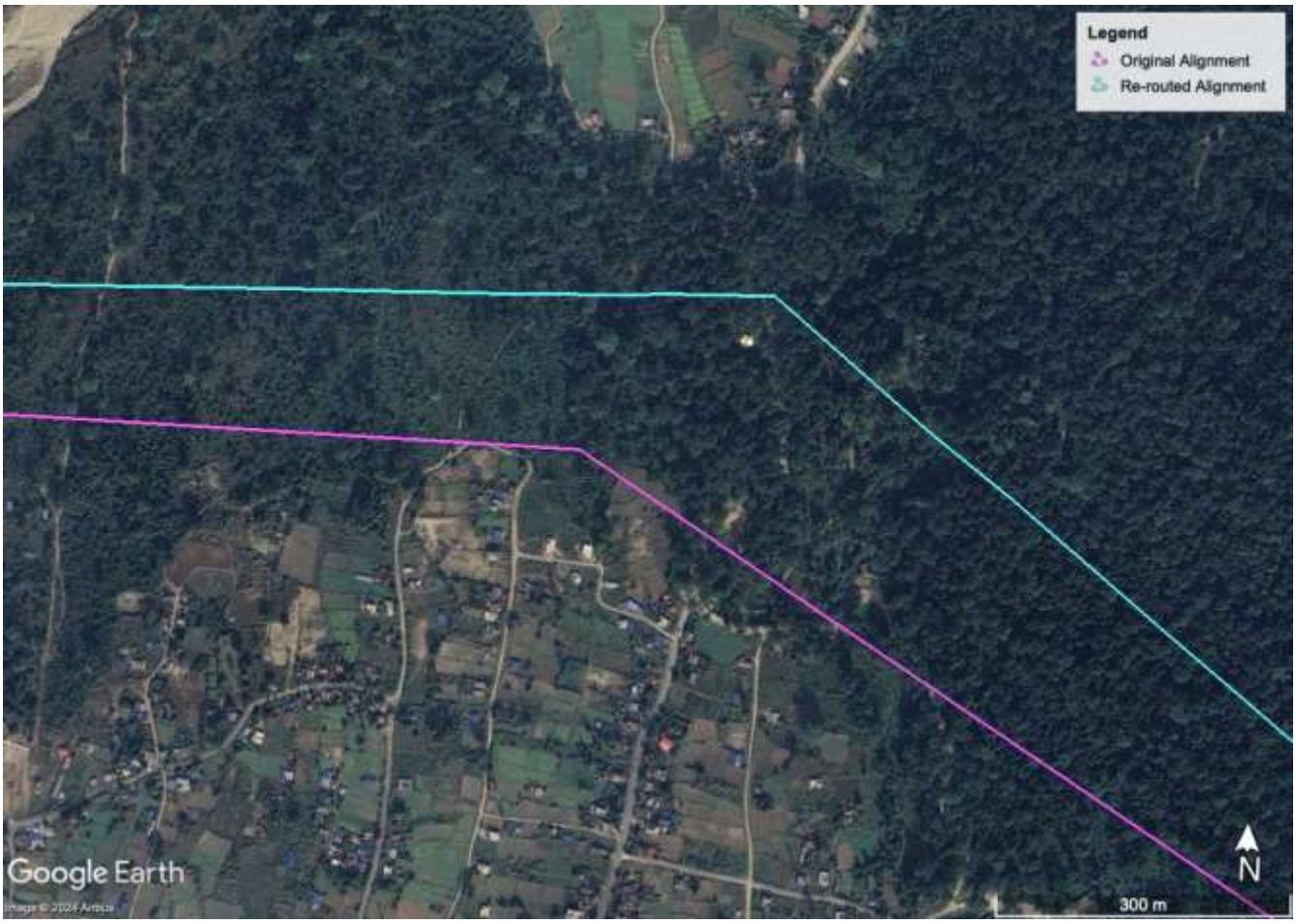
212. **Devdaha -** This site was identified on Google Map and this site has been is included in an inventory prepared by UNESCO / Tokyo University Team that also identified a visible and potential areas. Devdaha, the pond of the gods, is also the name of the municipality. In the UNESCO / Tokyo University inventory, the site is called Ghodaha, and the pond 'Dewdaha', and information they collected assumes that source of the pond and the pond are there from ancient times. There is no written source to justify this. The alignment has been shifted 100m north of the original planned alignment to ensure that the NBTL is kept behind the existing tree line and provide privacy to this site.

Figure 23: Alignment Change around Devdaha



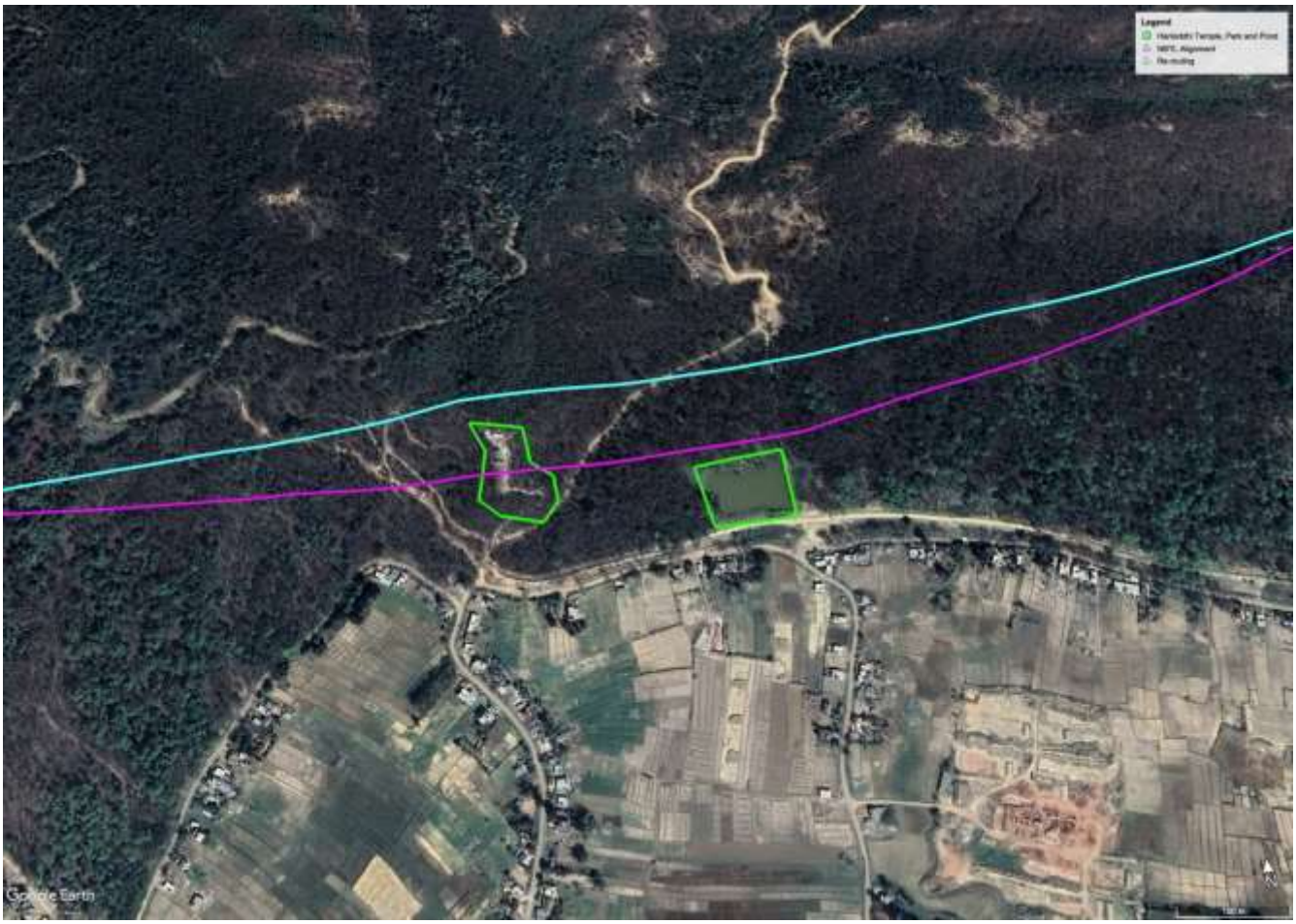
213. **Gautam Buddha Park -** The Gautam Buddha Park is located on the northern edge of the Shivalaya Tole of Devdaha Municipality. It covers an area (1) extending into the community forest up to the water tank (2). The park consists of a Durga temple that was recently shifted there from across the road. The park also contains a woodcarving workshop and display run by Lalitkala (from Lalitpur, Kathmandu). There are also picnic spots and people pay an entry fee, with large crowds gathering on weekends and holidays. Beyond the forest is Daunne Village (3). Based on consultations with the community the alignment has been shifted north to avoid direct impacts on the park.

Figure 24: Alignment Change around Guatam Buddha Park



214. **Harisiddhi Temple, Park and Pond** - Holy bath at the pond and then worship at the temple at Maghe Sankranti. It is important site for Indigenous Tharu Community. The alignment has been shifted slightly north to avoid impacting directly on this area, on the request of the community.

Figure 25: Re-routing around Harisiddhi Temple, Park and Pond

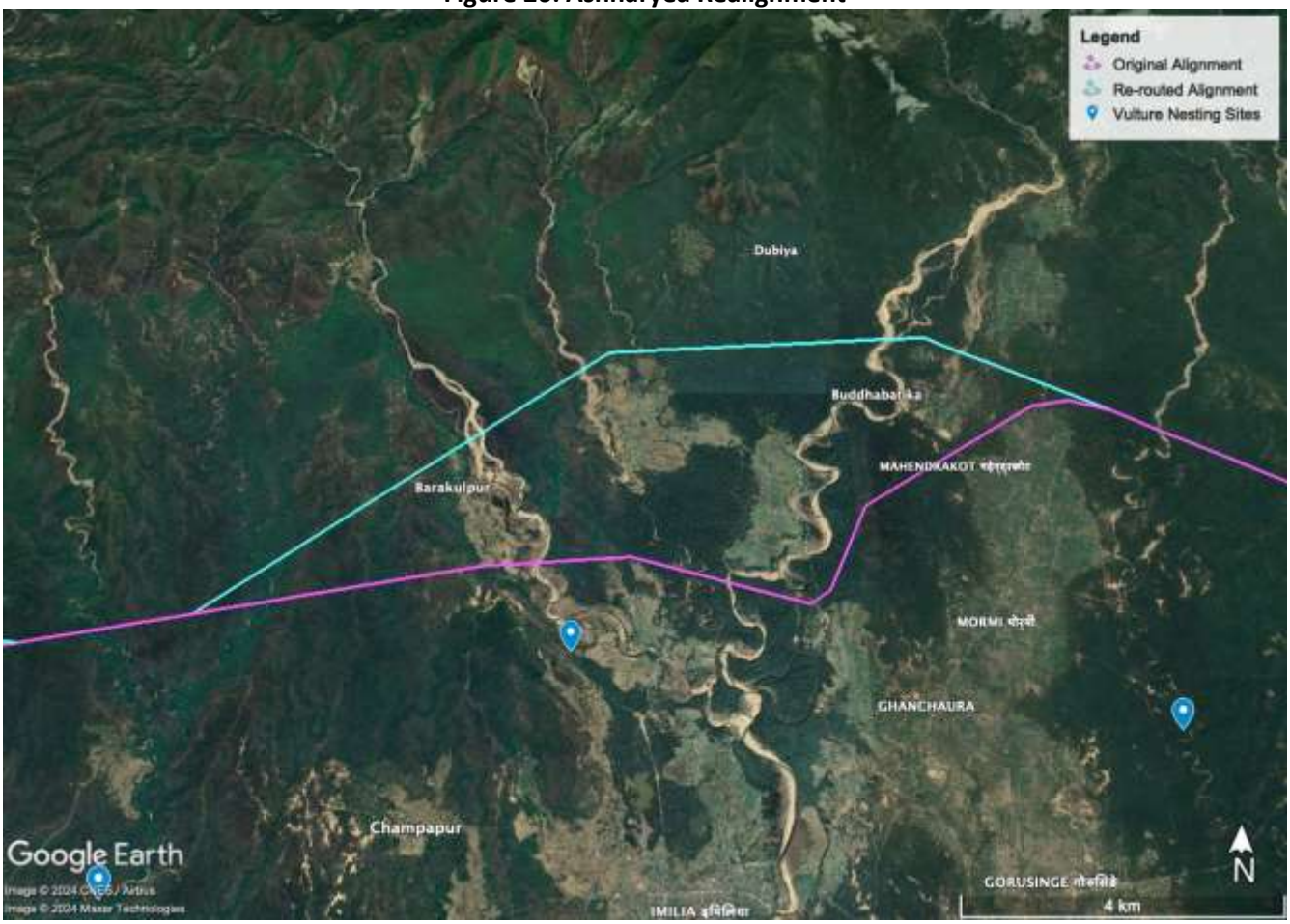


Biodiversity Alignment Changes

215. This impact assessment, and its surveys and consultations with Bird Conservation Nepal (BCN), has identified several sites where special status species are at risk of being significantly impacted by project works. Where practical the alignment has been re-aligned to reduce the potential significance on these species. Of particular concern is the proximity of one nesting site and a vulture restaurant

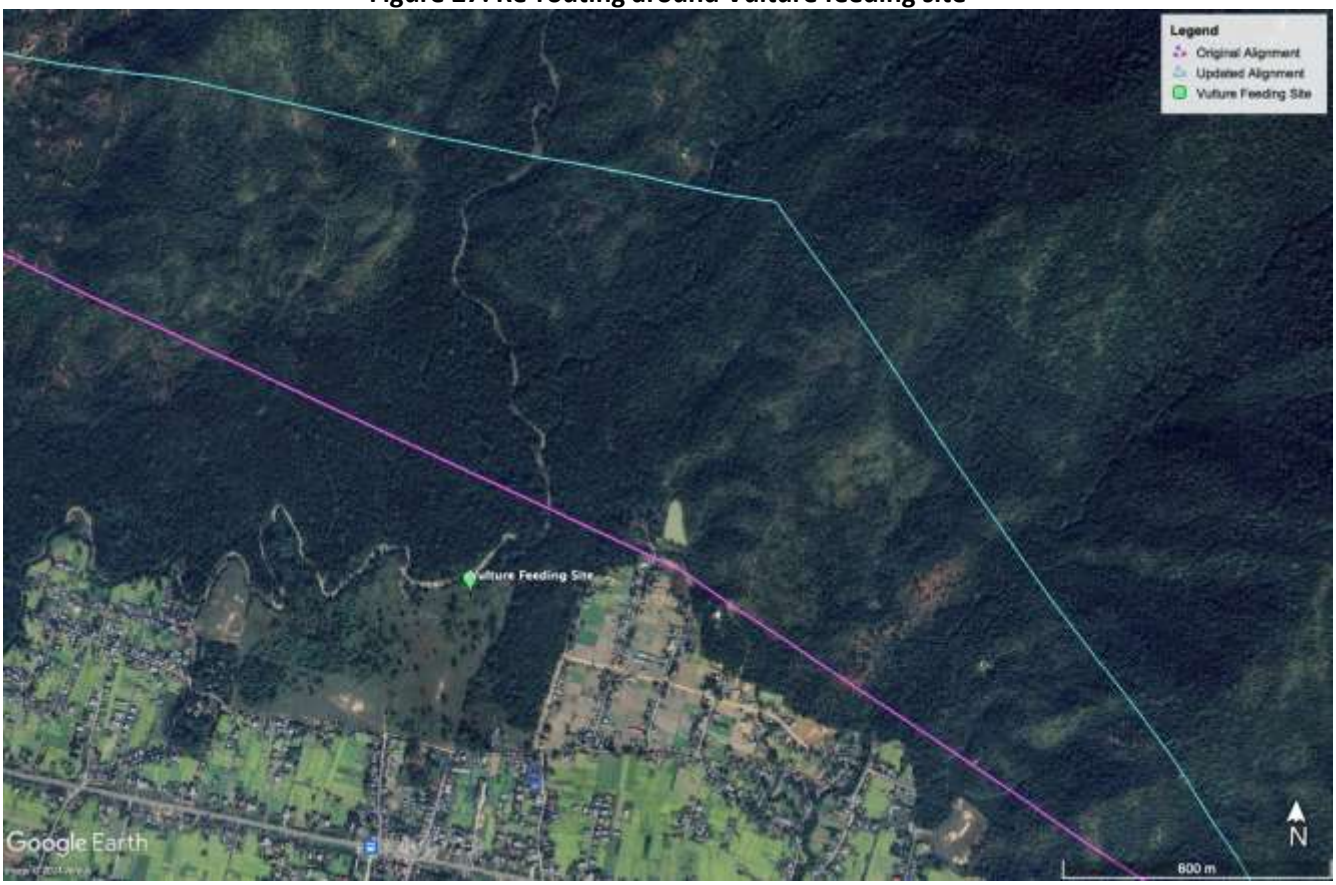
216. **Vulture Nesting Site – Ashnaryea.** The planned alignment was located approximately 1.3km from the nesting sites. Based on stakeholder feedback and discussions with NEA on engineering constraints, the alignment has been moved to be more than 3.5km from the nesting site at its nearest point, a shift of more than 2km from the original route.

Figure 26: Ashnaryea Realignment



217. **Vulture Restaurant - Lalmatiya, Dang district.** The planned alignment was very close to the area where carcasses are being dumped, approximately 300m. The alignment has been re-routed a further 800m to the north of the feeding site, approximately 1.1km from the feeding area.

Figure 27: Re-routing around Vulture feeding site



Other Alignment Changes

218. **Shivapur Forest** – in this location the alignment has been moved from the western side of the highway to the eastern side. The rational for the change is twofold; firstly from a technical perspective crossing the highway at two points is more complicated and involves more safety risks, both during construction and operational phases. Secondly, shifting the alignment away from residential properties was required to avoid resettlement and compensation payments. It should also be noted that the re-routing runs broadly parallel to the existing 132kV line, meaning that access to this area of the forest has already been opened up by this line. West of the highway the forest will remain undisturbed.

Figure 28: Shivapur Forest Re-routing

219. Further alignment adjustments were made south of the Shivapur forest to avoid agricultural land, see Figure 29.

Figure 29: Re-routing around agricultural land

4.3.4 HV Power Lines – Final Alignment Changes

220. Further alignment changes at some locations may be necessary and will be determined during the detailed design prepared by the EPC Contractor and based on the findings of the additional vulture surveys recommended as part of this EIA. These changes may also occur as a result of additional information received during the document disclosure period. This EIA will be updated during detailed design considering any of the alignment changes.

4.4 Alternative Tower Designs

4.4.1 Span

221. The design of the tower and foundation heavily relies on the selection of the ruling span. Increasing the ruling span helps minimize the number of towers, but it necessitates heavier and taller tower structures to maintain the required ground clearance. On the other hand, shorter ruling span results in a higher number of towers, leading to increased land acquisition. Therefore, an optimal standard ruling span has been adopted, considering a balance between minimizing the number of towers and ensuring manageable tower structures and land requirements.

4.4.2 Tower Height

222. Within the project design, alternate heights of Towers were considered. The primary purpose of the height alternate is to minimize the number of trees to be fell. In accordance with the Nepal Electricity Rules 2050, the vertical clearance between top of the tree canopy and the conductor must be 7 m, that means the taller trees that cannot maintain vertical gap will have to be felled. Two alternate heights of the towers were thus considered:

a) Alternate A - 40 m tower height

b) Alternate B - 90 m tower height

223. Under the proposed alignment, a total of 177,900 numbers of different tree species (pole size and tree size together) will have to be removed. Most of the trees fall within the Community Forests and some of the area is under National Forest.

224. By increasing the tower height to 90 m, it became possible to avoid clearing 75% of the estimated trees, while still maintain a safe vertical and horizontal gap between the tree canopy and the conductor. This approach aimed to preserve the forest in the RoW. The 25% of trees that exceeded 20m in height would only be cut. However, for construction purposes, tower pad and substations, approximately 46,1 00 tree will still need to be cleared.

4.5 Alternative Substation Design

225. The selection between GIS and AIS for the 400 kV substation was determined through a specific study. Several considerations need to be considered during the selection process, including:

- Reliability -GIS typically offers higher reliability compared to AIS.
- Climate resistance- GIS is not affected by climatic variations such as wind and rain making it particularly suitable for higher rated voltages where insulation and switch operation reliability are crucial.
- Remote operation- GIS enables easier, safer, and more efficient remote operation.
- Operational organization- GIS allows for streamlined operation by centralizing control in the control room.
- Cost - The initial cost of GIS is higher than AIS when considering the equipment alone. However, inclusion of cost for the land, can make GIS more cost effective.
- Installation requirement - The installation of GIS requires a clean environment and specialized assistance from the manufacturer.
- Space and time efficiency - GIS require less space, involves fewer civil works, and has a quicker installation process compared to AIS.

226. A negative aspect of GIS is the requirement of sulphur hexafluoride (SF6) as the insulating gas. SF6 is a potent greenhouse gas (GHG) with a global warming potential 20,000 times greater than CO2.

227. The recommended solution for the proposed substation is to implement a GIS-type installation. The choice enables the installation of all the required bays, and it provides flexibility in optimizing the layout of

the substation by allowing rotation of the building housing GIS and the gantry for line connections. It is worth noting that despite most of the designated area being allocated for the 220 kV sector, the GIS version can still accommodate the 400 kV substation sector within the identified area. This highlights the versatility and adaptability of the GIS solution, making it an advantageous choice.

V. IEE APPROACH

5.1 Assessment Boundaries

228. The boundaries of the assessment (or the project area of influence) have been divided depending upon the specific environmental and social characteristic to be affected and the type of activity. For example, the potential area of impact for operational phase noise around a HV substation will be different to the potential area of impact upon soils which will be confined to the areas within the substation boundary. These boundaries are defined in Section 7 as part of the overall assessment process.

5.2 IEE Methodology

229. The methodology used to prepare this EIA is based on the requirements of ADB's Safeguard Policy Statement (2009) and the joint experience of the consultants involved in the EIA.

5.2.1 Desk-top Data

230. Background data and information collected by the team was obtained from published and unpublished sources, e.g., on climate, topography, geology and soils, natural resources, flora and fauna, agriculture, and socio-economic data. Review of alignments using google earth was undertaken. References to all sources used is made throughout the report.

5.2.2 Site Surveys

231. Several site inspections of the Project area were conducted during 2023 and 2024. The substation sites were visited and where practical (due to access constraints and length of the lines), portions of the NBTL route were observed by the EIA team.

232. The potential areas of impact have been inspected by the EIA Team during 2023-2024 and areas of potential environmental significance assessed carefully. Baseline ecological walkover surveys in 2023 and instrumental physical environment monitoring (by an accredited laboratory in 2023/2024) has also been undertaken. Socio-economic surveys by the ADB TA Social Safeguards Consultant Team (responsible for preparation of the Project Resettlement Plan) have been completed in 2023-2024

Table 41: Physical Monitoring and Surveys Undertaken

Topic	Survey
Noise	Monitoring of baseline noise conditions
Air	Monitoring of baseline air quality
Water	Monitoring of water quality
Social	Socio-economic Survey and Census
Biodiversity	• Bird Survey • Reptile survey • Forest density and quality survey
Cultural Heritage	Survey of key cultural heritage sites along the alignment
General site visit	To observe general site characteristics as well as the immediate areas around substations

Figure 30: Wildlife Survey Locations

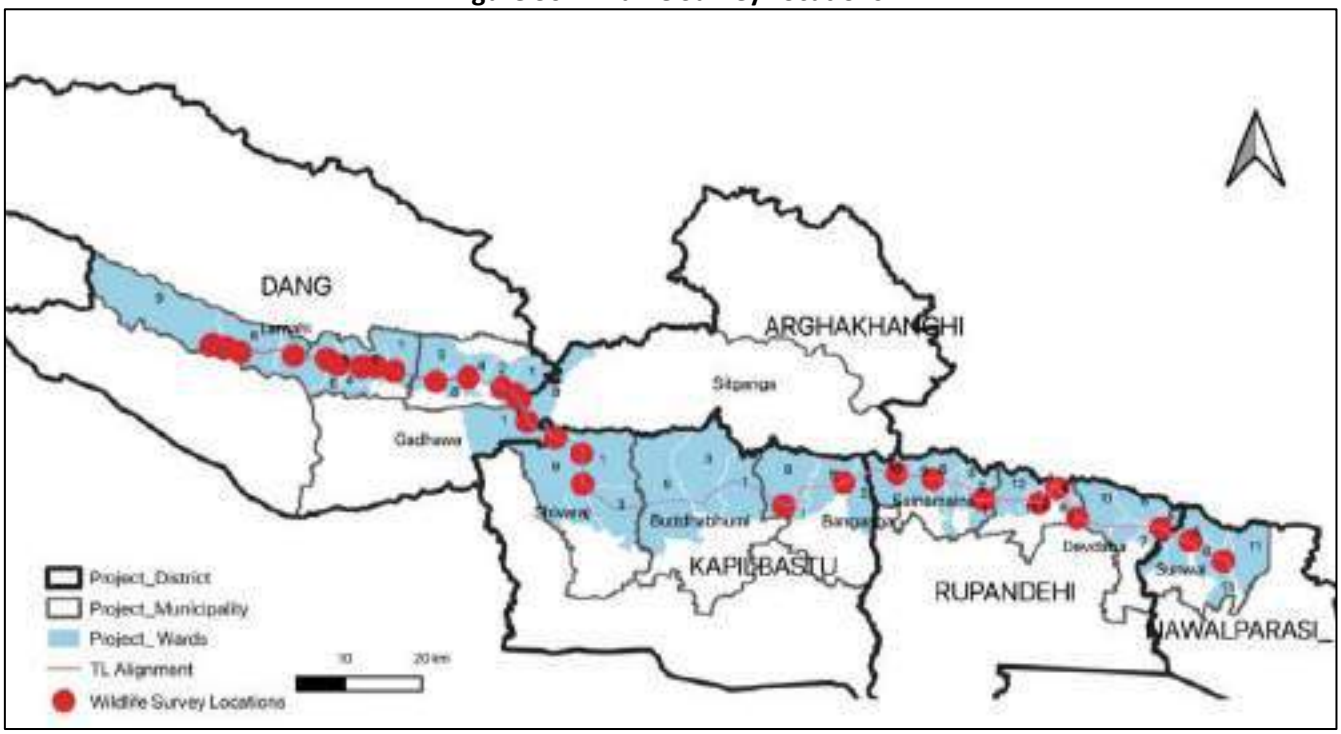


Figure 31: Reptile Survey Locations

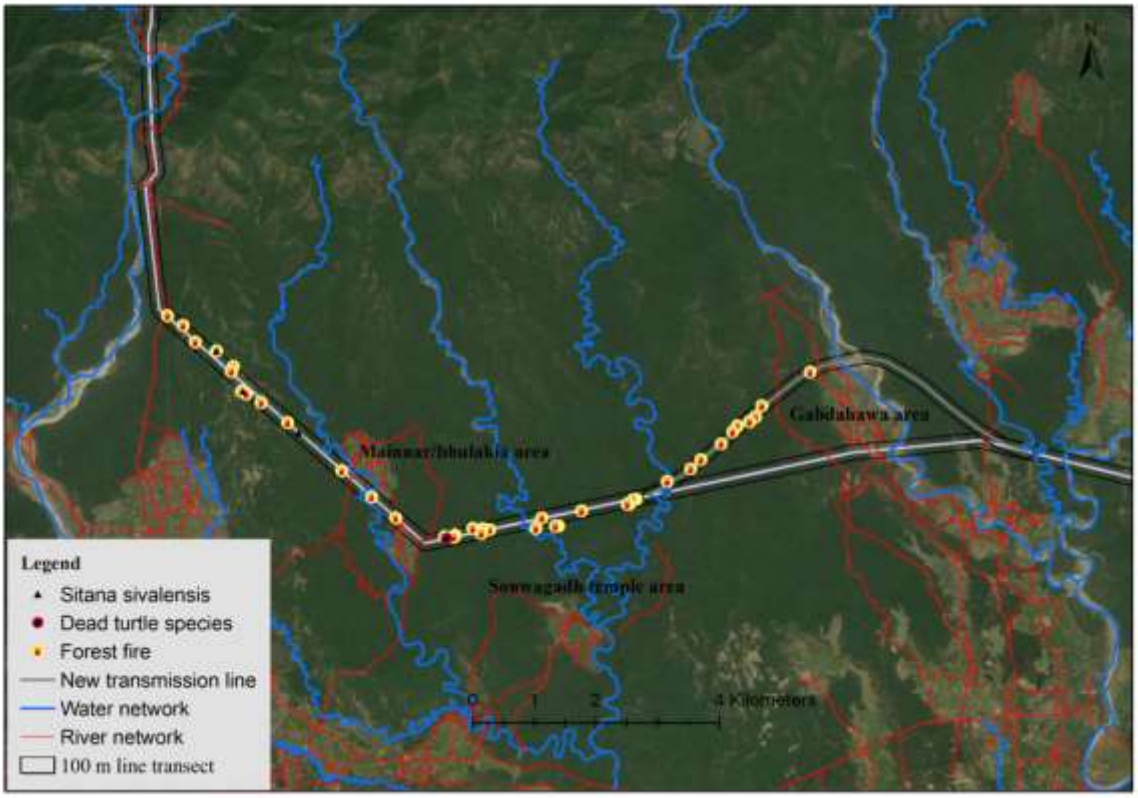


Figure 32: IEE Instrumental Monitoring Locations

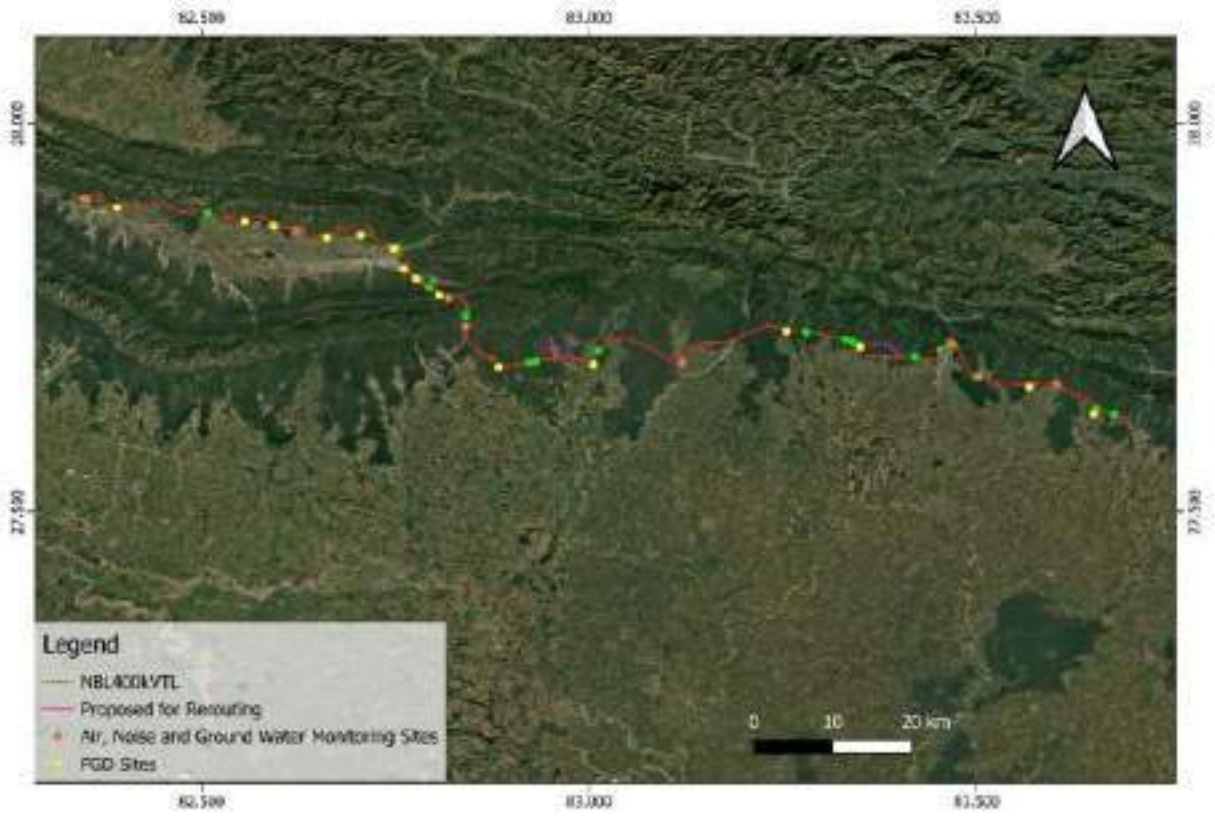
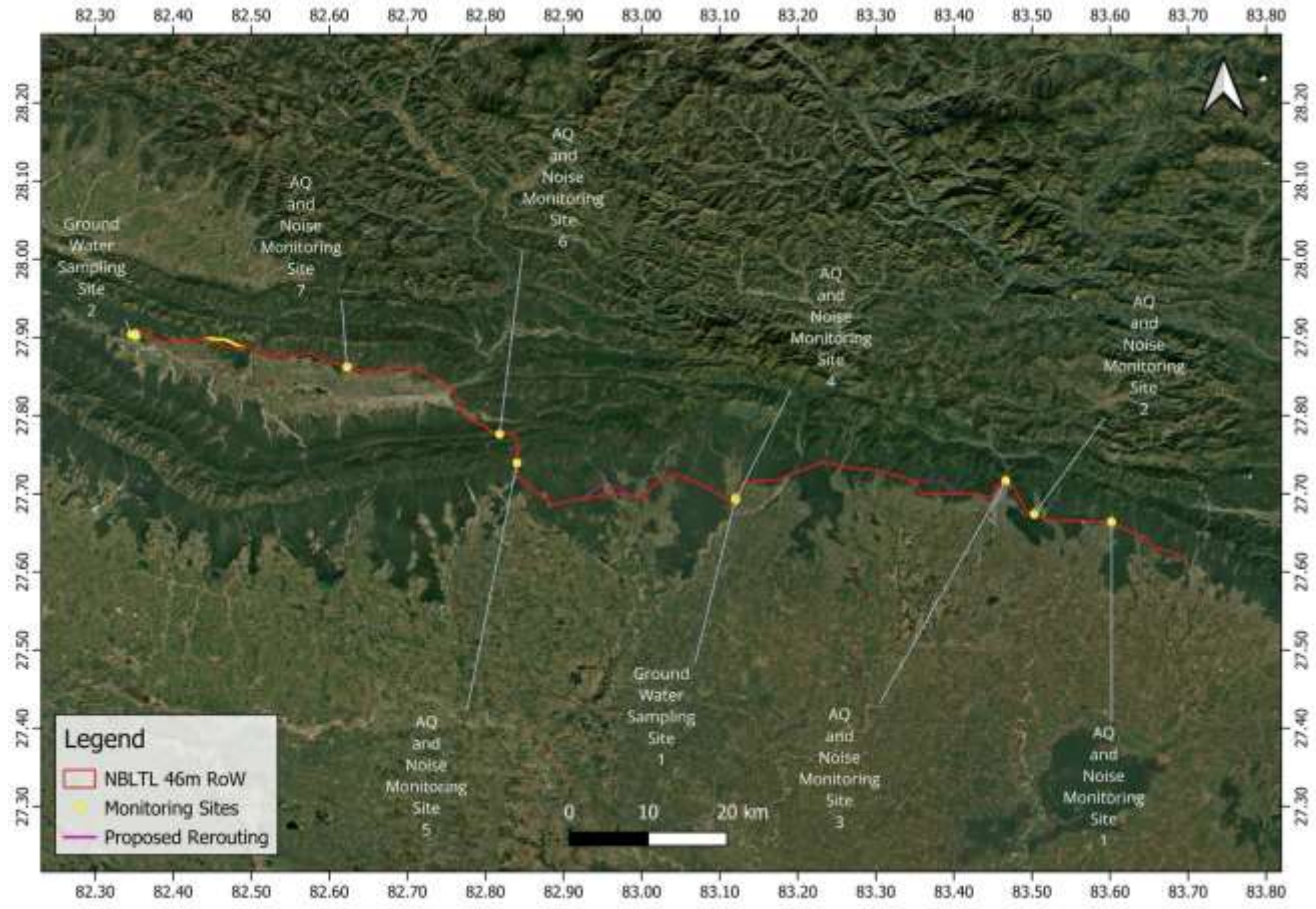


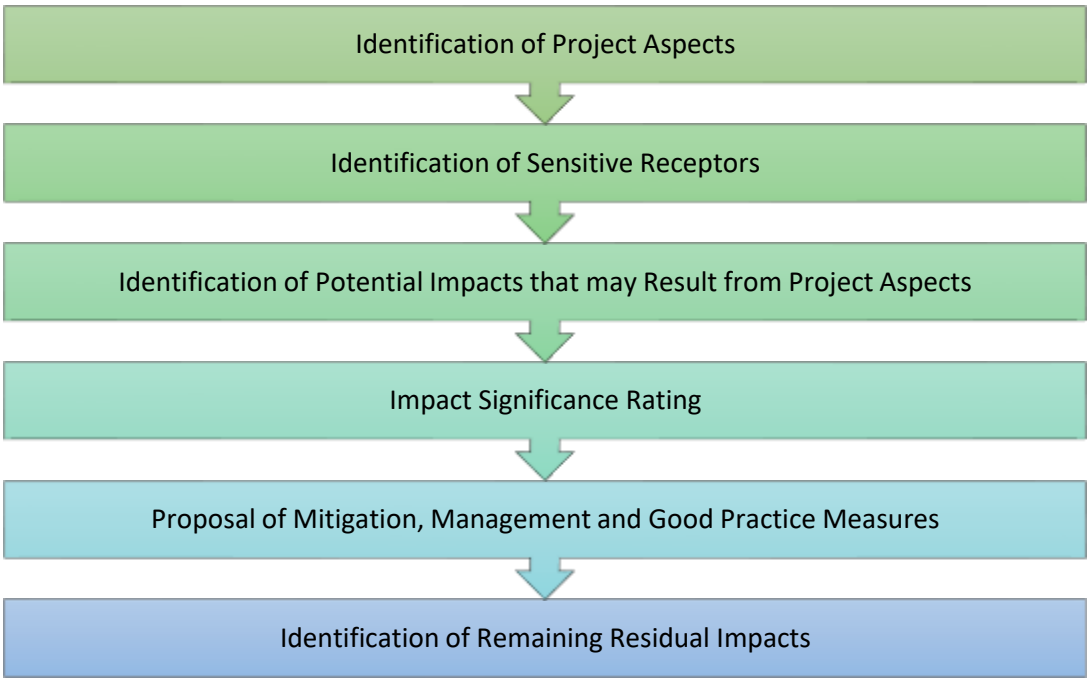
Figure 33: EIA Instrumental Monitoring Locations



5.2.3 Impact Assessment Methodology

233. This EIA follows a set format during the impact assessment process. As shown in the flow chart and described further below.

Table 42: Impact Assessment Process



Project Aspects

234. Firstly, the main environmental aspects of the Project are noted. An environmental aspect is any activity of the Project that interacts with the environment. E.g., an aspect of the Project that may impact upon air quality will be the movement of construction vehicles on unpaved roads through rural settlements.

Identification of Sensitive Receptors

235. Once the main aspects of the Project have been identified any sensitive receptors within the Project area of influence are noted. Examples of sensitive receptors include residents, rivers, groundwater, birds, etc. Identification of receptors is a key part of the impact assessment process as without a receptor there will be no impact. For example, if a substation generates significant noise but there are no sensitive receptors who can hear the noise, then there will be no noise impact on them.

Identification of Impacts

236. Thirdly, the potential impacts of the identified aspects are outlined and how they could impact upon the identified receptors, in the case above, this could be the movement of a construction vehicles creating dust on an unpaved road which impacts upon local villagers.

Impact Significance Rating

237. The Environmental Protection Regulations 2020 and National Environmental Impact Assessment Guidelines 1993 provide methodology for assessing the intensity of impact, which include magnitude, extent, and duration.

238. ***Magnitude*** of impact determines the severity of the impact and whether it is reversible of irreversible. It is often categorized as high (H), moderate (M), or low (L).

239. ***Extent of impact*** refers to the spatial reach or zone of influence of an impact. As impact can be site-specific (SS) if it is confined to the Right of Way (RoW) and within the substation site of the project area, locally occurring (L) if it happens within a range of 100m up to 300m from the transmission line or the tower or substation, or regional ®if it extends beyond the entire district or even further.

240. The ***Duration of impact*** relates to the time frame involved and can be categorized as follows: short-term (ST) for the impacts lasting up to 4 years, medium-term (MT) for the impacts that persist for more than 4 years but less than 20 years, and long-term (LT) if the impacts lasting more than 20 years.

241. Additionally, impacts occurring during the construction period are typically considered short-term, while those continuing for 1 – 2 years of operation fall under the medium-term category. Impacts that arise during the operational period are generally regarded as long-term.

Table 43: Impact prediction criteria (Source: EPR 2077)

Impact criteria	Magnitude			Extent			Duration		
Impact category	High [H]	Medium [M]	Low [L]	Regional [R]	Local [L]	Site-specific [SS]	Long-term [LT]	Medium-term [MT]	Short-term [ST]
Impact score	60	20	10	60	20	10	20	10	05

242. The ranking of impacts plays a crucial role in assessing the overall predicted impact and its potential significance for both the decision-making process related to mitigation measures and the project itself. These impact qualifiers are combined to determine their significance, which can be categorized as highly significant, moderately significant, or insignificant. The significance of an impact reflects its potential to influence and potentially modify the existing environmental condition

243. For the identification and prediction of impact significance, the following scoring method will be employed based on expert judgment

Table 44: Categorization of impact significance

Categorization of impact significance	Highly significant	Moderately significant	Low significant
Score	Greater than 75	45 to 75	Less than 45

Source: EPR 2077

Mitigation, Management and Good Practice Measures

244. Wherever the Project is likely to result in unacceptable impact on the environment, mitigation measures are proposed (over and above the inherent design measures included in the Project description). In addition, good practice measures may be proposed however these are unlikely to change the impact significance. In the case of positive impacts, management measures are suggested to optimize the benefits to be gained.

245. The following mitigation hierarchy will be utilized in selecting practical mitigation measures for unacceptable impacts as follows (in order of preference):

- Avoid the impact wherever possible by removing the cause(s).
- Reduce (minimize) the impact as far as possible by limiting the cause(s).
- Ameliorate (mitigate) the impact by protecting the receptor from the cause(s) of the impact.

Residual Impacts

246. Once mitigation measures are declared and committed to, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation measures.

247. The final step is providing compensatory measures to offset the impact, particularly where an impact is of high significance and none of the above are appropriate, e.g., for impacts to natural and critical habitat.

5.2.4 Stakeholder Consultations

248. According to the ADB Safeguard Policy Statement (2009):

> "The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation. Meaningful consultation is a process that:
>
> (i) Begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle;
> (ii) Provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people;
> (iii) Is undertaken in an atmosphere free of intimidation or coercion;
> (iv) Is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and
> (v) Enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.
>
> Consultation will be carried out in a manner commensurate with the impacts on affected communities. The consultation process and its results are to be documented and reflected in the environmental assessment report."

249. NEA have led stakeholder engagement activities. The stakeholder engagement has been undertaken with the support of the EIA team and the findings presented in this EIA. To date consultations have involved over 600 people. Further consultation on the draft EIA will be completed during disclosure.

VI. DESCRIPTION OF THE ENVIRONMENT

6.1 Introduction

250. This section presents a description of the environmental baseline conditions, firstly at the state level and then at the sub-activity level covering the following topics. Ecological walkovers and socioeconomic surveys were conducted in 2023 & 2024 whilst the water, air, soil and noise data were collected in 2023 and 2024:

Table 45: Data Types

		Primary Data	Secondary Data
Physical Environment			
1	Topography	No	Yes
2	Geology and Soils	No	Yes
3	Geohazards	Yes	Yes
4	Climate and Climate Change	No	Yes
5	Climate hazards	No	Yes
6	Hydrology, Water Quality and Water Use	Yes	Yes
7	Air Quality	Yes	No
Biological Environment			
1	Protected and Notable Ecological Areas	No	Yes
2	Notable Habitat	Yes	Yes
3	Notable Species	Yes	Yes
Socio-Economic Environment			
1	Administration and Demographics	Yes	Yes
2	Local Economy	Yes	Yes
3	Tourism	No	Yes
4	Land Use and Landscape	No	Yes
5	Infrastructure	Yes	Yes
6	Noise and Vibration	Yes	No
7	Physical Cultural Resources and Cultural Landscape	Yes	No

251. In this section, the environmental setting of the project is discussed first at state and then at the site level, followed by environment baseline monitoring from the substation sub-activity project areas of influence.

6.2 Physical Environment

6.2.1 Topography

252. The NBTL is in the Siwalik Region and partially in Terai Region mostly in the Bhabhar Zone (71% through hills of Chure Region). The alignment commences in Nawalparasi-West and terminates at Lamahi in Dang District. Initially, the alignment traverses through flat Terai region. The starting point of this alignment is at the forested area of Sunwal Urban Municipality, which located close to the Sarbottam Cement Factory. From East to West the alignment runs parallel to Main Frontal Thrust at flat plains, follows Siwalik foothills, and crosses it before rising the Siwalik Hill (reaching Its highest elevation at 550 meters above sea level (masl) and descending to the West Rapti River Valley where It terminates at flat plains of Lamahi SS at 255 masl.

253. The proposed Lamahi SS is situated within the Lamahi Municipality, specifically in ward no. 9, covering an area of 11 ha. The SS is positioned in the Terai region, which is characterized by the flat terrain.

Figure 34: Topography of the Region

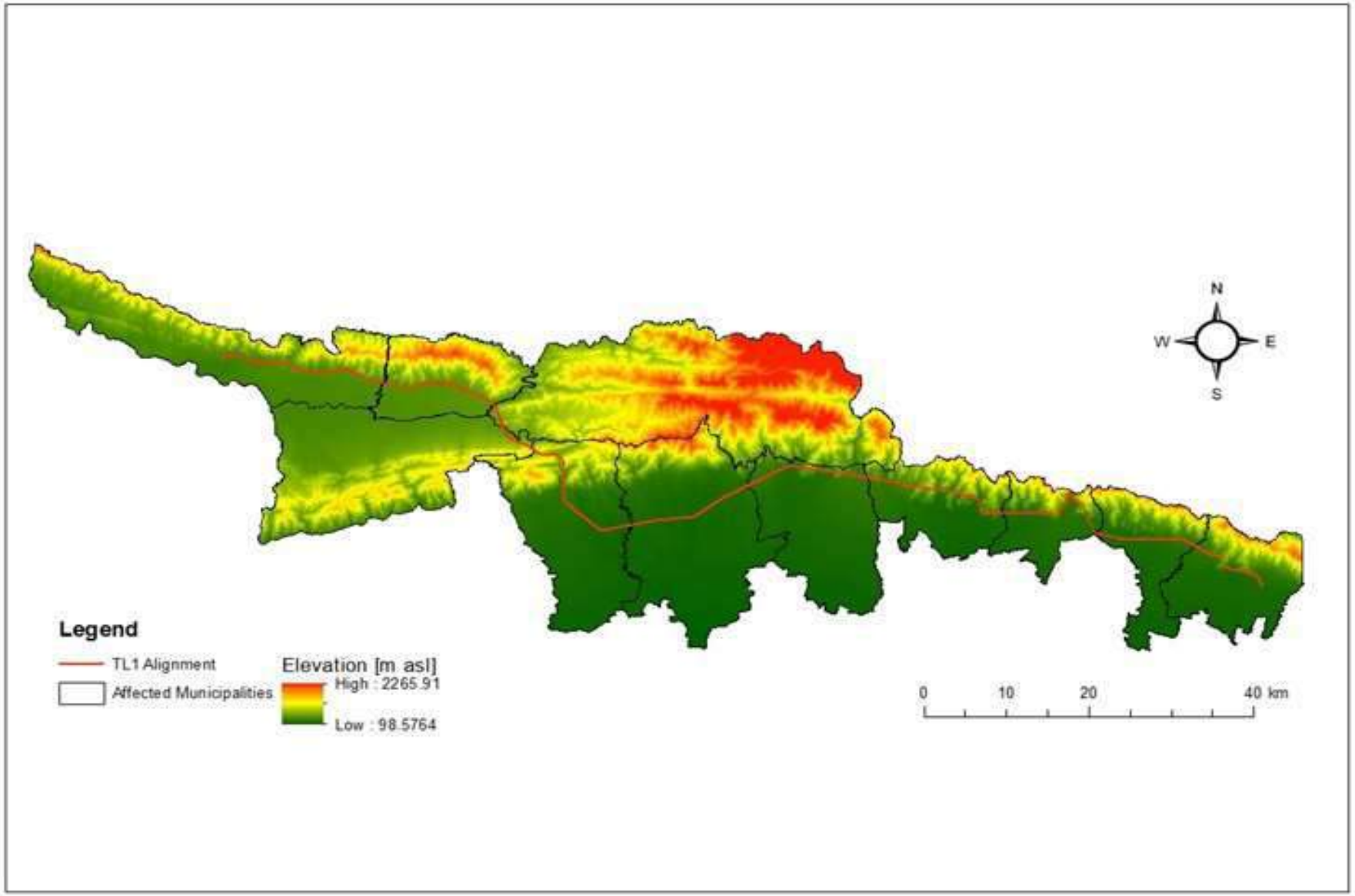
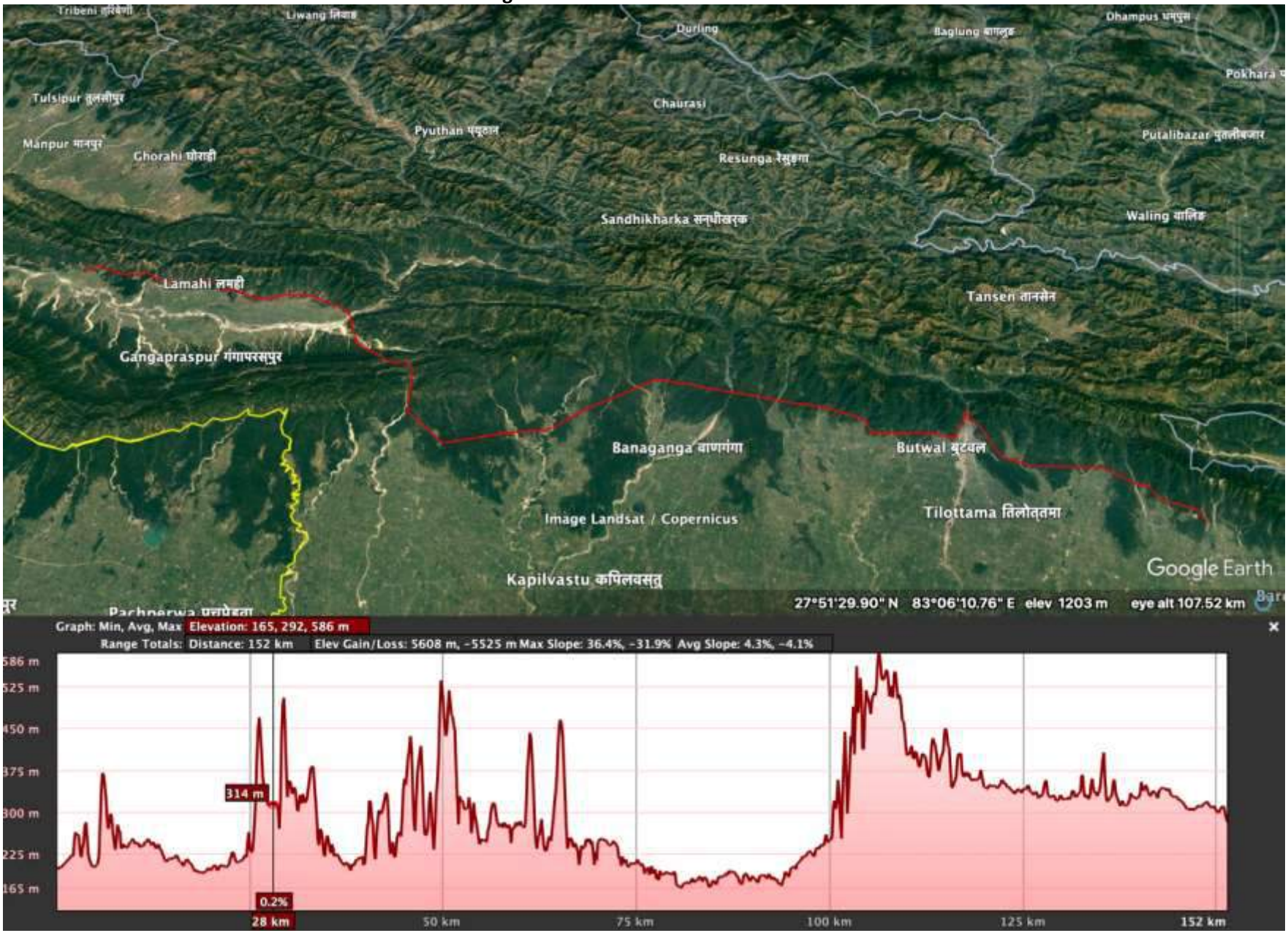


Figure 35: Elevation Profile of NBTL



6.2.2 Geology and Soils

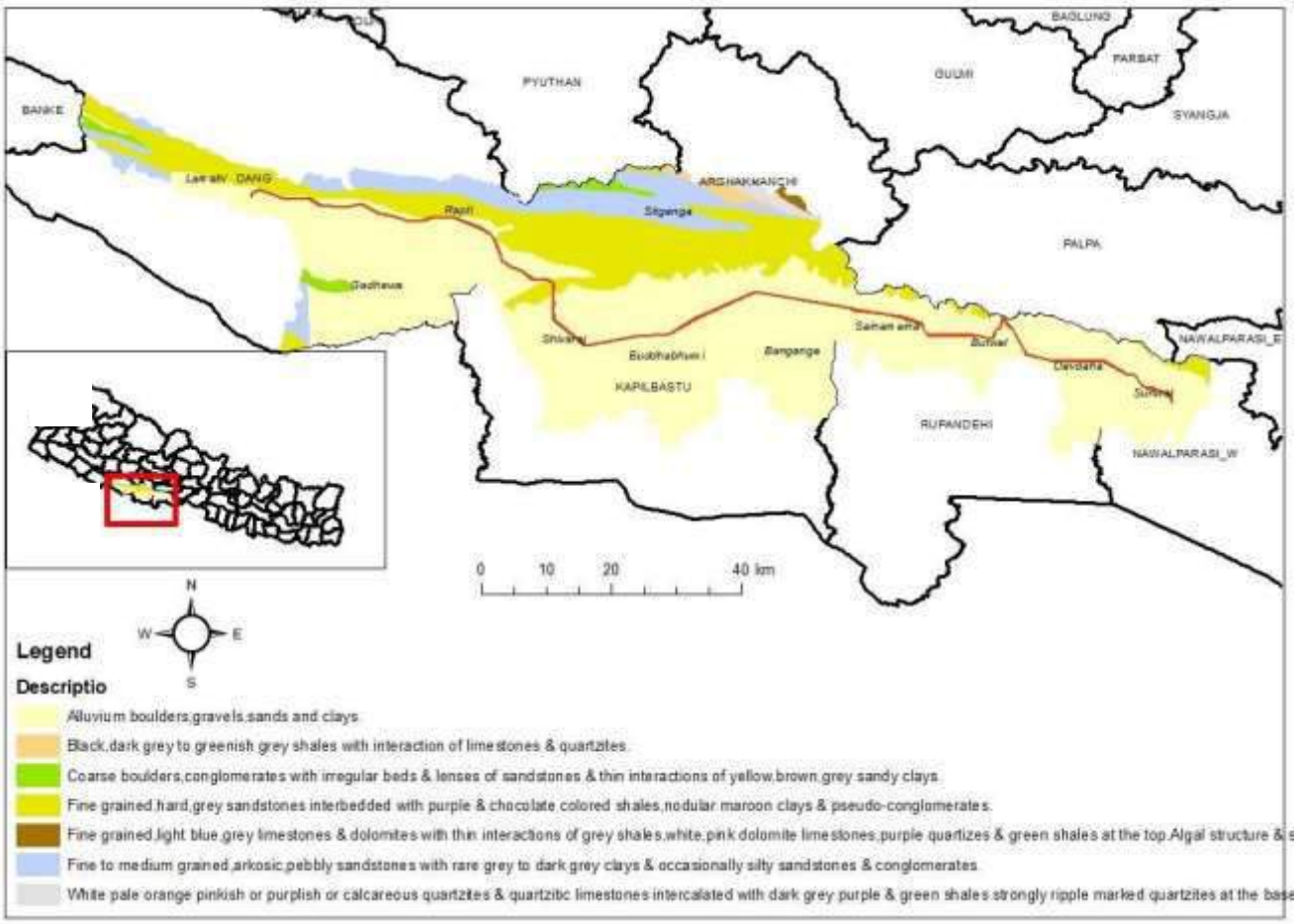
254. The Geology of the project area is dominated by sandstone, mudstone and recent deposits of alluvium consisting boulders and gravel mixed sand with equal number of fines. The Chure area, through which a large part of the alignment passes, is very fragile and distinctive in terms of its geology. Mainly, sandstone, mudstone and conglomerates are found in the region, and are in the state of being eroded as these rocks have not been totally solidified. Soil type includes Loam and Sandy Loam soils with boulders. These loose soils are easily eroded during heavy rains. The soil properties along the NBTL is in Table 46 below:

Table 46: Soil Properties Along NBTL

Properties	Max Value	Min Value	Mean Value	Median Value
pH value:	8.308	5.721	6.67	6.547
Organic Matter:	4.40%	0.87%	2.31%	2.33%
Total Nitrogen:	0.20%	0.05%	0.11%	0.11%
Available Phosphorus (P2O5):	288.498kg/ha	5.711 kg/ha	65.850 kg/ha	63.975 kg/ha
Available Potassium (K2O):	779.524 kg/ha	29.146 kg/ha	188.110 kg/ha	143.595 kg/ha
Zinc:	15.400 ppm	0.035 ppm	0.933 ppm	0.506 ppm
Boron :	26.325 ppm	0.138 ppm	2.612 ppm	1.059 ppm
Sand:	81.24%	5.07%	45.19%	43.29%
Clay :	87.37%	0.46%	20.11%	15.16%

Figure 36: Soil Type Along NBTL

Figure 37: Geology of the Project Area Source: IEE



6.2.3 Geohazards

Seismicity

255. Nepal is a Himalayan nation with young fold mountains where potential large earthquakes with specified return period have been recorded with damage and destruction to infrastructure. Some major earthquakes recorded in Nepal in Richter Scale includes 7.9 in 1833, 8.4 in 1934, 6.5 in 1980, 6.8 in 1988, 6.2 in 1993, 5.2 in 1997, 6.9 in 2011, 7.8 in 2015. The most recent earthquake measured 5.6 by US Geological Survey and 6.4 magnitude by National Earthquake Monitoring Research Center in Jajarkot District of Karnali Province on November 3rd 2023. Between 2015 January to 2023 November 171 incidence of earthquakes in Nepal were recorded of magnitude 4.5 and above and 16 in 2023 alone (among these 40 incidents were of 4.5 magnitude)[10].

256. The Dalian University of Technology (PRC) conducted a "probabilistic seismic hazard analysis in Nepal" to assess the seismic ground motion risk for the design of Transmission Lines and Substations within a specific project area in Nepal. To achieve this, the analysis utilized various components, including-

- seismic source information,
- probabilistic earthquake hazard parameters, and
- selected ground motion prediction model.

[10] https://earthquake.usgs.gov/

257. The goal was to calculate Peak Ground Accelerations (PGAs) at the level of bedrock.

258. PGAs were computed under different scenarios, each representing a specific probability of exceedance over a 50-year period. These probabilities were set at 63%, 10%, and 2%. Bu considering the range of probabilities, the study aimed to account for various levels of seismic events that could occur over the specific timeframe.

259. The result of the analysis were presented in the form of ground motion maps. These maps visually represented the distribution of PGAs across the project region. Notably, two distinct patterns emerged: the western and eastern sections showed higher seismic hazard levels, indicating a greater likelihood of intense ground shaking in these areas. Conversely, southern Nepal exhibited lower hazard levels, suggesting a relatively lower risk of strong seismic events (see Figure 38 to Figure 40).

260. To apply these findings to the design of the NBTL and Lamahi SS within the project area, a seismic factor reference was established. This reference, in terms of PG, ranged from 0.3 to 0.5 g. This range represented the acceleration that structures and infrastructure could experience during a seismic event. However, it's important to note that this reference range is not universally applicable to all locations within the project area. The variability in seismic conditions across different regions requires a more customized approach. Therefore, a careful and detailed evaluation is necessary for NBTL and substation location during detailed design. This involves considering factors such as local geological conditions, proximity to seismic sources, and potential ground motion amplification before determining the appropriate seismic design criteria for those specific structure.

Figure 38: PGA distribution with 63% probability of exceedance in 50 years (source - Probabilistic seismic hazard analysis in Nepal)

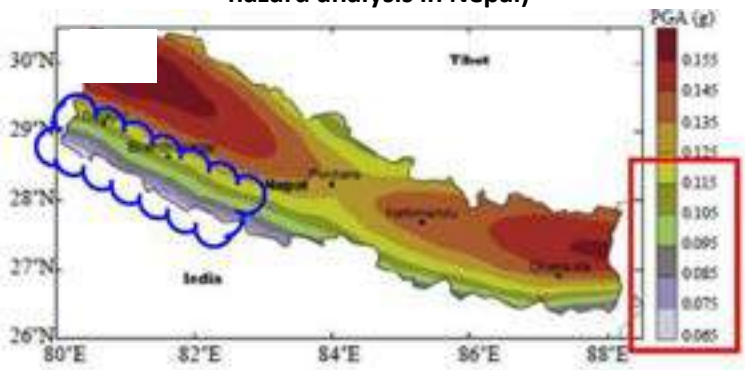


Figure 39: PGA distribution with 10% probability of exceedance in 50 years (Source - Probabilistic seismic hazard analysis in Nepal)

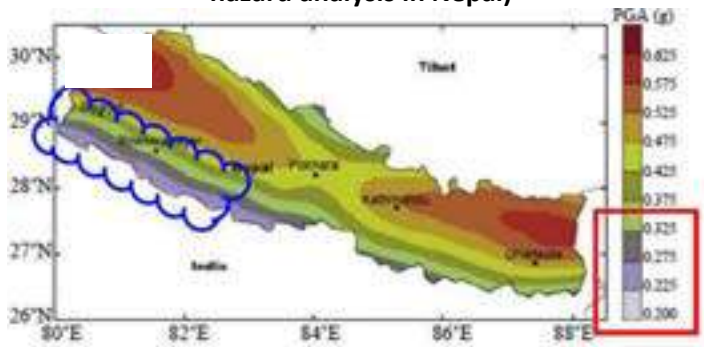
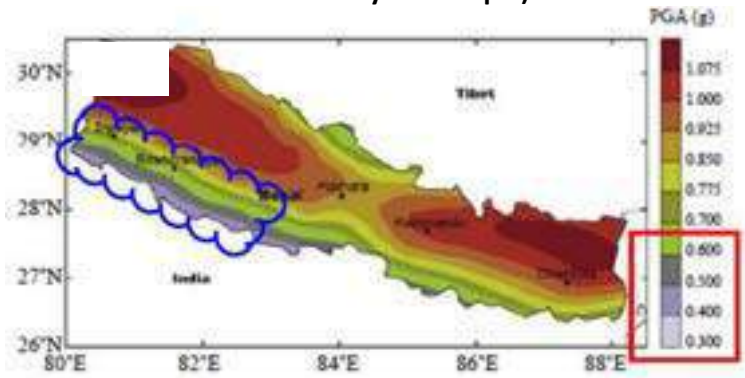


Figure 40: PGA distribution with 2% probability of exceedance in 50 years (Source - Probabilistic seismic hazard analysis in Nepal)



Floods

261. Flood mapping was completed as part of the Project feasibility study. Towers near to rivers and tributaries are more prone to the flooding. From flood hazard map, it was observed that most of the towers lie on low to medium flood hazard zone with few towers in high flood hazard zone. Tower number 1-2, 55-68, 78-83, 119- 123, 165-170, 190-194, 212,213, 229-233,238,239,240,311,320,321 and 336-344 are mapped on high flood hazard zonation.

Figure 41: Flood Hazard Map Tower #1 to 7A

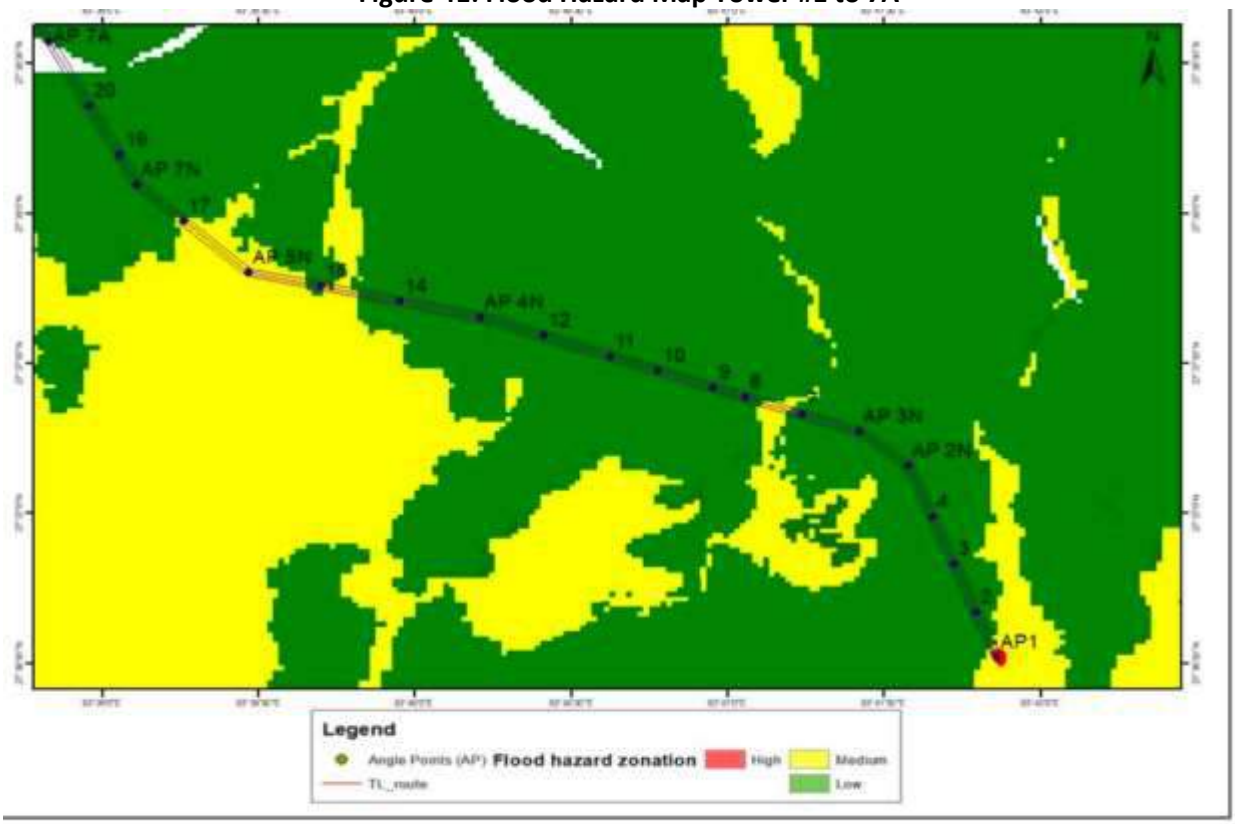


Figure 35: Flood hazard map from Tower no. 1 (AP1) to 7A

Figure 42: Flood Hazard Map Tower 7A to 48

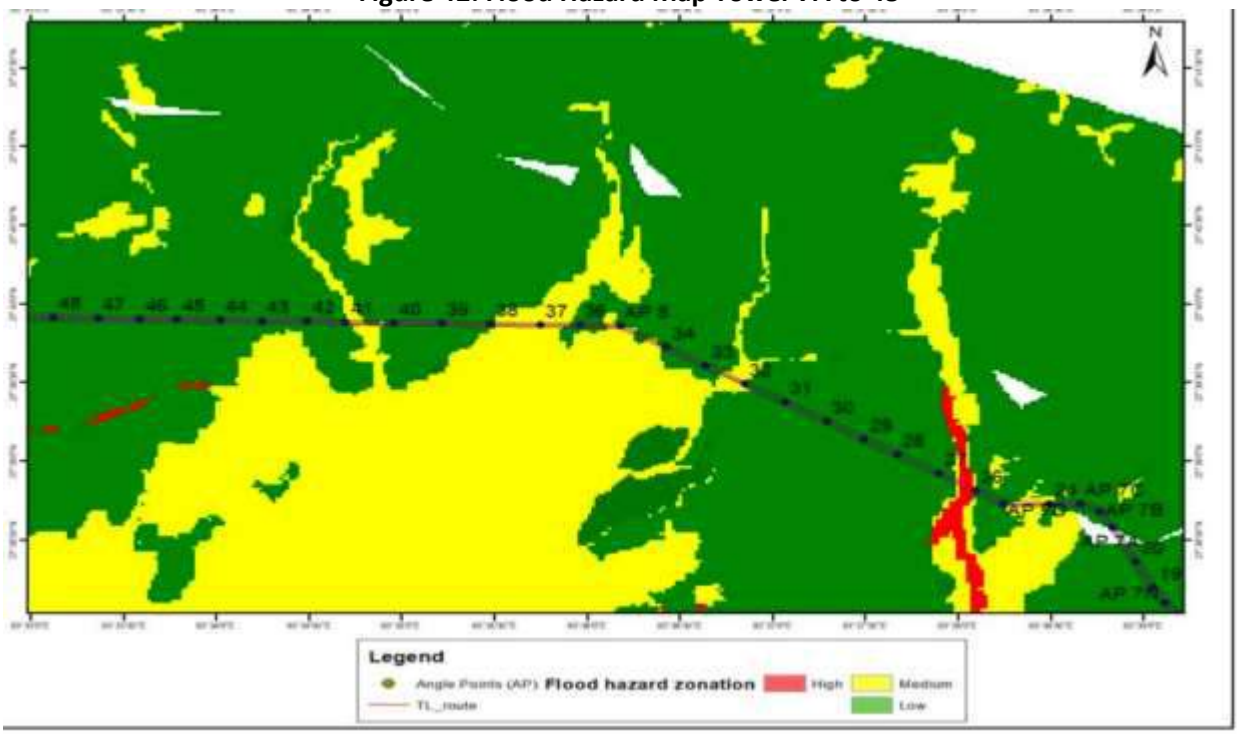


Figure 36: Flood hazard map from Tower no. 7A to 48

Figure 43: Flood Hazard Map Tower 48 to 90

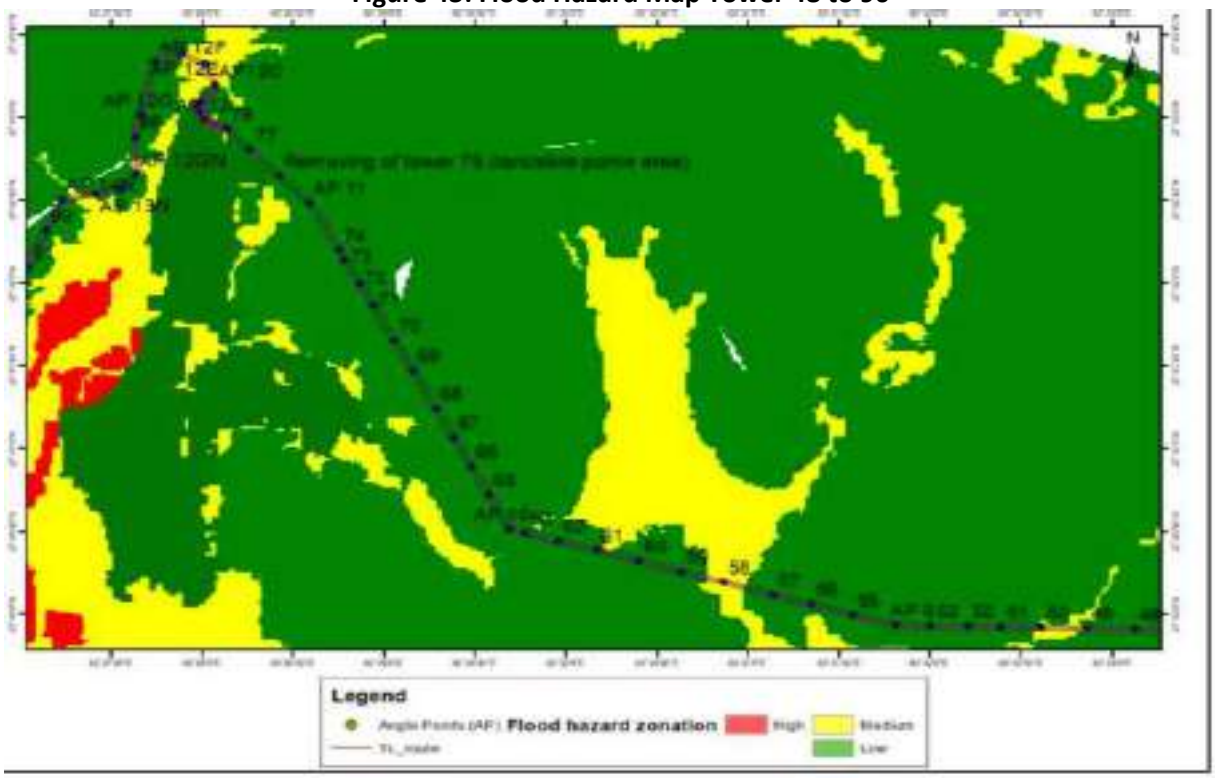


Figure 37: Flood hazard map from Tower no.48 to 90

Figure 44: Flood Hazard Map Tower 90 to AP18

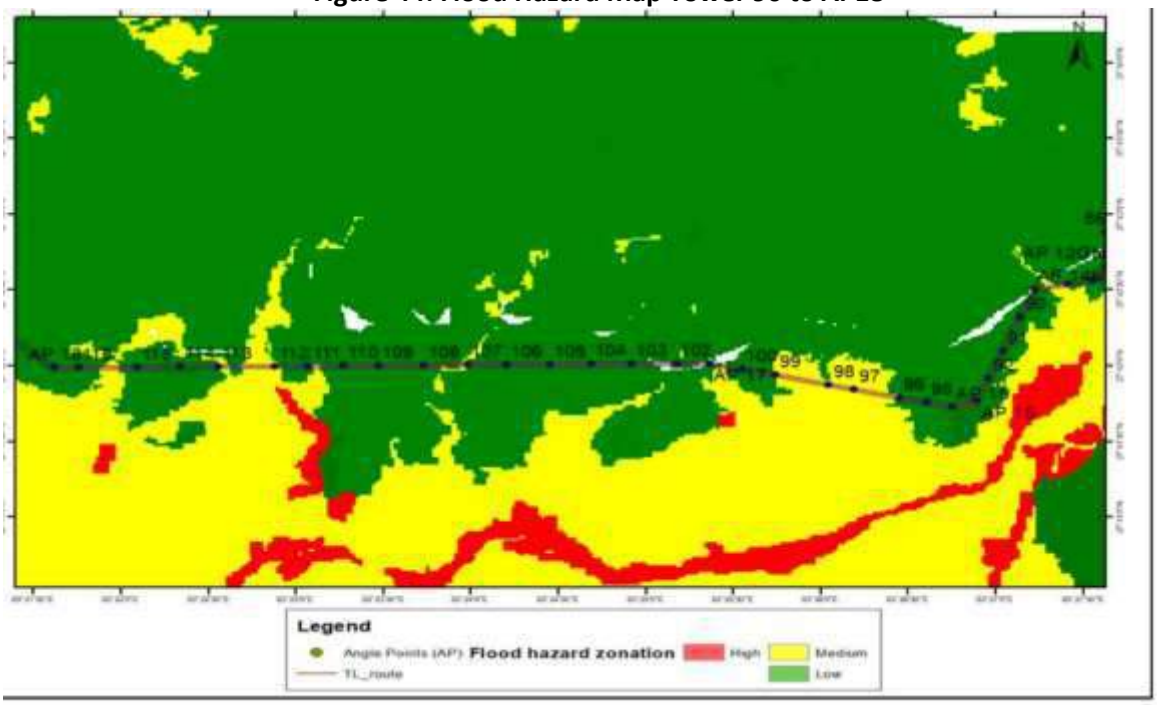


Figure 38: Flood hazard map from Tower no.90 to AP18

Figure 45: Flood Hazard Map Tower AP18 to 145

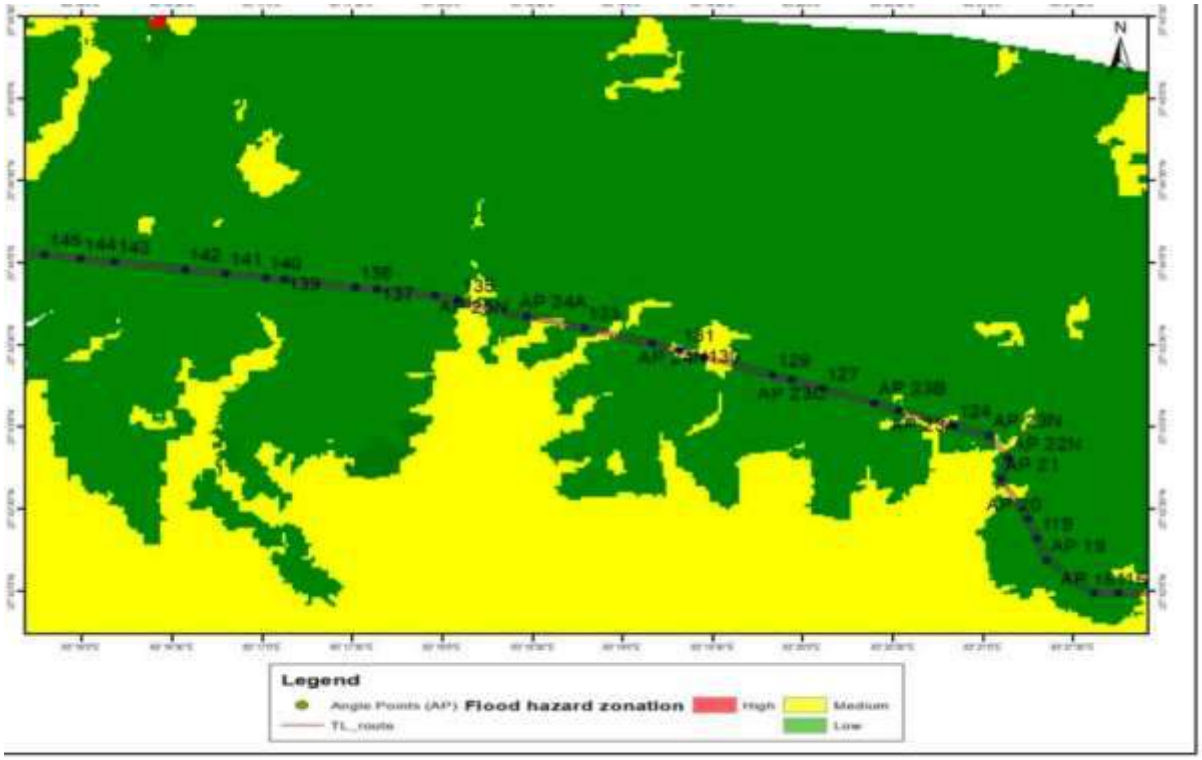


Figure 39: Flood hazard map from Tower no.AP18 to 145

Figure 46: Flood Hazard Map Tower 145 to 173

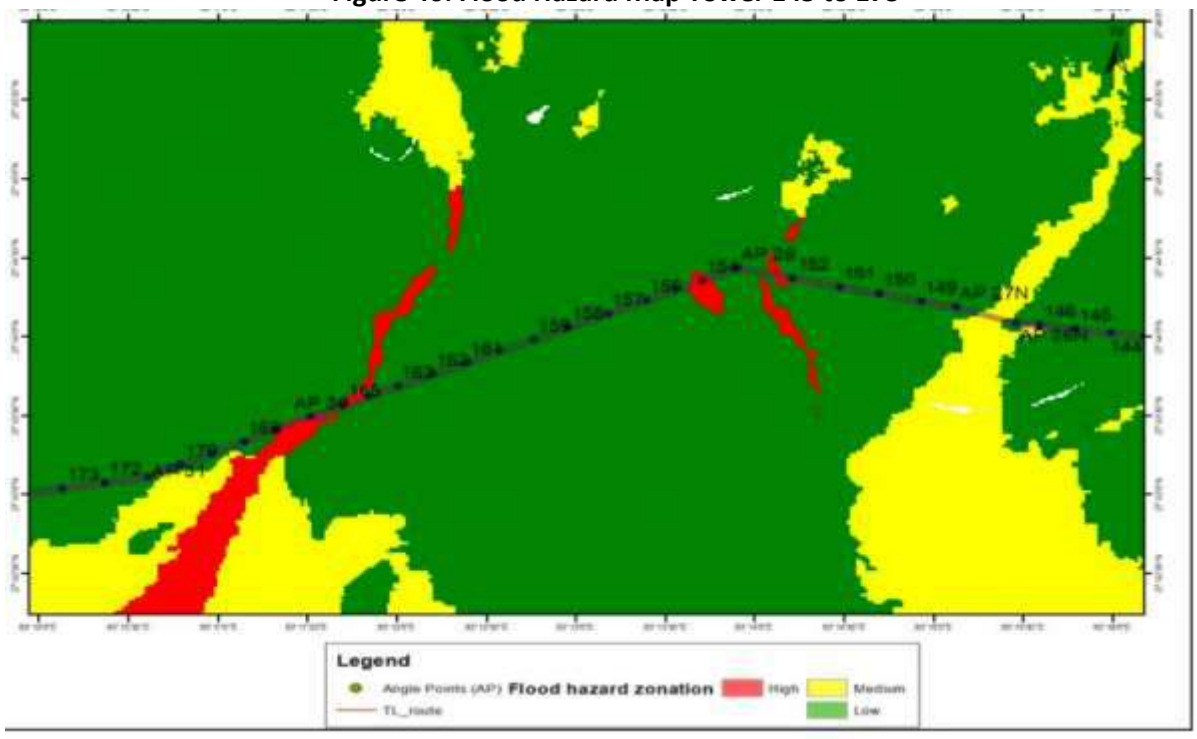


Figure 47: Flood Hazard Map Tower 161 to 192A

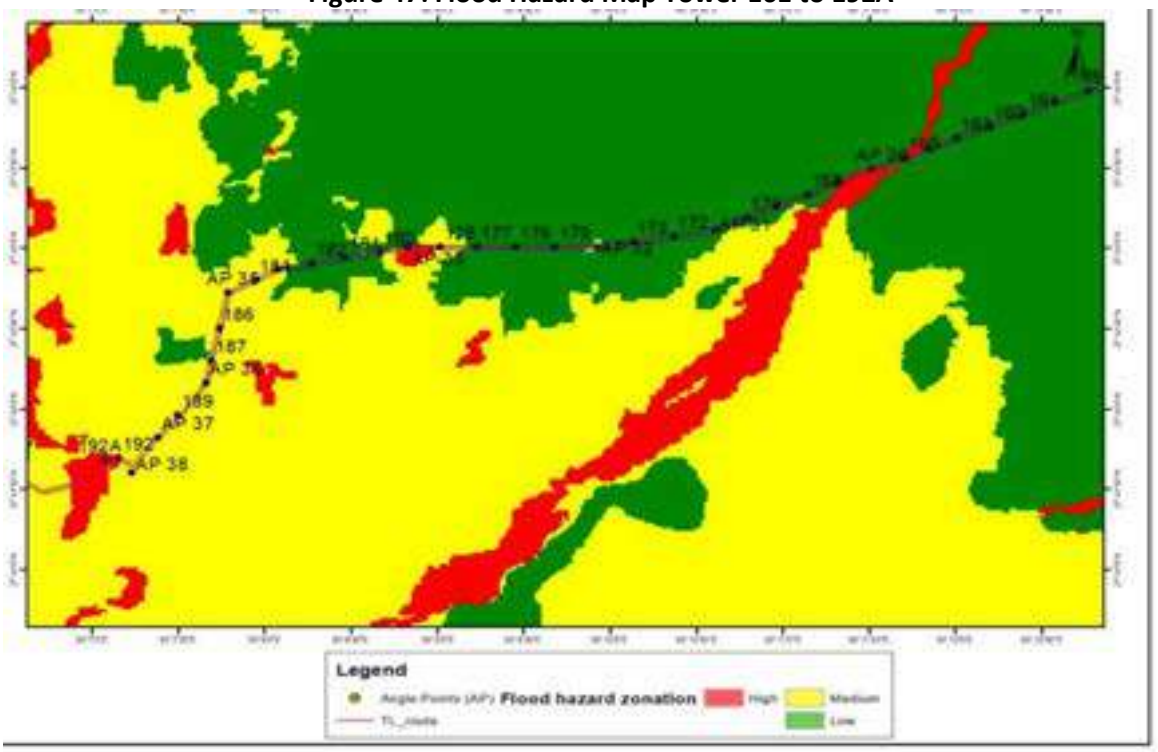


Figure 41 Flood hazard map from Tower no. 161 to 192A

Figure 48: Flood Hazard Map Tower 195 to 241

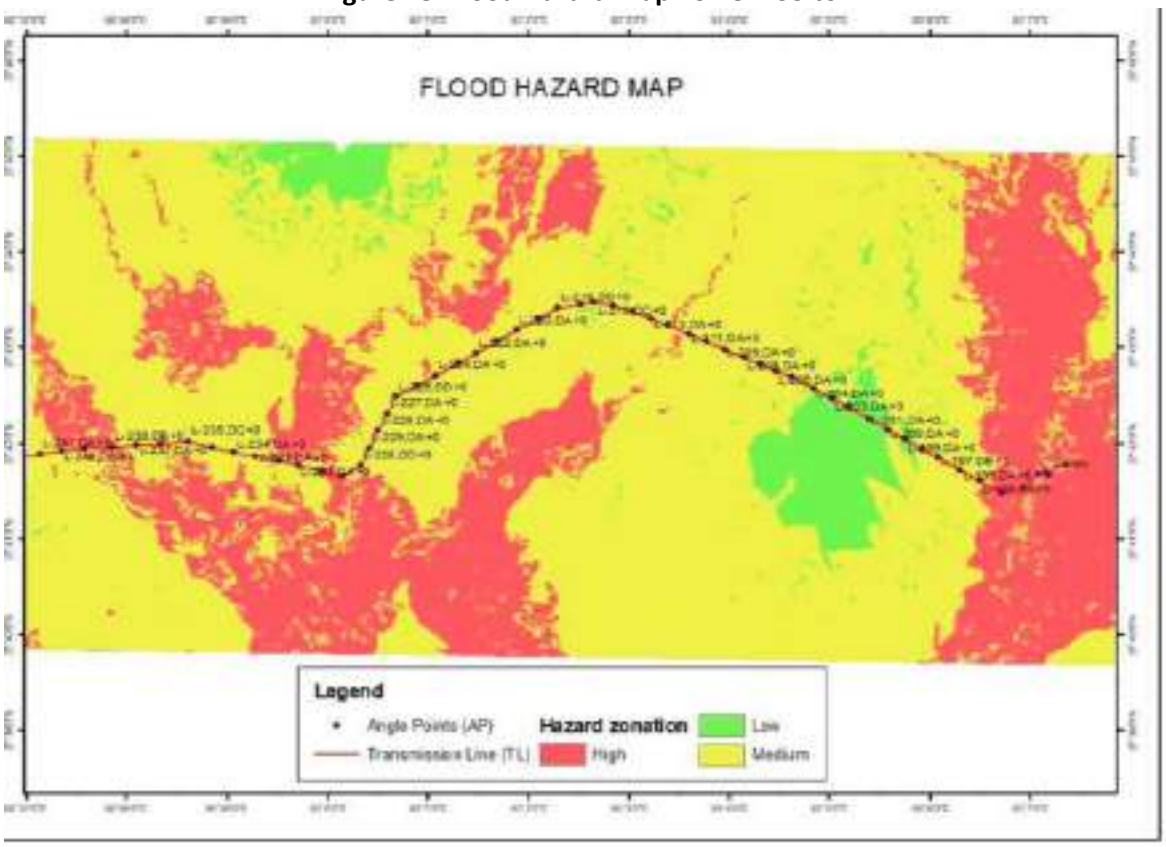


Figure 49: Flood Hazard Map Tower 240 to 267

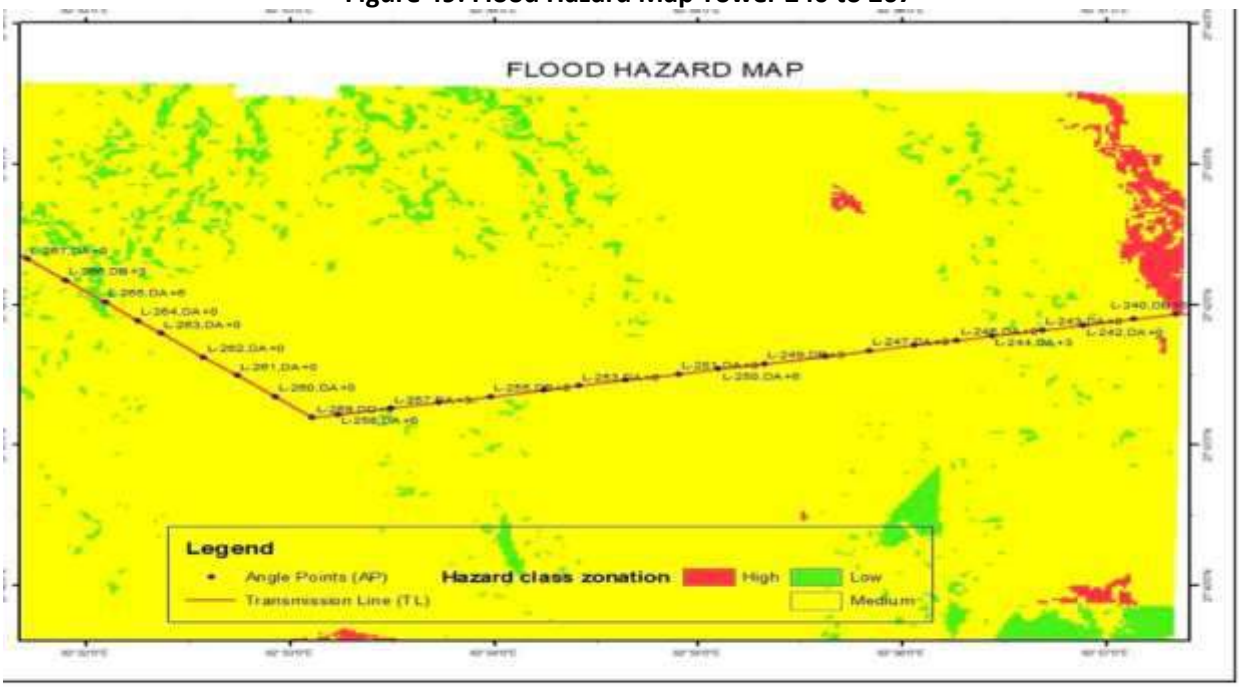


Figure 43: Flood hazard map from Tower no.240 to 267

Figure 50: Flood Hazard Map Tower 266 to 303

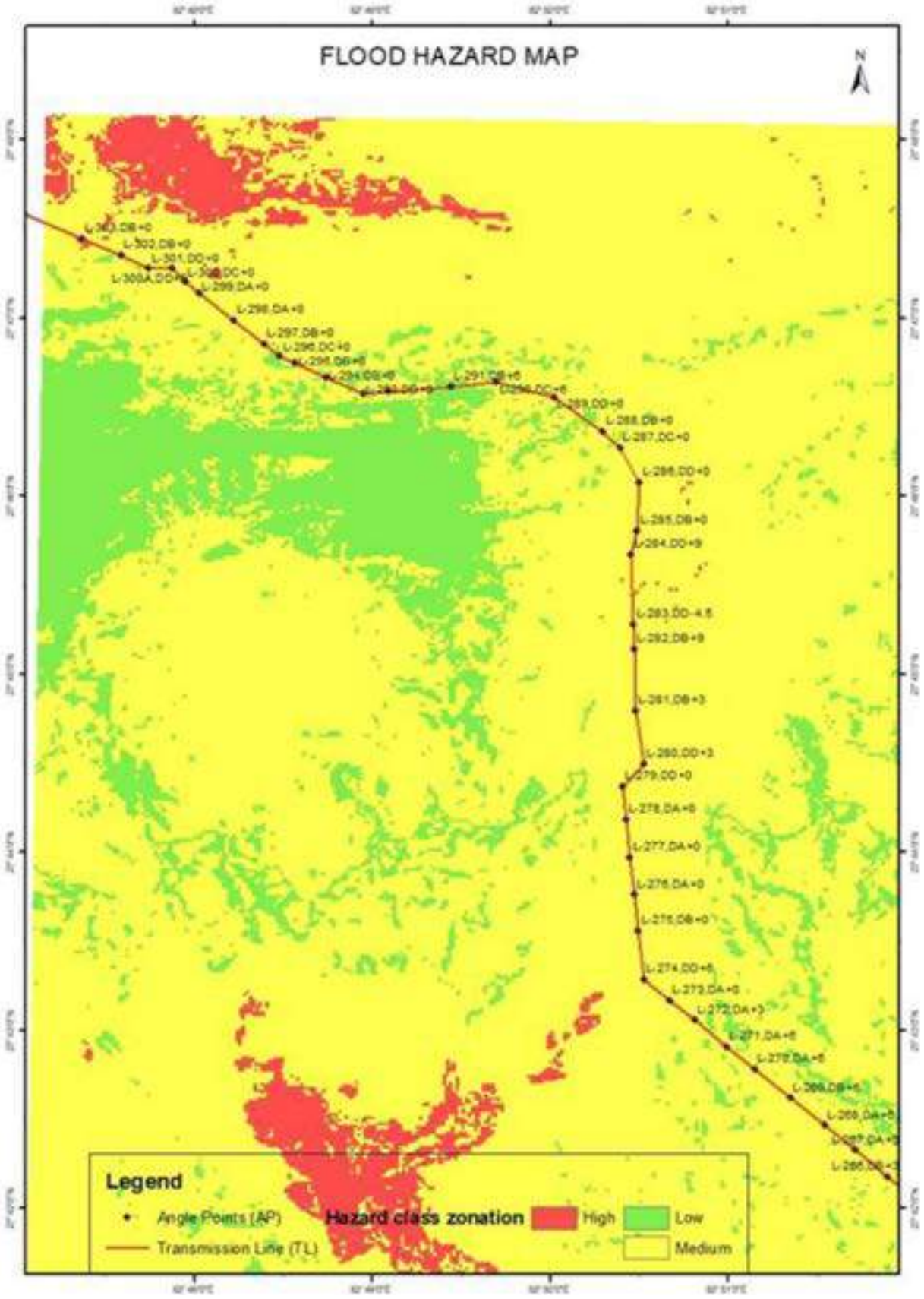


Figure 51: Flood Hazard Map Tower 303 to 350

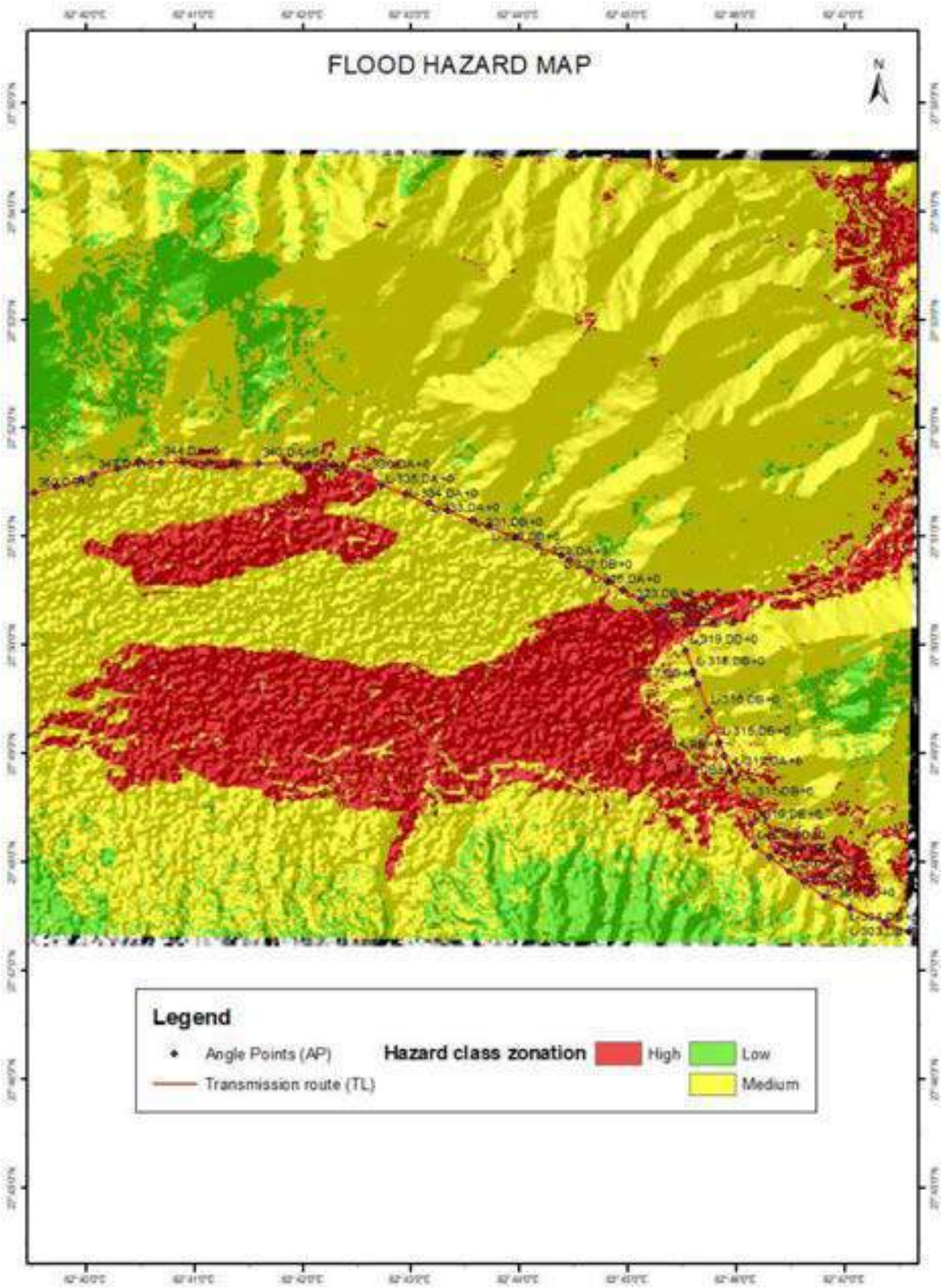


Figure 52: Flood Hazard Map Tower 349 to 393

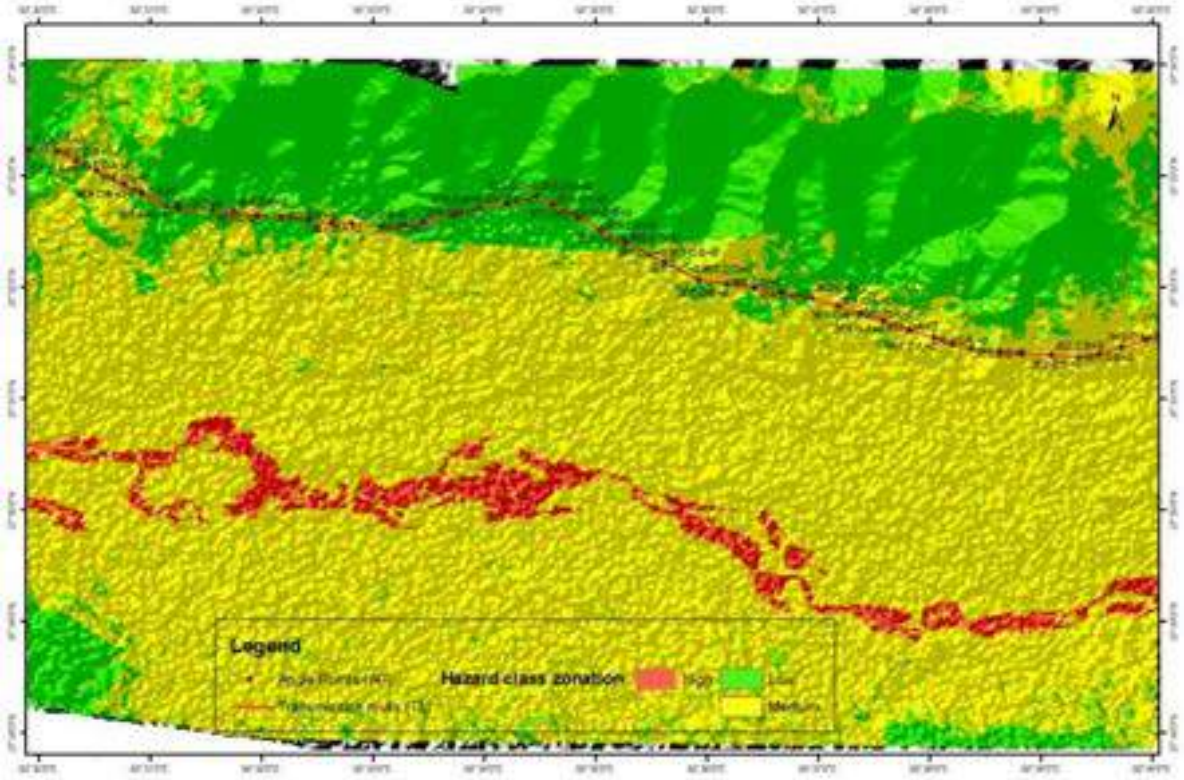
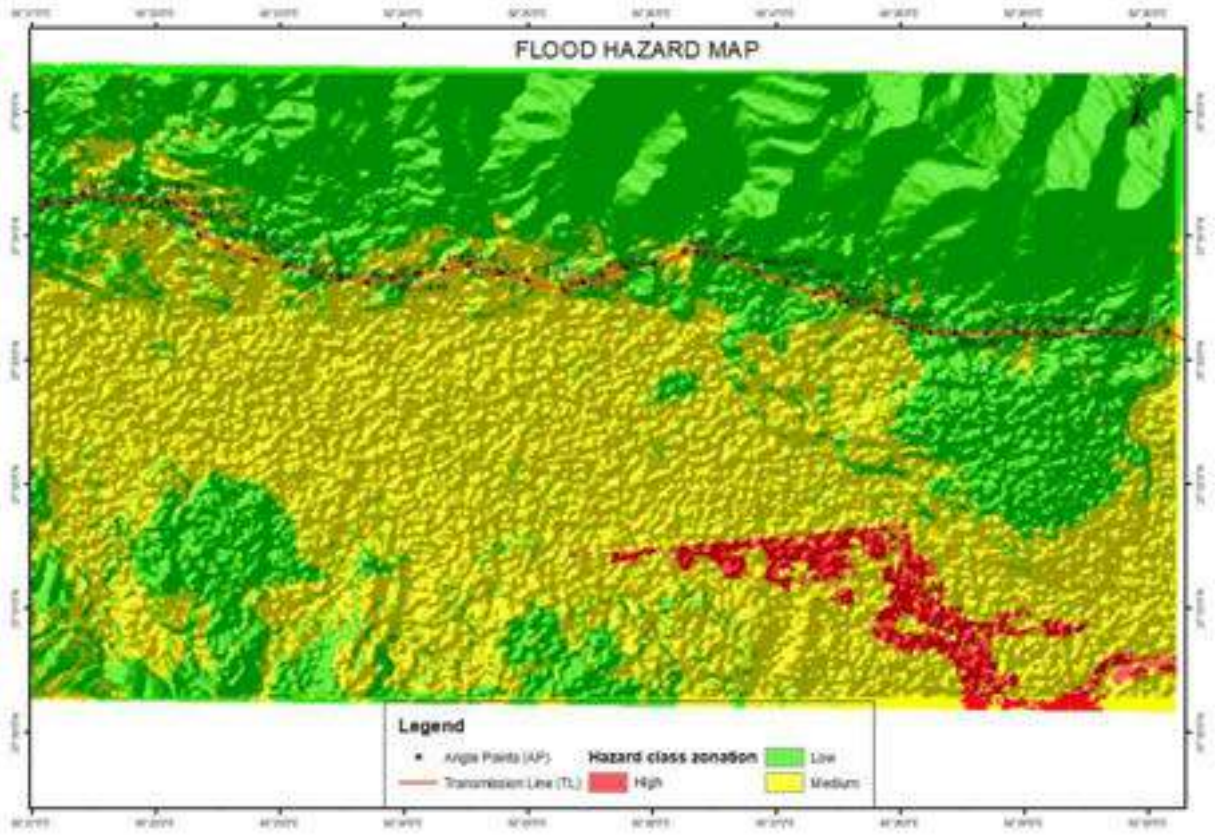


Figure 53: Flood Hazard Map Tower 394 to 434



Landslides

262. Landslide mapping has been completed for the Project as part of a feasibility study. Several locations have been identified at high risk of landslides, specifically around Butwal and Shivapur Forest. The following maps illustrate the locations of these high-risk areas.

Figure 54: Landslide Hazard Mapping Shivapur Area

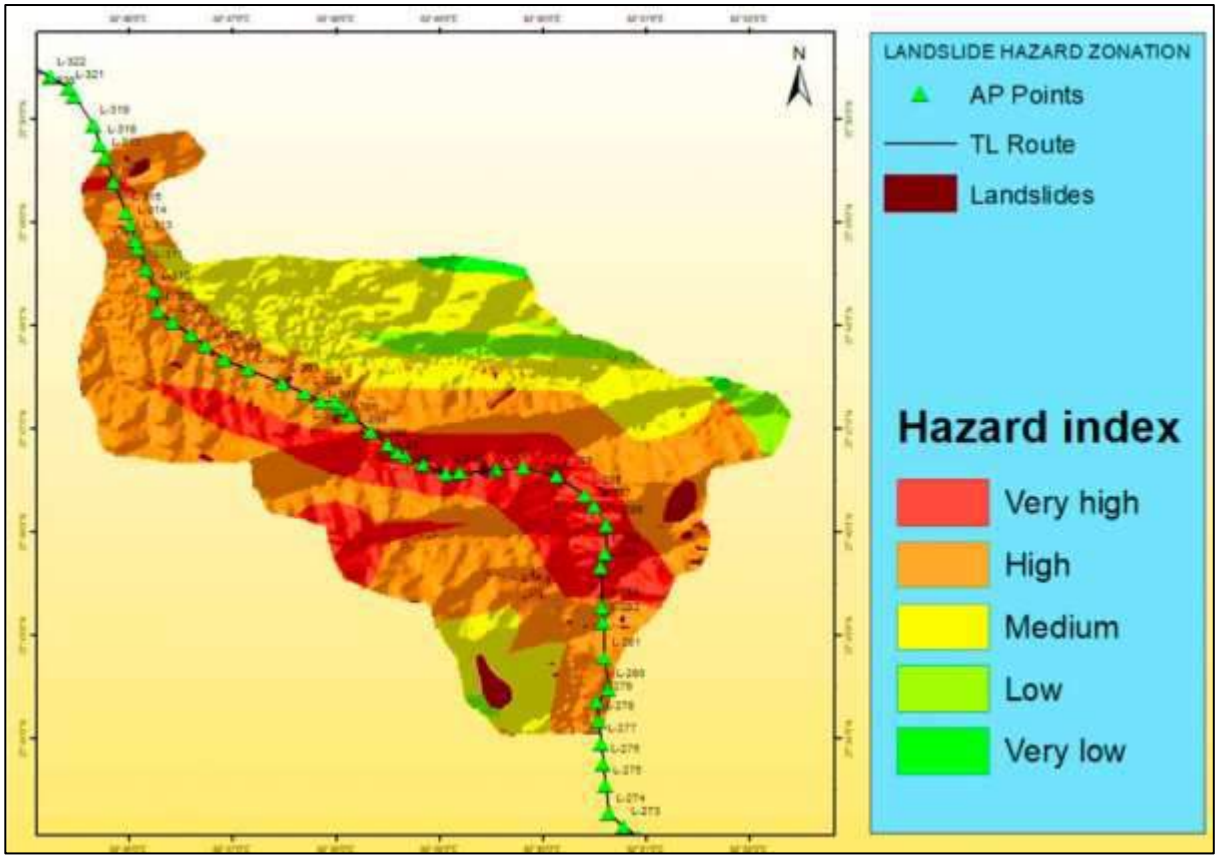


Figure 55: Landslide Hazard Mapping Butwal Area

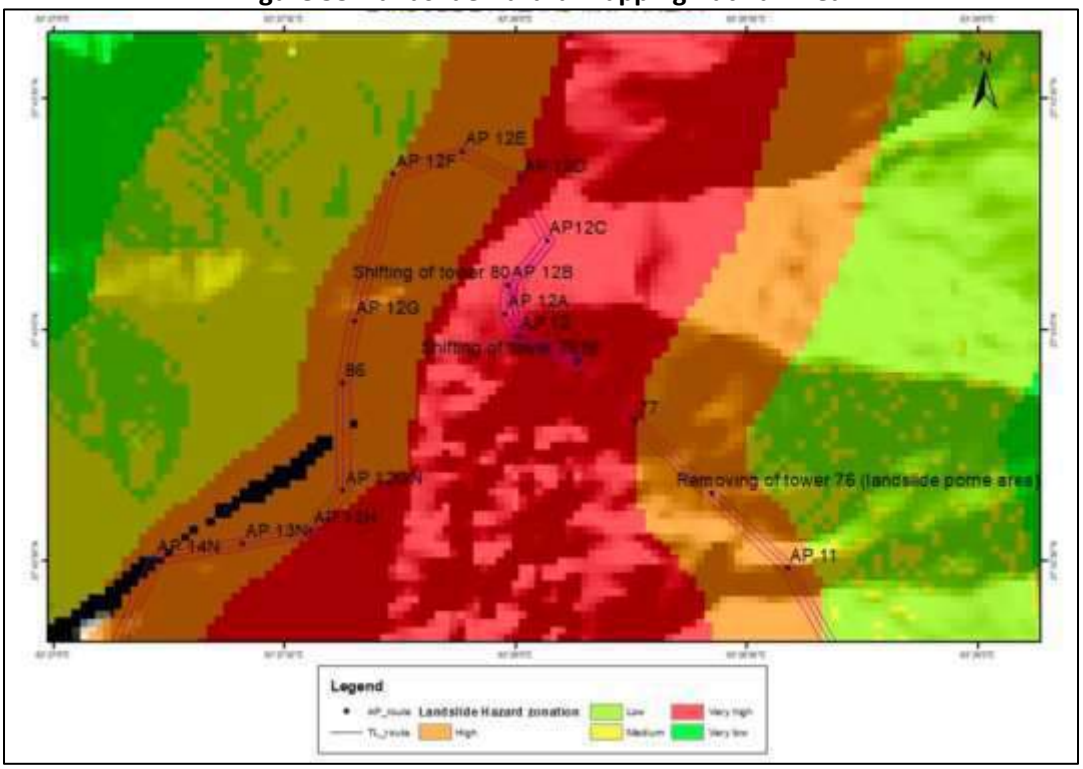
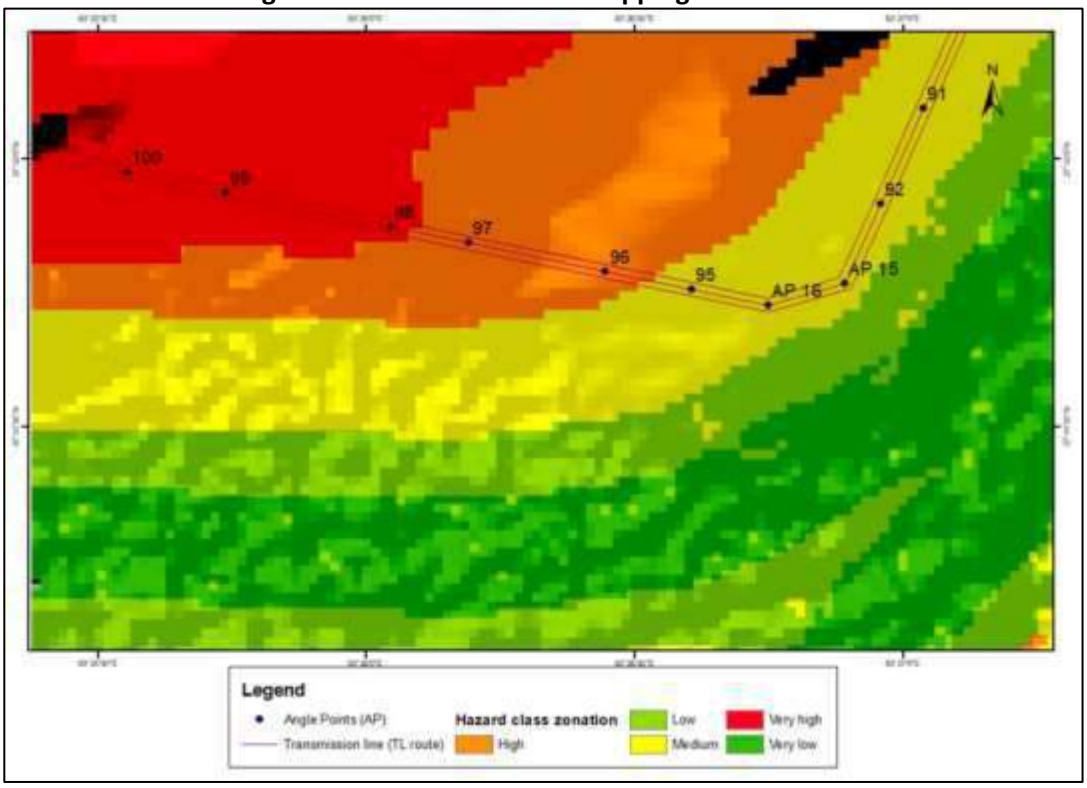


Figure 56: Landslide Hazard Mapping Butwal Area

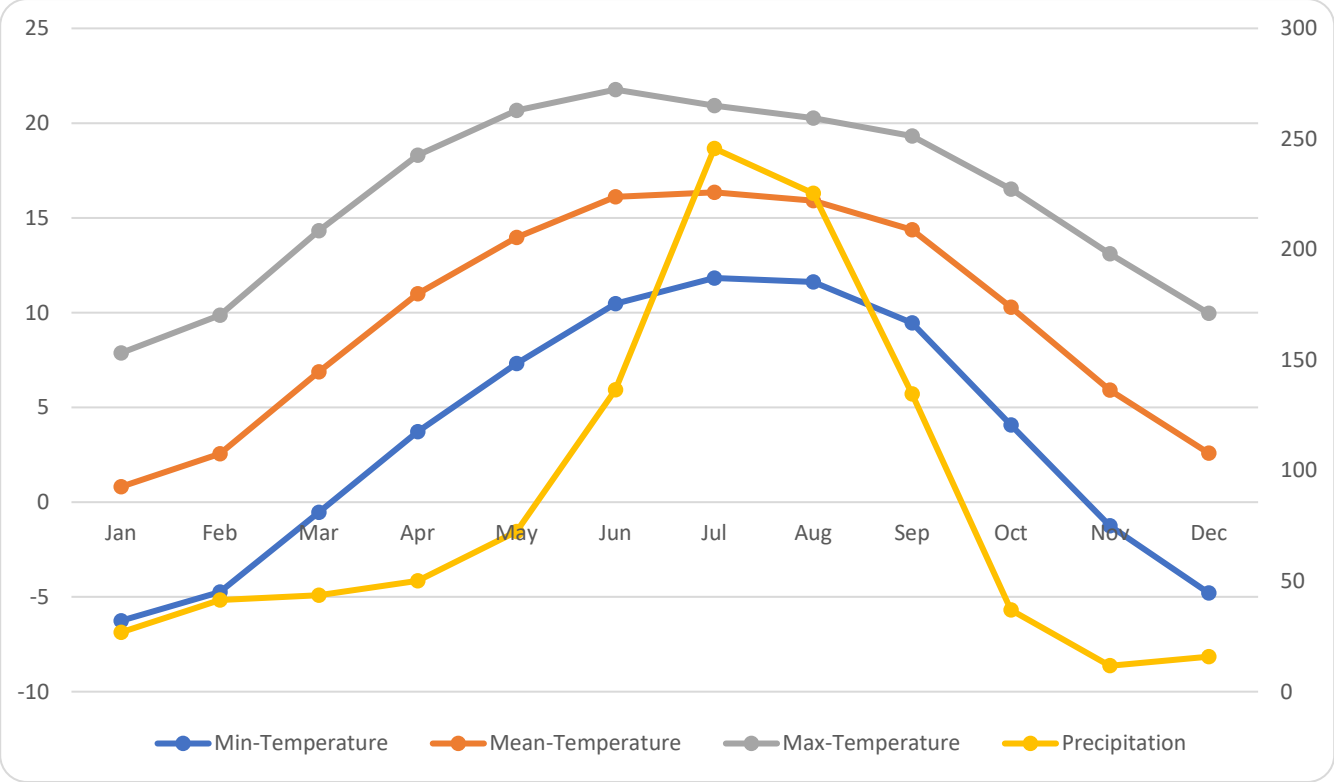


6.2.4 Climate, Climate Change and Climate Hazards

263. The Terai Region and the foothills of the Siwalik ranges experience tropical climatic conditions. However, elevation has contributing factors to microclimatic changes which varies between 145 to 600 masl. The

project area undergoes hot and rainy summers, as well as cold and dry winters. On one hand during summers, the temperatures soar, with maximum temperature surpassing 37°C. The summary season commences in mid-May and extends until mid-September. This period also coincides with the monsoon season, characterized by heavy rainfall in the project area, Analysis of average monthly rainfall from 1992 to 2020 indicates that the project area receives the highest average monthly rainfall of 245 mm in July (concentrated between May to Mid-September). Winter, on the other hand, is the driest period in the project area, lasting from December to February. During this time, the average monthly temperatures range between 3 – 5°C. The wind speed figure considered by the project design Includes 47m/s which falls under zone 4.

Figure 57: Temperature and Precipitation in the Project Area



Source: Climate Change Knowledge Portal, The World Bank

Table 47: Monthly minimum, mean and maximum temperature and precipitation averaged for the duration of 1992 – 2020

Category	Min-Temperature	Mean-Temperature	Max-Temperature	Precipitation
Jan	-6.26	0.81	7.87	26.82
Feb	-4.74	2.56	9.87	41.48
Mar	-0.54	6.88	14.32	43.57
Apr	3.72	11.00	18.31	50.18
May	7.31	13.97	20.67	72.39
Jun	10.48	16.11	21.77	136.60

Category	Min-Temperature	Mean-Temperature	Max-Temperature	Precipitation
Jul	11.83	16.35	20.93	245.72
Aug	11.62	15.91	20.26	225.35
Sep	9.45	14.37	19.32	134.69
Oct	4.08	10.28	16.52	36.93
Nov	-1.24	5.92	13.10	11.70
Dec	-4.80	2.58	9.96	15.87

264. The wind speed data were available for meteorology stations of Chisapani, Surkhet, and Simara, which are presented below:

Table 48: Wind speed data

	Chisapani		Surkhet		Simara	
	Year 1968 to 2006		Year 1975 to 2014		Year 1982 to 1998	
	Km/h	m/s	Km/h	m/s	Km/h	m/s
Max	27.5	7.6	32.9	9.1	14.0	3.9
Average	5.2	1.4	2.3	0.6	2.6	0.7
Min	0.0	0.0	0.0	0.0	0.0	0.0

265. The wind speed data showed that the highest wind speed recorded over the years is 32.9 km/h, equivalent to 9.1 m/s. The project design has considered the wind speed of 47 m/s (as per IS 875 zone 4), which might seem excessive, however, it enhances safety by accounting for potential unknown data from past and future tropical storms.

266. In Nepal, wind velocities in lower altitude valleys are generally lower than those in higher altitude valleys and mountain ranges. This can be seen in the data from places like Kathmandu (which have lower values) and Kaligandaki valleys (with higher values).

267. The Nepal National Building Code (NBC) 104: 1994 categorizes the country into 2 regions for wind load considerations:

a. The first region comprises the lower plains and hills encompassing the southern plains (Terai), Kathmandu Valley, and areas below 3000 m altitude. In this zone, the foundational wind velocity is set at 47 m/s.

b. The second region pertains to areas situated above 3000 m. Here, the foundational wind velocity is increased to 55 m/s.

268. Despite the insufficient wind velocity data within Nepal, a local standard for wind load has been developed. The standard draws from the available data within Nepal, as well as data from comparable topographic regions in India. The Indian Standard IS: 875 (part 3) 1987, which provides guidelines for designing loads for structures apart from earthquakes, has been taken into account. This Nepal standard for wind load has been formulated by considering the basic wind speeds defined in categories (a) and (b) as described earlier.

6.2.5 Air Quality

269. The proposed alignment primarily traverses forested areas, with only a small portion cutting through settlements or cultivated areas. Air pollution in the project area is primarily attributed to vehicular emissions and the dispersion of dust particles caused by vehicular movement, particularly during the morning rush hour from 7 am to 10 am and in the evening from 5 pm to 8 pm. Furthermore, NBTL passes near Sarbottam Cement Limited, which contributes to air pollution as well.

270. In order to assess the Ambient Air Quality (AAQ), samples of ambient air has been collected the proposed alignment primarily traverses forested areas, with only a small portion cutting through settlements or cultivated areas. As a result, air and noise quality samples were gathered from both the forested regions and nearby settlements situated along the alignment. The locations of these samples, collected over a continuous 24-hour period are shown in Figure 32.

a. Tinau Bridge at Butwal, Rupandehi District
b. Saina Maina Municipality of Rupandehi District,
c. Gorusinghe Chowk Municipality of Kapilvastu District,
d. Shivaraj in Kapilvastu District.
e. Bhaluwang of Dang District.

271. Real-time measurements of fine ($PM_{2.5}$) and coarse (PM_{10}) particles, as well as Air Quality Index (AQI) and CO_2, were obtained using an "Air Visual Pro sensor" provided by IQAir to sample the ambient air quality data. The following findings were observed:

Figure 58: Air quality of Grousinge[11]

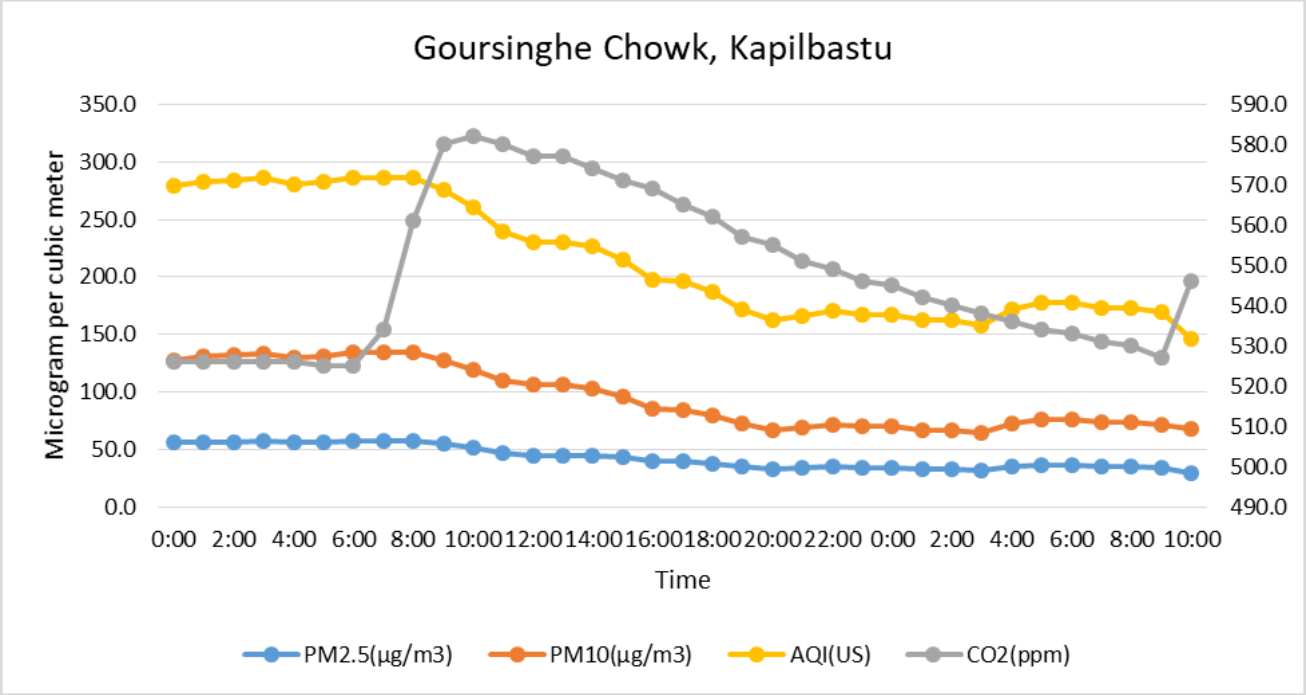
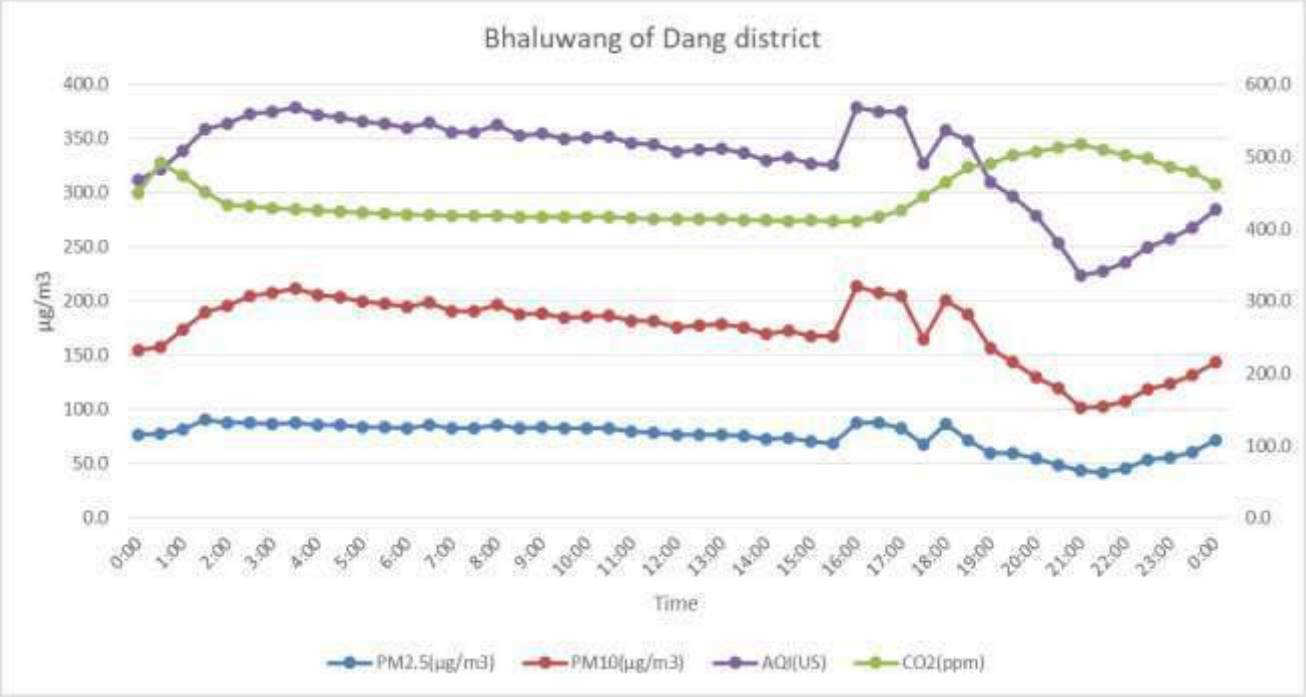


Figure 59: Air quality of Bhaluwang



[11] NBLTL IEE

Figure 60: Air quality of Sainamaina[12]

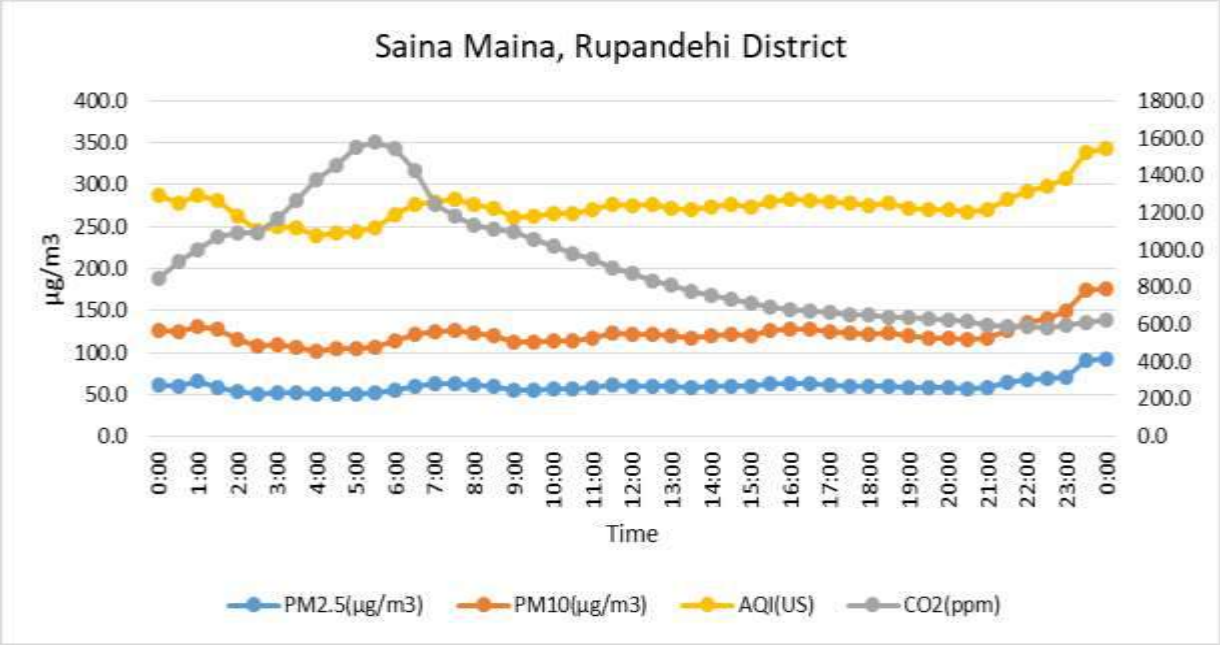


Figure 61: Air quality of Tinau bridge[13]

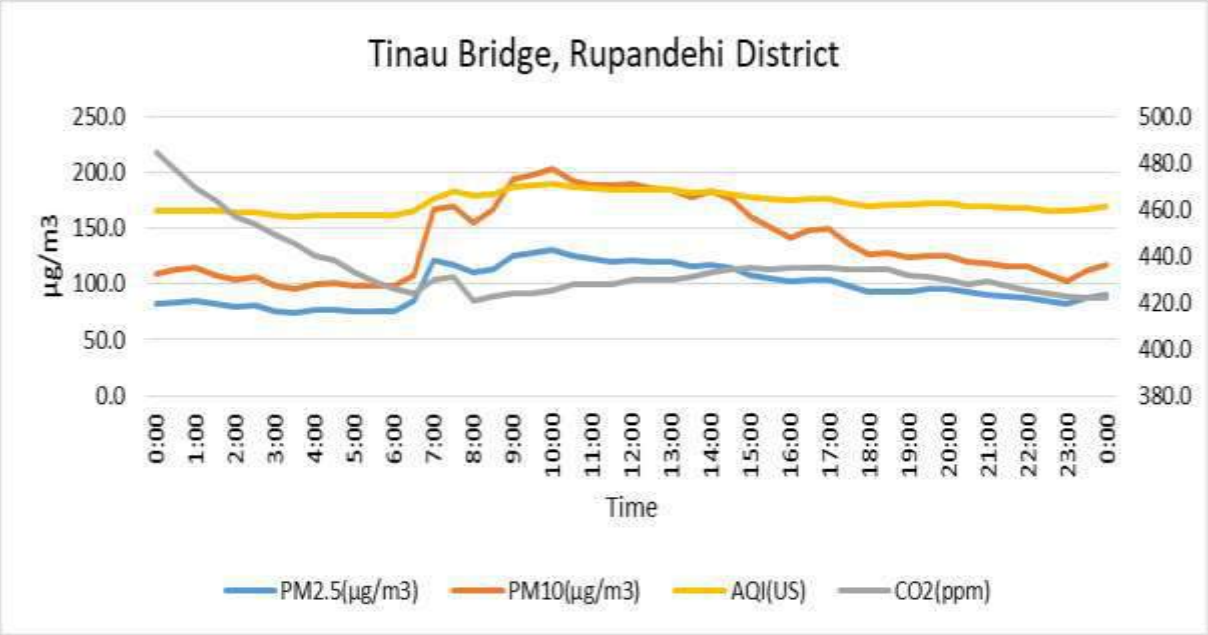


Figure 62: Air quality of Shivraj

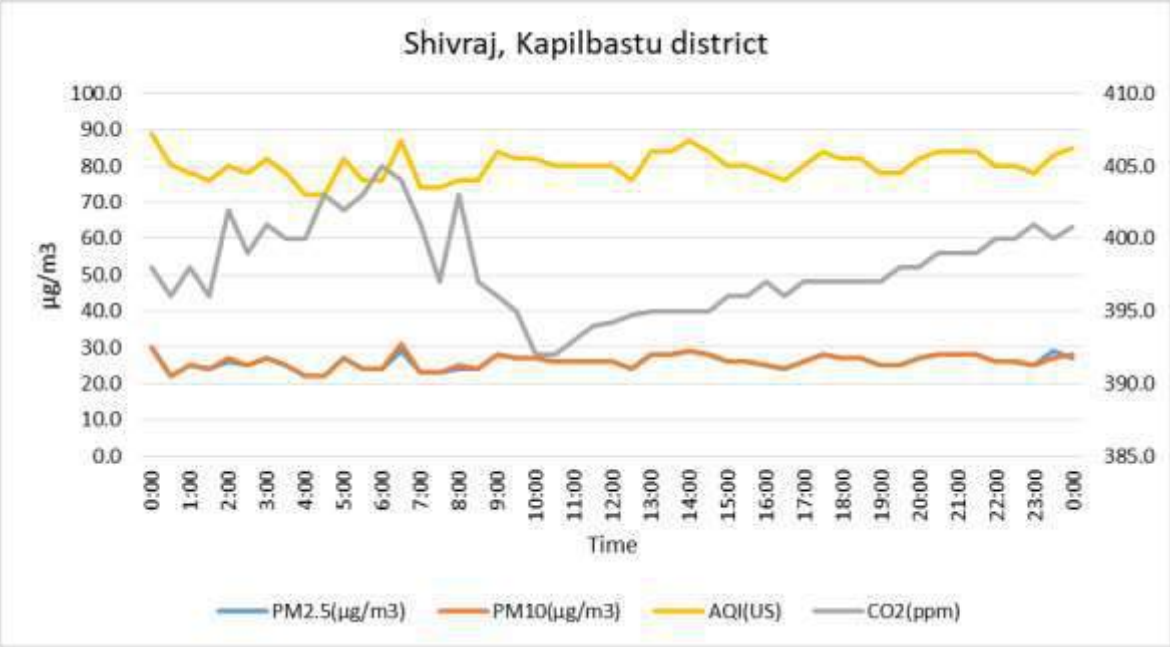


Table 49: Air quality of the project area[14]

Sample Site	$PM_{2.5}$ [mg/m^3]			PM^{10} [mg/m^3]			AQI		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Tinau Bridge	130	75	102	100	210	155	160	190	175
Sainamaina	100	50	75	180	100	140	350	240	295
Gorusinghe	55	40	47	140	60	100	280	150	215
Shivraj	32	22	27	32	22	27	90	72	81
Bhaluwang	80	45	62	220	100	160	380	220	300

272. According to the National Ambient Air Quality Standards (NAAQS) established by the Government of Nepal, the permissible limits for PM2.5 and PM10 based on the 24-hour average are 60 µg/m³ and 100 µg/m³, respectively. However, except for Gorusinghe and Shivraj stations, all the other monitoring stations indicate values that exceed these standards. This indicates that the air quality in those areas is harmful to both public health and the environment.

273. The Air Quality Index (AQI) serves as a numerical scale used to assess and convey the level of air pollution in a specific area. It is typically derived from measurements of various pollutants present in the air, such as particulate matter, nitrogen dioxide, sulfur dioxide, carbon monoxide, and ozone. In Nepal, the AQI is categorized into six levels, each with a specific range of values and corresponding health implications. The AQI values and categories in Nepal are as follows:

- Good: AQI 0-50, indicating no health impacts.
- Satisfactory: AQI 51-100, associated with minor breathing discomfort for sensitive individuals.
- Moderate: AQI 101-200, causing breathing discomfort for people with respiratory issues, including asthma, elderly individuals, and children.

[12] NBLTL IEE
[13] NBLTL, IEE
[14] NBLTL, IEE

- Poor: AQI 201-300, leading to breathing discomfort and potential respiratory illness with prolonged exposure.
- Very Poor: AQI 301-400, resulting in respiratory illness for individuals with prolonged exposure, while the general population may experience discomfort.
- Severe: AQI 401-500, where respiratory impacts are likely to be experienced by the entire population.

274. However, none of the stations analyzed fall within the "Good" category, which represents acceptable air quality with minimal health risks. The Shivraj station exhibited an average AQI of 81, falling within the "Satisfactory" level. In contrast, the other stations reported AQI values ranging from "Poor" to "Very Poor," indicating compromised air quality with potential health implications for the local population.

275. Additional air quality monitoring has been undertaken as part of this EIA to supplement the monitoring completed as part of the national IEE. The monitoring locations can be found in Figure 32, with full monitoring results provided in Appendix C. The results show that air quality, for the periods sampled, was within the limits set by NAAQS.

Figure 63: Total Suspended Particulate Matter (TSPM) µg/m3

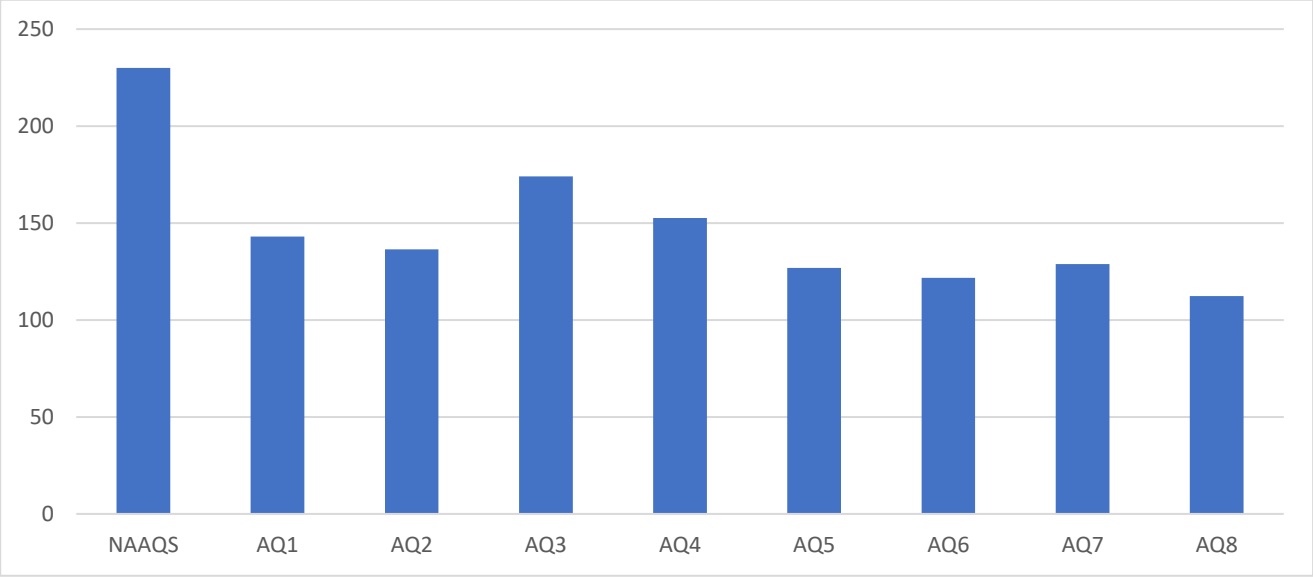


Figure 64: Particulate Matter (PM10) µg/m3

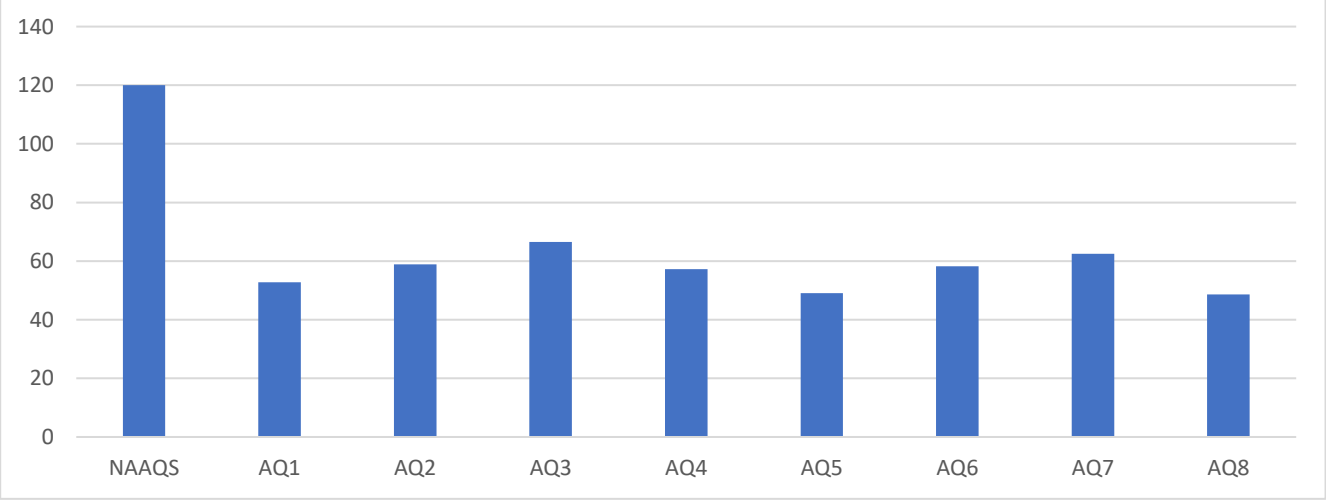


Figure 65: Particulate Matter (PM2.5) µg/m3

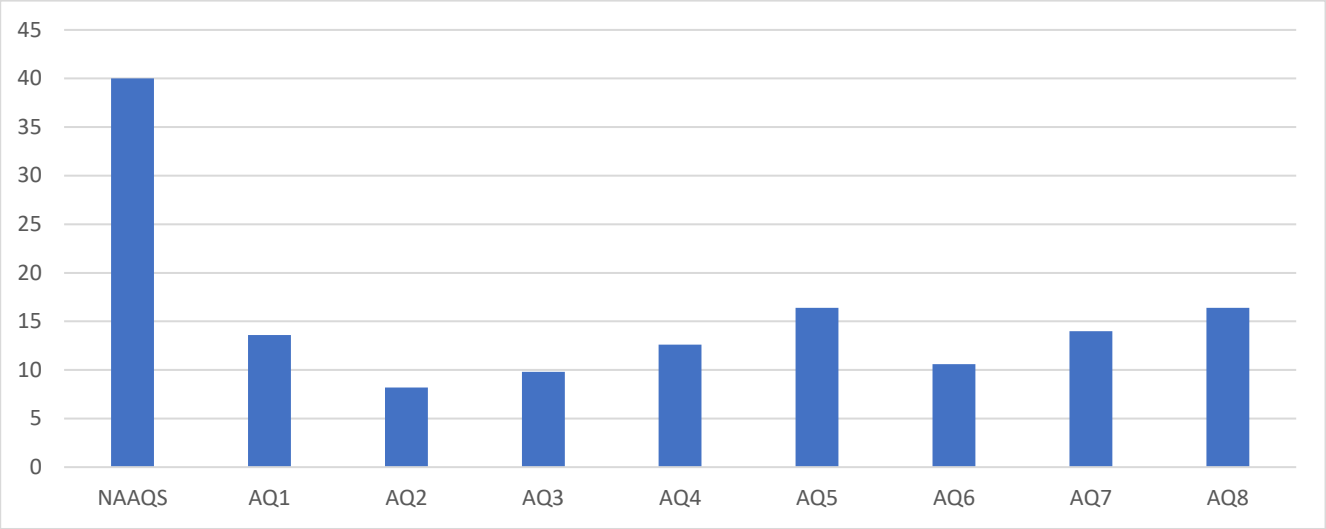


Figure 66: Sulphur Dioxide (SO2) µg/m3

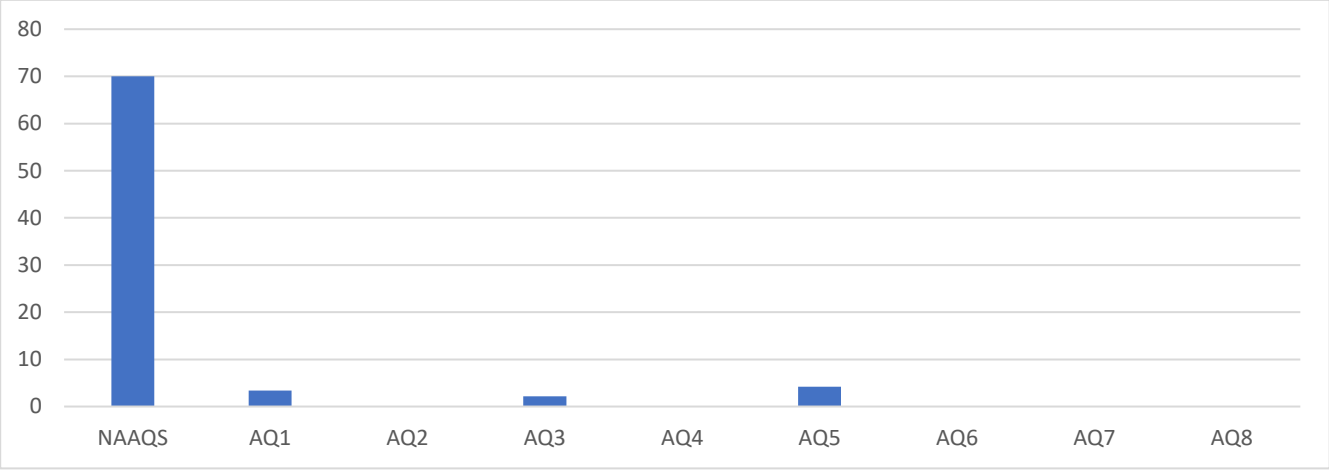
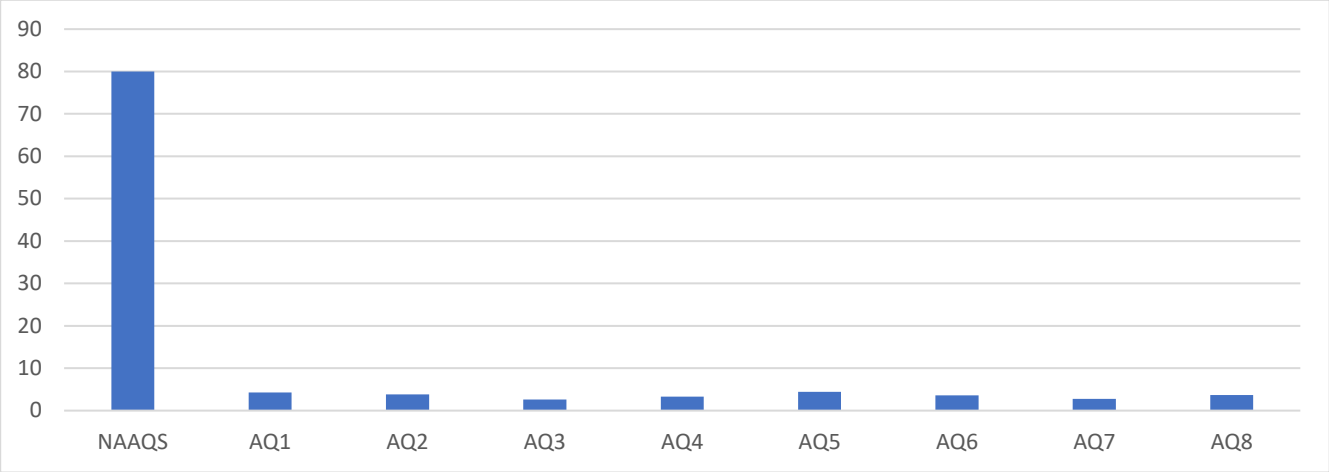


Figure 67: Nitrogen Dioxide (NO2) µg/m3

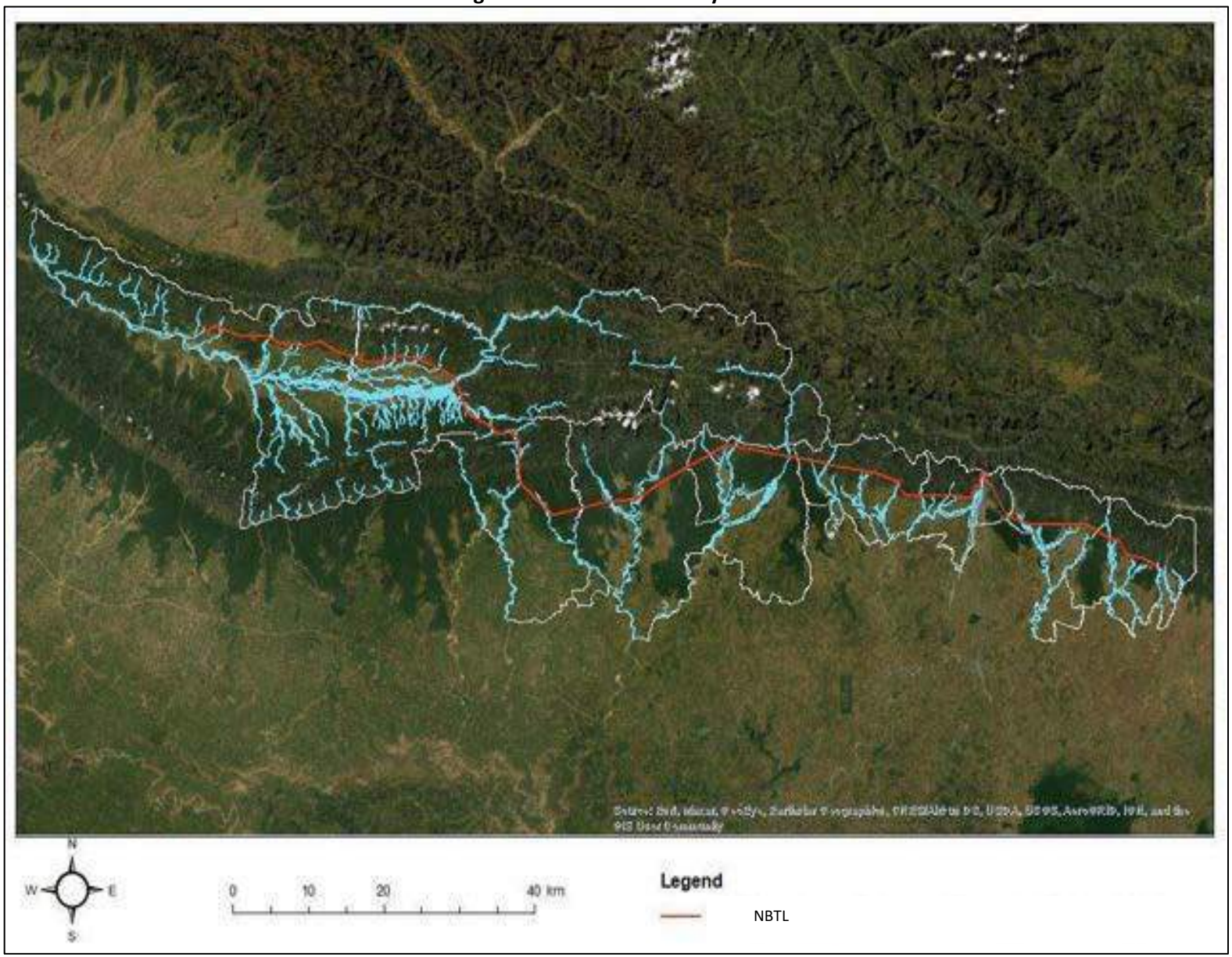


6.2.6 Hydrology and Water Quality

276. NBTL has 9 river crossings of which Tinau, Banganga, West Rapti and Arjun Rivers are major rivers. Among these Banganga River is source for Jagdishpur Reservoir (A Ramsar Site), while West Rapti River is considered as an important bird migratory route. According to the conducted survey, residents do not dispose of their waste into these rivers, although the EIA team understands that carcasses are dumped into the West Rapti River.

277. The Tinau River, located in the Rupandehi district, originates from the Mahabharat range and experiences high water flow during the monsoon season. Similarly, the Banganga River, situated in the Terai region, extends from the Churia range. The West Rapti and Arjun Khola rivers serve as significant sources of construction materials extraction, including stones, gravel, and sand. The water condition in these rivers is generally of good quality as nearby residents utilize the river water for household purposes. It has also been observed that no industrial units directly discharge their effluents into these rivers. However, the extraction activities taking place at West Rapti and Arjun Khola have negatively impacted the overall condition of these rivers.

Figure 68: Rivers crossed by NBTL



278. The NBTL alignment intersects the Tinau River at a chainage of 28.5 km. The crossing occurs near Siddha Baba Temple, situated to the north of Butwal Sub-Metropolitan City. The span of the river crossing measures approximately 70 meters.

Table 50: Water quality of the Tinau River

#	Parameter	Desired level	Observed value
1	pH	6.5 - 8.5	7.5
2	Turbidity [NTU]	5	8.81
3	Total Dissolved Solids [mg/l]	1000	182
4	Dissolved Oxygen [mg/l]		8.23
5	EC [micro m/s]		95
6	Chloride [mg/l]		7.45
7	Nitrogen [mg/l]		0.66
8	Phosphate [mg/l]		1.10

279. The water quality of the Tinau River falls within acceptable limits, with most of the values obtained during the study period conforming to the guidelines set by the World Health Organization (WHO) and the National Bureau of Standards and Metrology (NBSM). The physicochemical parameters generally meet the standards for drinking water, except for turbidity, which may be slightly higher.

280. The alignment of NBTL intersects the Banganga River at a chainage of 58.5 km. The river crossing is in a forested area to the north of the town of Motipur in Banganga Municipality. The span of the river crossing measures approximately 80 meters. During the field survey conducted in October, the water quality of the river was observed to be clean.

Figure 69: River crossing at the Banganga River

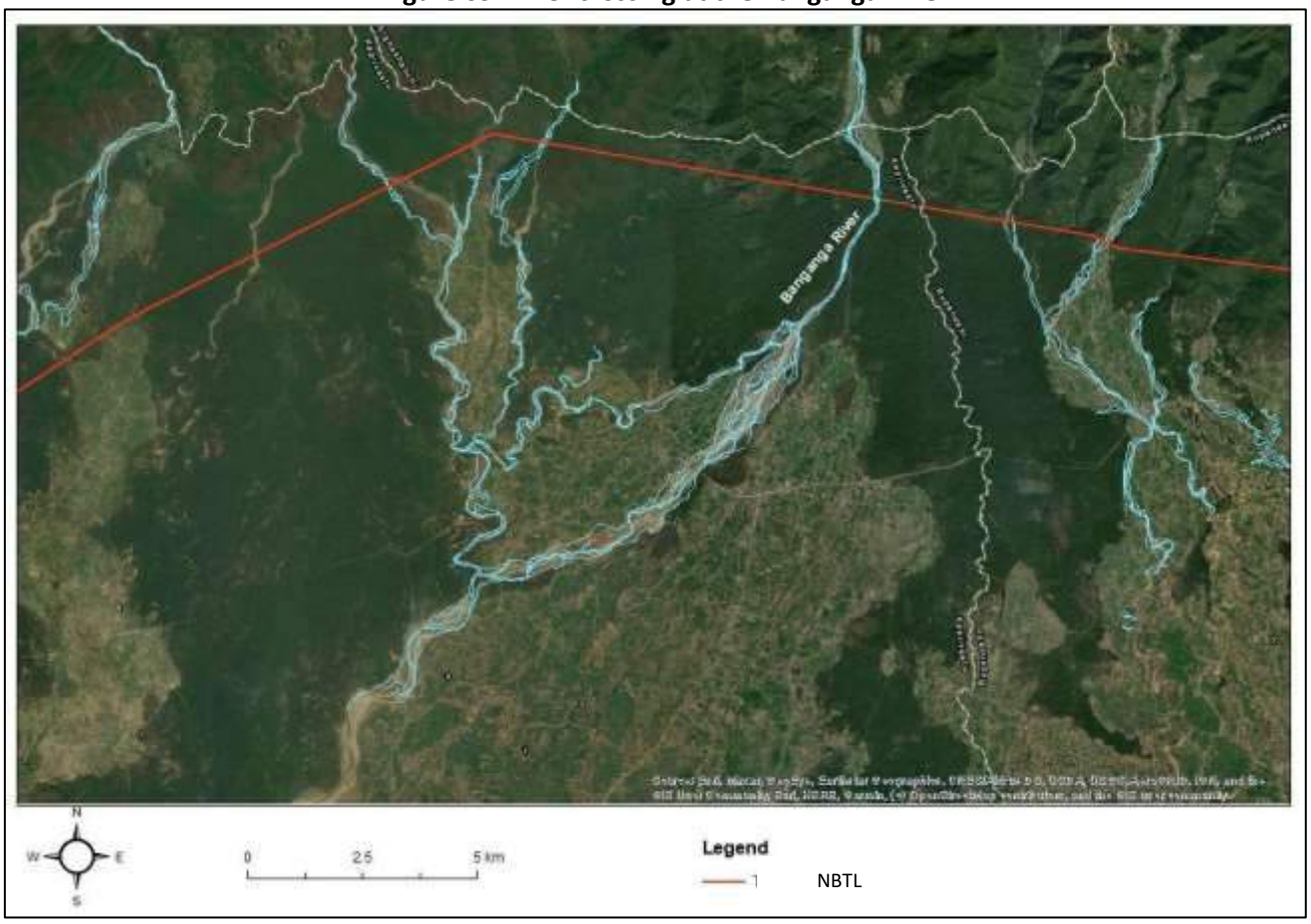


Table 51: Water quality of the Banganga River

#	Parameter	Desired level	Observed value
1	pH	6.5 - 8.5	7.1
2	Turbidity [NTU]	5	2.54
3	Total Dissolved Solids [mg/l]	1000	167
4	Dissolved Oxygen [mg/l]		8.1

281. Based on the water quality results, the Tinau River is presently in a favorable condition. The water sampling took place in October, which marks the onset of the dry season. During this time, turbidity and total suspended solids were found to be within acceptable limits. However, it should be noted that these parameters may rise significantly during the wet season. Additionally, the levels of dissolved oxygen (DO), a crucial indicator of river health, were within the acceptable range. While no specific standard value has been recommended, DO levels below 3 mg/l in river water are typically cause for concern. The recorded values from the sampling stations indicate a healthy DO level.

282. At a chainage of 115 km, the NBTL alignment crosses the West Rapti River, near the town of Bhaluwang in Lamahi Municipality, situated on the river's right bank. The span of the river crossing measures approximately 38 meters. During the field survey conducted in October, the river was observed to be clean. However, it was noticed that domestic waste is being dumped on the riverbanks, and public sewage is discharged into the river. As a result, downstream water quality may be affected, particularly noticeable during the dry months. There are no industrial units in the area that directly discharge their effluents into this river. It was also observed that construction materials such as stone, gravel, and sand are being extracted from the river. During the dry period, activities such as dredging, and truck movements have the potential to impact the river's water quality.

283. The water quality sampling was carried out for this river, which is presented below:

Table 52: Water quality of the West Rapti River

#	Parameter	Desired level	Observed value
1	pH	6.5 - 8.5	7.4
2	Turbidity [NTU]	5	3.03
3	Total Dissolved Solids [mg/l]	1000	243
4	Dissolved Oxygen [mg/l]		6.7
5	Total Hardness		180

284. Based on the water quality results, it is evident that the river remains in a good condition. The sampling was conducted in October, which marks the beginning of the dry season, resulting in turbidity and total suspended solids being within the desired range. However, it should be noted that these parameters may significantly increase during the wet seasons. Additionally, the level of dissolved oxygen (DO), an important indicator of river health, is found to be within the desired limit. Although no specific standard value has been recommended, DO levels below 3 mg/l in river water are generally a cause for concern. The recorded values from the sampling stations confirm a healthy DO level.

Figure 70:River crossing at the West Rapti River

Figure 71: West Rapti River NBTL Crossing Point

Source: EIA team, 2024

285. NBTL crosses the Arjun Khola at a chainage of 141 km, flowing through the western end of Lamahi town. The span of the river crossing measures only 77 meters. During the field survey conducted in October 2023, the river quality was found to be clean. However, it was observed that domestic waste is being dumped on the riverbanks and public sewage is discharged into the river in Lamahi. These activities may result in downstream pollution during the dry months. No industrial units in the area directly discharge effluents into the river. The river is also subjected to extraction of construction materials such as stone, gravel, and sand. During the dry period, activities such as dredging, and truck movement have the potential to impact the quality of the river water.

Figure 72: River crossing at the Arjun Khola

Drinking Water

286. Survey results completed as part of the RIPP social survey revealed that the primary source of drinking water for the majority of households in the project area is piped water, about 57.9% households are using piped water while 22.8% households are using spring water for drinking. Additionally, during the survey, it was observed that approximately 9% of households rely on wells and rivers as their primary sources of drinking water. Moreover, around 3.5% of households reported that they are receiving water supply services from the private sector using water supply trucks/tankers. In all sources of water there is no provision of water treatment even though they collect water from wells, streams, rivers. A summary of the overall water supply across all projects affected areas is presented in Table 52.

Table 53: Source of Drinking Water of the Surveyed Households

Municipalities	Piped Water	Springs	Wells	Rivers	Delivery from private sector	Institution/ Unspecified
Butwal	5.3%					1.8%
Devdaha	1.8%		1.8%			
Gadhawa	8.8%	19.3%	1.8%			
Lamahi	17.5%		1.8%		3.5%	
Rapti	5.3%					5.3%
Sainamaina	3.5%					
Shivraj	12.3%	1.8%		3.5%		
Sitganga	3.5%	1.8%				
Total	57.9%	22.8%	5.3%	3.5%	3.5%	7.1%

Source: HHs survey, NBL-TL, 2021.

287. Groundwater monitoring was completed at two locations, see Figure 32, including from a groundwater source close to Lahami SS. The results, summarised in tabular format below, show that groundwater meets National Drinking Water Quality Standard (2079).

Table 54: Groundwater Monitoring Results

Parameters	Unit	NDWQS	Observed Values	
			WQ1	WQ2
pH	-	6.5 - 8.5*	7.1	6.9
Colour	-	5 (15)	<0.1	<0.1
Turbidity	NTU	5 (10)	<1.0	2
Total Suspended Solids	mg/l	-	<1.0	<1.0
Total Dissolved Solids	mg/l	1000	124	158
Total Hardness	mg/l as $CaCO_3$	500	43	58
Chloride	mg/l	250	2.8	5.9
Ammonia	mg/l	1.5	<0.02	0.03
Nitrate	mg/l as NO_3	50	1.2	3.2
Nitrite	mg/l as NO_2	3	<0.02	0.06
Lead	mg/l	0.01	<0.01	<0.01
Cadmium	mg/l	0.003	<0.002	<0.002
Chromium	mg/l	0.05	<0.05	<0.05
Copper	mg/l	1	<0.01	<0.01
Zinc	mg/l	3	0.13	0.21
Mercury	mg/l	0.001	<0.001	<0.001

Parameters	Unit	NDWQS	Observed Values	
			WQ1	WQ2
Iron	mg/l	0.3 (3)	0.02	0.09
Manganese	mg/l	0.2	<0.02	0.04
Arsenic	mg/l	0.05	<0.01	<0.01
Fluoride	mg/l	0.5-1.5*	0.07	0.04
Aluminium	mg/l	0.2	<0.01	<0.01
Total Coliform	CFU/100 ml	Nil	Nil	Nil
E.Coli	CFU/100 ml	Nil	Nil	Nil

6.3 Biological Environment

6.3.1 Protected Areas and Notable Ecologically Sites

Nationally Designated Sites

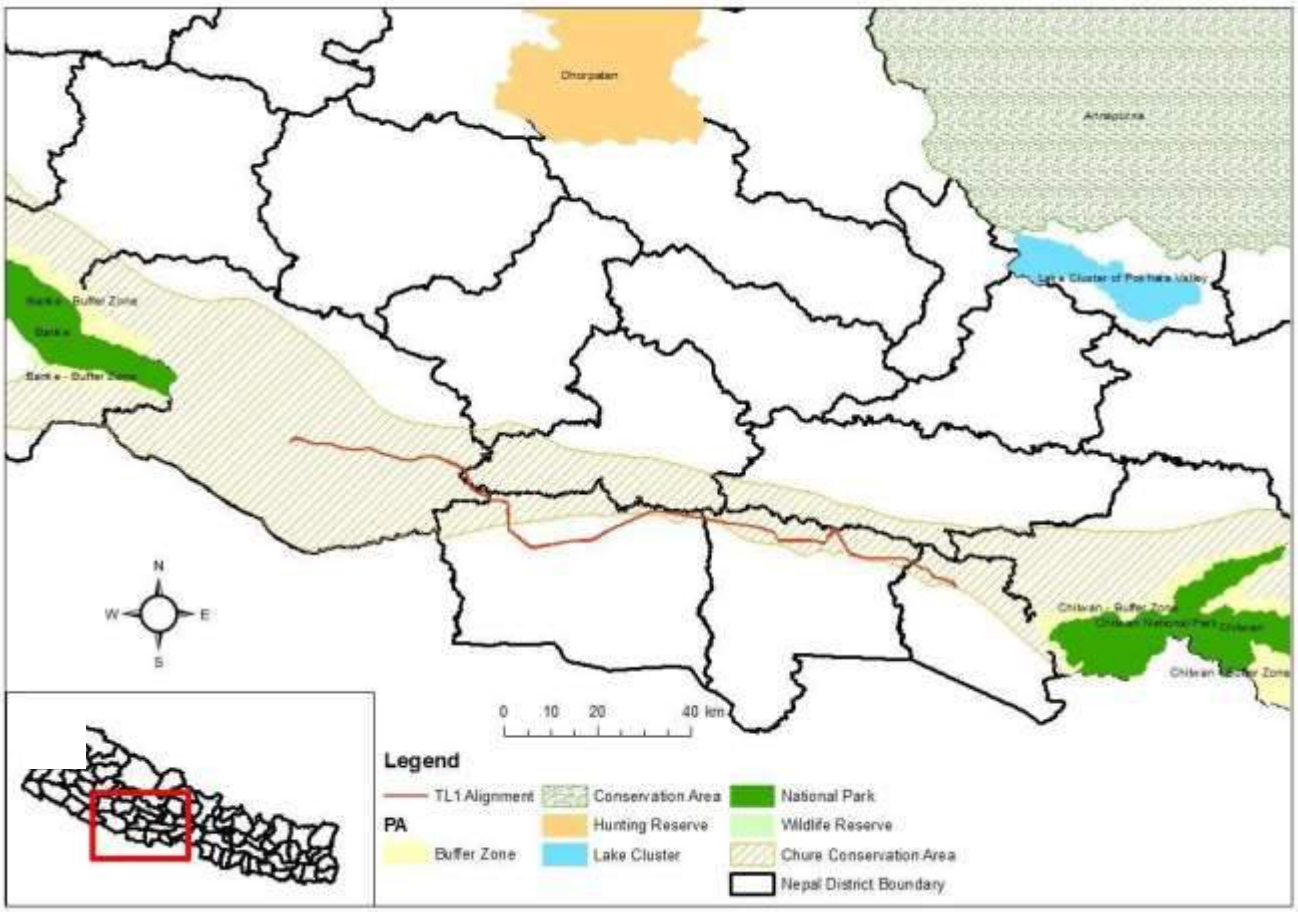
288. Nepal has 23.39% of area covered by 20 Protected Areas (12 National Parks, 1 Widlife Reserve, 1 Hunting Reserve and 6 Conservation Areas) managed by Department of National Park and Wildlife Conservation (DNPWC). In addition to this there are 10 wetlands that have been listed as Ramsar Sites (of these 5 are outside legally protected areas of Nepal among which 1 is inside Chure Conservation Area). In addition to this Government of Nepal as a national pride project named President Chure-Terai Madhesh Conservation Area Program in 2067/68 BS initiated Chure Conservation Area to conserve natural resources of Chure Region that occupies 12.78% of Nepal's territory. Likewise, with identification of the importance of any forest area for its environmental, scientific, cultural or any other importance using Forest Act have declared 10 Forest Conservation Areas occupying 190809.43 ha of land.

289. Lumbini Province endowed with five nationally protected areas Chitwan National Park, Bardiya National Park, Banke National Park, Dhorpatan Hunting Reserve, Krishnasar Conservation Area. Among these Chitwan National Park is a UNESCO Natural World Heritage Site. The province southern region falls in the Terai Arc Landscape, while the Siwalik Ranges and its foothill regions fall in Chure Conservation Area. The northern eastern part of the province fall under the Chitwan Annapurna Landscape. Government of Nepal's Landscape level conservation commenced from 2000 with the objective of enhancing ecological integrity and endangered species through the support of several national as well as international partners. The aim has been to develop network approach of protected areas management through inclusion of social with the ecological dimension[15]. The project falls outside all protected areas defined by GoN[16]

[15] Ghimire, P. (2019). Landscape Level Efforts to Biodiversity Conservation in Nepal: A Review of Current Approach and Lessons Learned. Grassroots Journal of Natural Resources, 2(3): 16-24. Doi: https://doi.org/10.33002/nr2581.6853.02032

[16] CBD Strategy and Action Plan - Nepal (English version)

Table 55: Distribution of the Protected Area in relation to the TL alignment



Source: IEE Study

Chure Conservation Area

290. The most part of the proposed NBTL alignment passes through the Chure Conservation Area. The region is very fragile and distinctive in terms of its geology, hydrological cycle, and ecology. Mainly, sandstone, mudstone and conglomerates are found in the region, and are in the state of being eroded as these rocks have not been totally solidified. Being sensitive towards various socioeconomic and developmental activities, the Government of Nepal has initiated the President Chure Conservation Program in the FY 2066/2067. Despite its name, the Chure Conservation Area is an environmental protection area declared in 2071 Bikram Sambat (BS) and does not have the same status as a Conservation Area. It covers both the Chure Hills and the associated Dun (fertile river valleys used for agriculture).

291. The Chure range is situated at south and almost parallel the Himalayan range in Nepal., Geologically, it is known as the "Siwalik" or "Sub-Himalaya". Some narrow gorges created by the rivers such as the Marin and Kamala gorges of Sindhuli, the Rangoon Valley of Dadeldhura together with the Dun Valley or the Inner-Terai such as the Dang, Deukhuri Surkhet and Chitwan Valleys lie within the Chure Range extending over 800 km from Mahakali in the west to Mechi in the east. It occupies, altogether, 36 (fully or partially) out of the 75 districts of the nation. Moreover, its width varies from 10 km to 50 km (north south), having more width where there are valleys. The Chure Hills range occupies about 12.78% of the total land area (147,181 sq.km.) of Nepal and is inhabited by 3.6 million people. The elevation of the Chure Conservation Area ranges from 120 m to 1,972 m.

292. About 48% of the total area of the Chure-Terai Madhesh Landscape is covered by agriculture and settlement, 47% by forest, shrub-land and grassland, and the rest 5% by river and riverbed. Of the total area of the Chure Hills range (including gullies) 83% is occupied by forest, shrub, and grassland while 13% by agriculture and settlement, and the rest 4% by river and riverbed. On the contrary, 83% of the Terai Madhesh region is occupied by agriculture and settlement, 13% by forest, shrub and grassland, and the rest 4% by river and riverbed. The proportion of land under the forest, shrub, and grassland in the Chure Hills range is comparatively quite high while there is dominance of agriculture in the Terai Madhesh region. However, the proportion of agriculture is nearly 58% in the Dun, while almost the same proportion of ground is covered by forest, shrub, and grassland in the Bhavar region.

293. Ecologically, the Chure Hills range is a very important physiographic zone of Nepal. Of its forests, 3% are conifers (all Chir pine), 83% hardwoods, in almost equal amount of Sal Forest and tropical mixed forest, and 14% mixed Chirpine and hardwoods. Altogether, 14 of Nepal's total 118 ecosystems lie in the Chure Hills.

The Terai Arc Landscape

294. The Terai Arc Landscape (TAL) is a transboundary expanse that stretches over 900 km from Nepal's Bagmati River in the east to India's Yamuna River in the western state of Uttaranchal, covering an extensive area of 51,002 km^2. This landscape encompasses the Terai, a flat, lowland region, as well as the nearby Chure Hill range. Conceived by the Government of Nepal in 2001, the TAL was conceived with inspiration from the Tiger dispersal model, recognizing that relying solely on conservation efforts within protected area would not be sufficient to ensure the long-term survival of tigers.

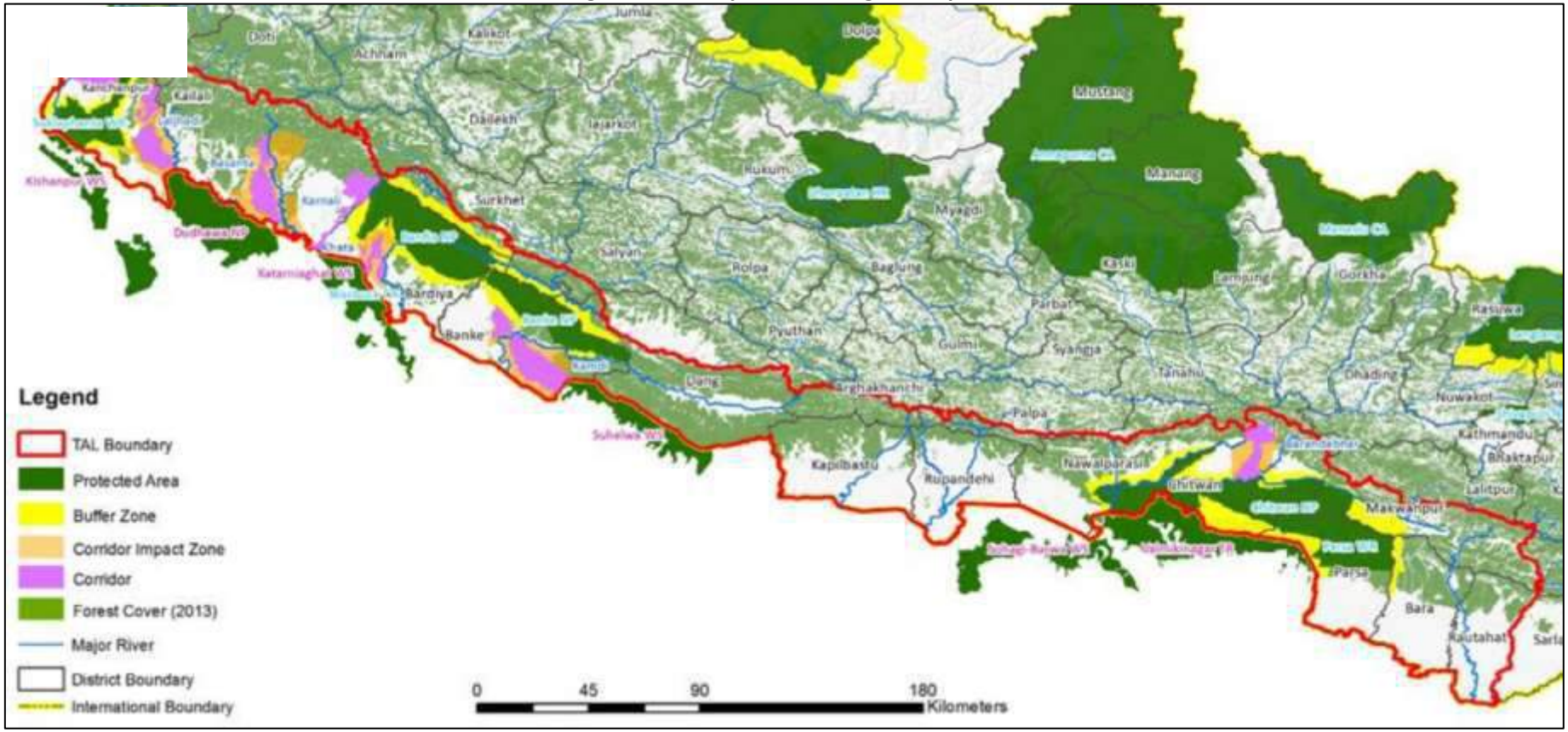
295. In Nepal, the norther boundary of the TAL has been thoughtfully delineated to encompass the north-facing slopes of the Chure hill range. This specific region encompasses an expansive land area measuring 24,710.12 km^2, and it extends its reach across 19 districts within the country. Within this northern portion of the TAL, there are a total of 6 protected areas, which play a crucial role in safeguarding the diverse and unique ecosystems found in this remarkable landscape.

Table 56: Protected areas in the TAL-Nepal

Protected Area	Declared year	Core area [km^2]	Buffer Zone [km^2]	Total area [km^2]
Chitwan National Park	1973	932	750	1682
Bardiya National Park	1976	986	507	1475
Shuklaphanta Wildlife Reserve	1976	305	243	548
Parsa Wildlife Reserve	1984	637	385	922
Banke National Park	2010	550	343	893
Krishnasar Conservation Area	2009	16.95	-	16.95
Total		3409	2,128	5,538

Source - MoFSC (2015) Strategy and Action Plan 2015 – 2025, Terai Arc Landscape, Nepal, Ministry of Forests and Soil Conservation, Singh Durbar, Kathmandu, Nepal

Figure 73: TAL spatial coverage in Nepal



Source: MoFSC (2015) Strategy and Action Plan 2015 – 2025, Terai Arc Landscape, Nepal, Ministry of Forests and Soil Conservation, Singh Durbar, Kathmandu, Nepal

296. Within the TAL, the habitat corridors serve as vital conduits that enable the smooth movement and dispersal of wildlife, with a particular emphasis on iconic species like tigers and rhinoceros. A total of 7 of these essential corridors have been carefully identified and are now actively managed through a participatory conservation approach. This approach involves engaging local communities in conservation efforts, acknowledging their role as stewards of the land.

297. Furthermore, 4 of these critical corridors have garnered special recognition as transboundary corridors, earning the designation of "protection forests." This designation underscores their significance not only for the preservation of biodiversity within their respective nations but also for facilitating the cross-border movement of wildlife, fostering cooperation between Nepal and India in the realm of conservation.

Table 57: Protected forests and government designated corridors in the TAL-Nepal

Corridors		Forest Corridor [km2]	Impact Zone [km2]	Total Area [km2]
Barandabhar	Corridor and protection forest	148	113	261
Basanta	Corridor and protection forest	181	471	652
Brahmadev	Corridor	138	10	148
Kamdi	Corridor	291	159	450
Karnali	Corridor	149	78	227
Khata	Corridor and protection forest	74	128	202
Laljhadi - Mohana	Corridor and protection forest	202	153	355

Source: MoFSC (2015) Strategy and Action Plan 2015 – 2025, Terai Arc Landscape, Nepal, Ministry of Forests and Soil Conservation, Singh Durbar, Kathmandu, Nepal

298. The project area falls within the broader expanse of the TAL, a region of significant ecological importance. However, it's noteworthy that they project site itself does not overlap with any of the officially designated protected areas within the TAL.

Kamdi Corridor

299. The nearest ecologically sensitive area within the TAL, in proximity to the project site, is the Kamdi Corridor, located at a distance of about 40 km aerial distance from westernmost point of the project – Lamahi SS. The Kamdi Corridor holds particular significance as it serves as a vital linkage between the Banke National Park in Nepal and the Shohelwa Wildlife Sanctuary in India.

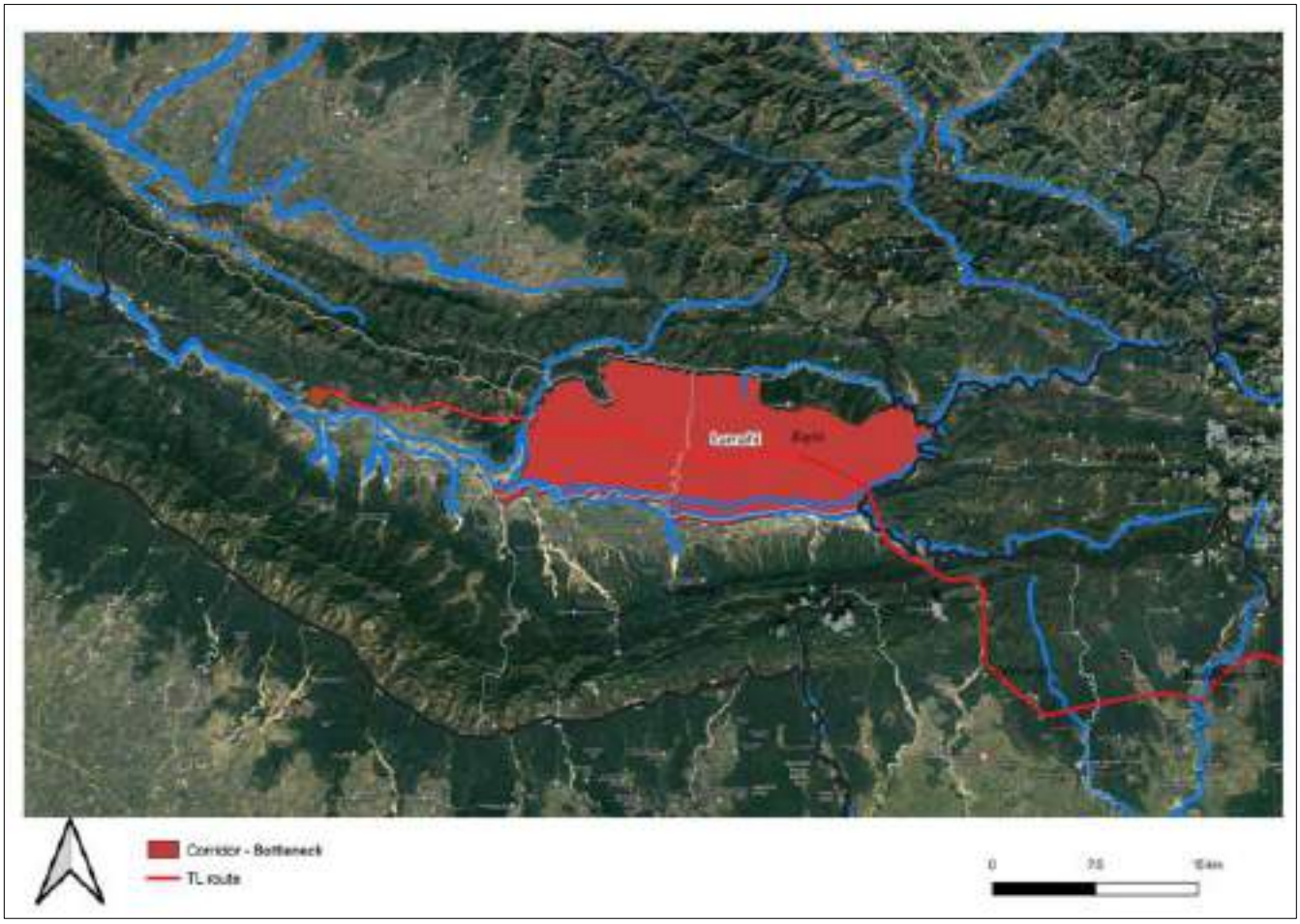
300. A report published by the Ministry of Forests and Soil Conservation (MoFSC) (now this Ministry is called Ministry of Forests and Environment (MoFE)) revealed the presence of several species within the Kamdi Corridor. This includes the tiger, common leopard, as well as their prey species such as wild pig, spotted deer, and the distinctive four-horned antelope. While the presence of these species underscores the ecological significance of the Kamdi Corridor within the broader context of the TAL, it's important to note that the project is not anticipated to directly impact the Kamdi Corridor.

Lamahi Bottleneck

301. Within the chainage from 116 km to 143 km, the NBTL route crosses the West-Rapti River and traverses through the Rapti Municipality, which is designated as the Lamahi bottleneck. It is wildlife

corridor that connects the Terai with the Churia and above ranges. However, this bottleneck is facing a number of threats, including deforestation and poaching. This area was reforested and restored during the period of the first TAL strategy.

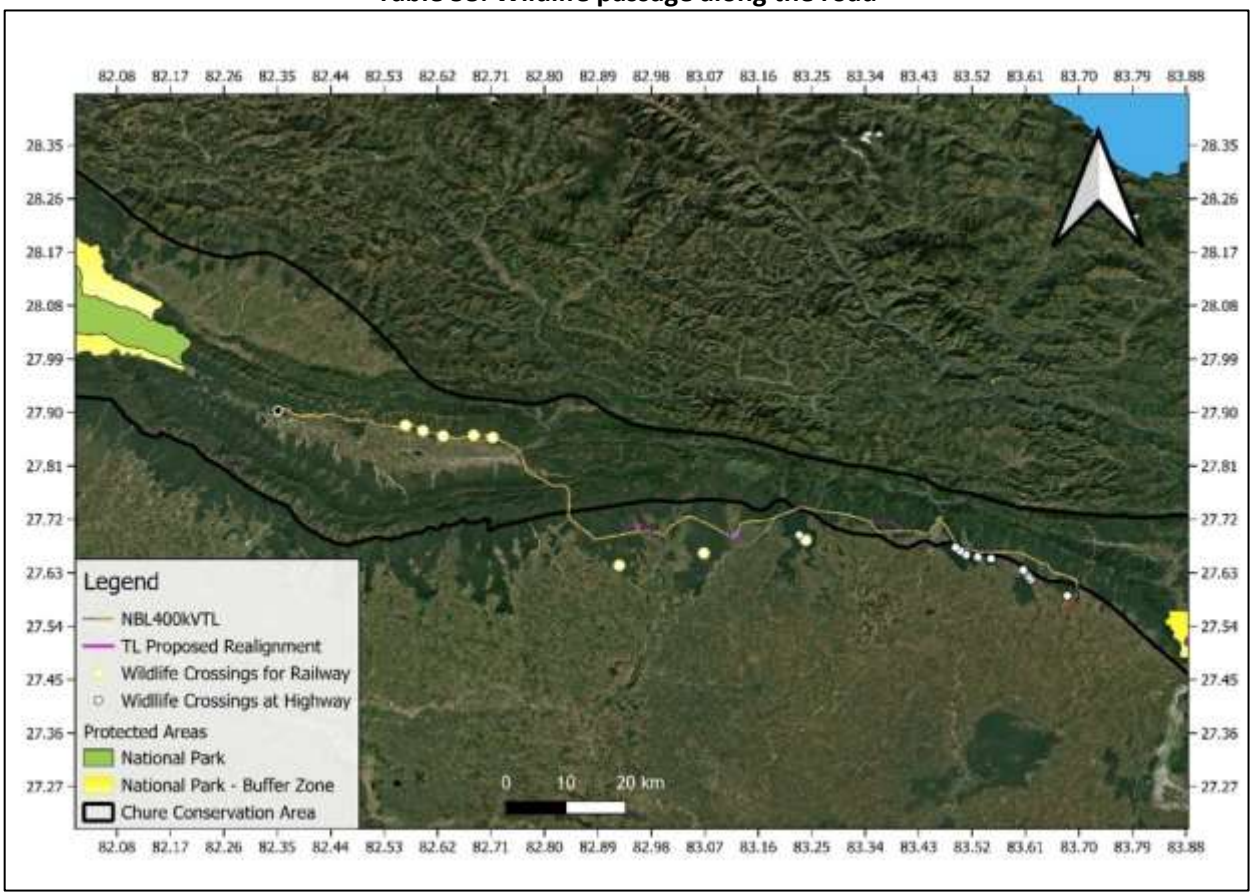
Figure 74: Lamahi Bottleneck



Other Wildlife Crossing Areas

302. The NBTL section between AP51 to AP 55 has some identified wildlife crossings. Notably, the on-going highway upgradation project within the ADB loan SASEC Road Improvement Project, stretching from Narayangadh and Butwal, had identified several animal passages. In total 12 such passages that have been carefully crafted to facilitate the movement of a variety of wildlife species. Likewise East West Electrified Railway has proposed 7 animal passages in this section of their proposed Railway alignment. These are presented below:

Table 58: Wildlife passage along the road



Source: SASEC Environmental Assessment Report

Table 59: Locations of wildlife passages relative to the NBTL route

Passage Type	Target Species	Width	Height	Length	Remark	Distance m to TL	Tower
Minor Bridge	Wild Boar, Jackal, Leopard	16	6	27.5	Openness index 3.49	2522.11	AP1
Minor Bridge	Wild Boar, Jackal, Leopard, Mongoose	16	6	27.5	Openness index 3.49	2538.89	AP1
Minor Bridge	Sambar, Spotted deer, Leopard	10	4.5	27.5	Openness index 1.64'	3470.19	26
Minor Bridge	Sambar Spotted Deer, Leopard	16	4.5	27.5	Openness index 2.62	3206.48	27 to 28
Slab Culvert	Sambar Spotted Deer, Leopard	5	4	27.5	Openness index 0.44	2925.55	29 to 30
Slab Culvert	Sambar Spotted Deer, Leopard	10	4	27.5	Openness index 1.45	2753.45	30 to 31
Minor Bridge	Spotted deer, Leopard	16	4.8	27.5	Openness index 2.79	1239.33	31
Rohini Khola, Major Bridge	Blue bull	31	5	27.5	Openness index 5.63	968.51	48
Slab Culvert	Blue Bull	5	4	27.5	Openness index 0.73	1116	AP9

Passage Type	Target Species	Width	Height	Length	Remark	Distance m to TL	Tower
Minor Bridge	Blue Bull	16	4.8	27.5	Openness index 2.79	715.43	58 to 59
Sukaura Khola, Major Bridge	Blue Bull	26.2	3.6	27.5	Openness index 3.43	353.99	61 to 62

Source: SASEC Environmental Assessment Report

Internationally Designated Sites

303. Internationally designated sites located within the Project area include important bird areas (IBA) and key biodiversity areas (KBA) and one RAMSAR site. No Alliance for Zero Extinction (AZE) sites are present.

304. **Key Biodiversity Areas** – two KBAs can be found close to or overlapping with the alignment (Figure 75), the most relevant of which is Shivapur Forest. Species triggering KBA status in the forest include:

- Three-keeled Land Tortoise (*Melanochelys tricarinata*) IUCN Vulnerable
- Yellow-headed Tortoise (*Indotestudo elongate*) IUCN Endangered.

305. **Important Bird Areas** – The project area is in the hotspot of the avian biodiversity. The alignment intersects three IBAs; namely (a) Dang Deukhuri Valley and Rapti River Corridor, (b) Kapilvastu Farmlands and (c) Devdaha (see Figure 77).

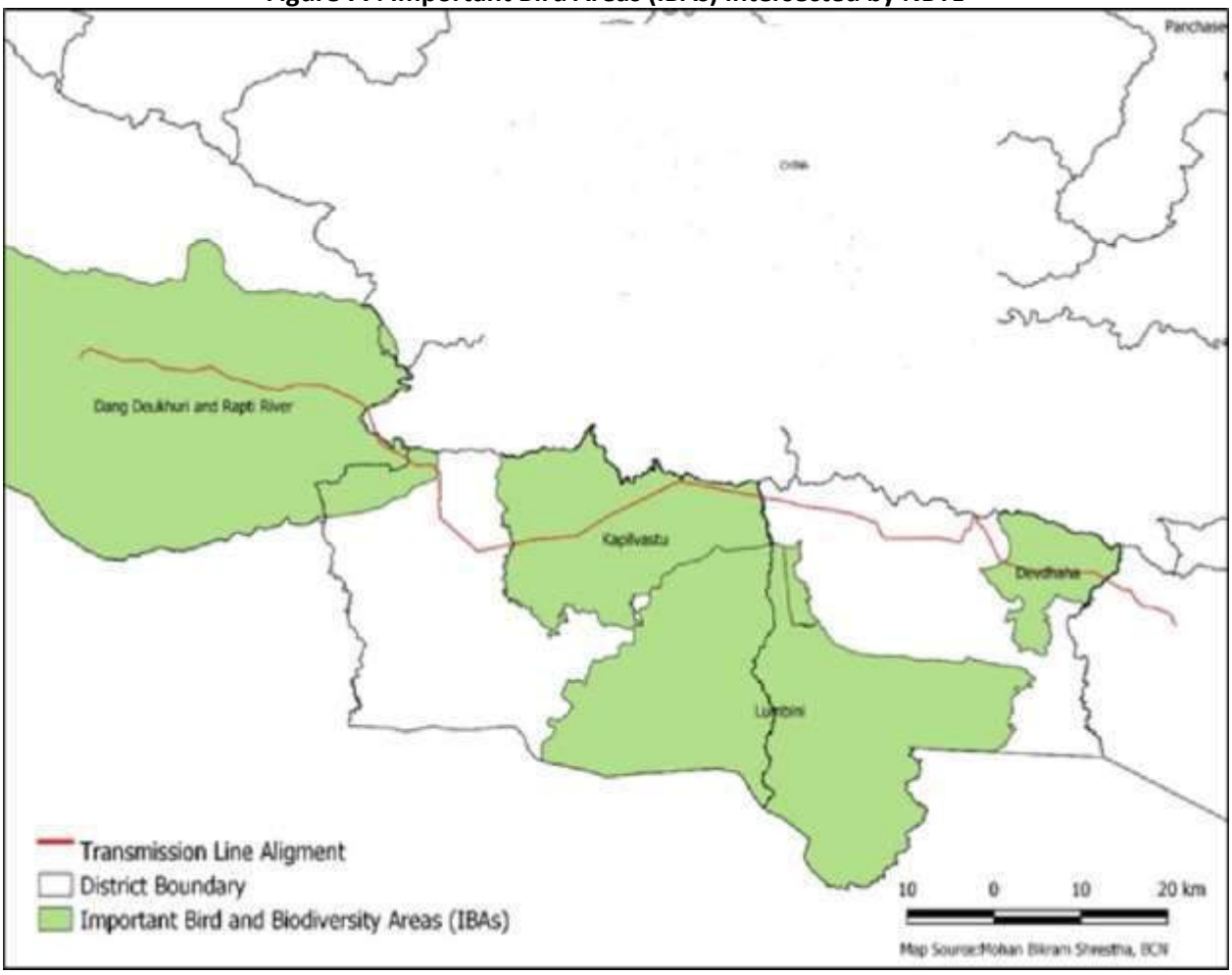
Figure 75: Key Biodiversity Areas

Source: IBAT

Figure 76: Shivapur KBA

Source: EIA Team, 2024

Figure 77: Important Bird Areas (IBAs) intersected by NBTL



Source: BCN, 2023

6.3.2 Habitat

306. The project area boasts a rich tapestry of diverse habitats, encompassing subtropical broadleaf forests, agricultural lands, and wetlands that comprise small ponds, streams, and rivers. Additionally, this landscape is interwoven with human settlements. Local communities have a deep-rooted connection with these habitats, relying on them to sustain their livelihoods. Activities such as livestock grazing, the collection of forest products, and the gathering of various resources have been integral to the well-being of these communities.

307. Regrettably, these vital habitats have experienced, and continue to face, a distressing trend of degradation, primarily driven by human activities. This degradation has far-reaching consequences, not only affecting the habitats themselves but also posing significant challenges to the delicate ecological balance of the surrounding forests.

308. The project area is in the Western Botanical Province and has moderately rich in local biodiversity, owing to much drier climatic conditions. According to the FRA publication (TISC Doc. No. 135, 2002), Stainton (1972) identified 35 forest types in Nepal, largely based on Champion's (1936) work. These 35 forest types are often categorized into the following 10 major groups (GoN, 2014):

1. tropical,
2. subtropical broadleaved,
3. subtropical conifer,
4. lower temperate broadleaved,
5. lower temperate mixed broadleaved,
6. upper temperate broadleaved,
7. upper temperate mixed broadleaved,
8. temperate coniferous,
9. sub-alpine and
10. alpine scrub.

Critical Habitat Assessment

309. Critical Habitat assessment ideally takes place across sensible ecological or political units that are sufficiently large to encompass all direct and indirect impacts from a project. These areas of analysis (AoAs) are thus often much broader than the direct project footprint. AoAs may be separate or combined, depending on the ecology of the biodiversity concerned.

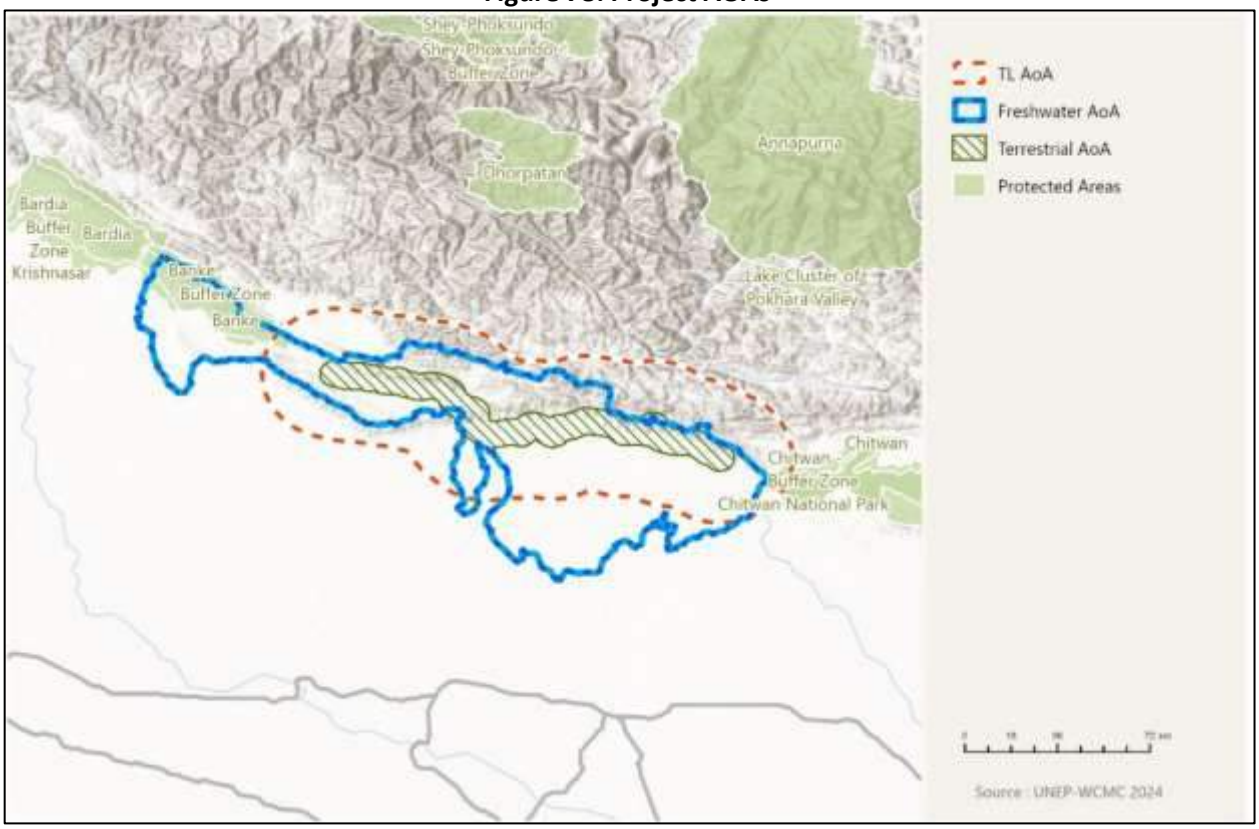
310. Simple AoAs for this Project were defined for ecologically-similar biodiversity, namely: (i) aquatic biodiversity; (ii) birds at risk of collision with transmission lines; and (iii) terrestrial biodiversity.

311. The AoAs for aquatic biodiversity were defined to encompass all infrastructure within each cluster. Hydrosheds (Lehner et al. 2008) are the units for which freshwater biodiversity data have been compiled by IUCN (2023). Level 9 hydrosheds were the most practical scale at which to develop aquatic AoAs that encompass potential areas of project impact. Single aquatic AoAs were chosen for each cluster in the absence of sufficient information on species' presence in the area to usefully identify multiple ecologically-suitable AoAs.

312. AoAs for birds (and large bats, which are also susceptible to collision and electrocution risks) were defined for each cluster using a buffer of 25 km around transmission lines and 5 km around substations.

313. The AoAs for other terrestrial biodiversity were defined to encompass all infrastructure in each geographic cluster, plus a precautionary 5 km buffer to encompass any likely significant impacts

Figure 78: Project AOAs



314. In summary, the all of the Project AoAs qualify as critical habitat. The full CHA can be found in Appendix D. The table below summarizes critical habitat qualifying biodiversity.

Table 60: Critical Habitat-qualifying biodiversity in the Project AoAs

Biodiversity type	Name	Critical Habitat criterion qualified[17]						Justification
		1	2	3	4	5	6[18]	
1. Mammal	Hispid Hare (Caprolagus hispidus)	✓?						>0.5% of the global population of this globally Endangered species might well occur in the Cluster 1 terrestrial AoA.
2. Bird	White-rumped Vulture Gyps bengalensis	✓						>0.5% of the global population of this globally Critically Endangered species likely occurs in the Cluster 1 avian AoA.
3. Bird	Slender-billed Vulture Gyps tenuirostris	✓?						>0.5% of the global population of this globally Critically Endangered species may occur in the Cluster 1 avian AoA.
4. Bird	Bengal Florican Houbaropsis bengalensis	✓		✓				>1% of the global population of this globally Critically Endangered migratory species likely occurs in the Cluster 1 avian AoA.
5. Bird	Lesser Adjutant Leptoptilos javanicus			✓				>1% of the global population of this migratory species likely occurs in the Cluster 1 avian AoA.
6. Reptile	Gharial Gavialis gangeticus	✓						>0.5% of the global population of this globally Critically Endangered species occurs in the Cluster 1 freshwater AoA.
7. Reptile	Spotted Pond Turtle Geoclemys hamiltonii	✓?						>0.5% of the global population of this globally Endangered species may well occur in the Cluster 1 freshwater AoA.
8. Reptile	Tricarinate Hill Turtle Melanochelys tricarinata	✓?						>0.5% of the global population of this globally Endangered species might possibly occur in the Cluster 1 terrestrial AoA.
9. Reptile	Indian Eyed Turtle Morenia petersi	✓?						>0.5% of the global population of this globally Endangered species may well occur in the Cluster 1 and 3 freshwater AoAs.
10. Fish	Kalabans Bangana dero			✓?				>1% of the global population of this migratory species may well occur in the Cluster 1 freshwater AoA.
11. Fish	Chagunius chagunio			✓?				>1% of the global population of this migratory species might possibly occur in the Cluster 1 and 4 freshwater AoAs.
12. Fish	Annandale Garra Garra annandalei			✓?				>1% of the global population of this migratory species might possibly occur in the Cluster 1 freshwater AoA.
13. Fish	Rainbow Minnow Psilorhynchus gracilis			✓?				>1% of the global population of this migratory species might possibly occur in the Cluster 1 and 3 freshwater AoAs.
14. Fish	Psilorhynchus nepalensis		✓					>10% of the global population of this restricted-range species likely occurs in the Cluster 1 freshwater AoA.
15. Fish	Stone Carp Psilorhynchus pseudecheneis			✓				>1% of the global population of this migratory species may well occur in the Cluster 1 freshwater AoA.
16. Fish	Mahseer Tor tor			✓?				>1% of the global population of this migratory species might possibly occur in the Cluster 1 freshwater AoA.
17. Site	Banke National Park						✓	An IUCN Category II protected area.
18. Site	Banke National Park Buffer Zone						✓	An IUCN Category VI protected area.
19. Site	Chitwan National Park and KBA						✓	An IUCN Category II protected area, which actually or likely holds >0.5% of the global population of the Critically Endangered White-rumped Vulture, Slender-billed Vulture, Gharial and Elongated Tortoise, and Endangered Tiger and Bengal Florican, and also qualifies as Critical Habitat for Indian Rhinoceros.
20. Site	Chitwan National Park Buffer Zone						✓	An IUCN Category VI protected area, and part of Chitwan National Park KBA (which actually or likely holds >0.5% of the global population of the Critically Endangered White-rumped Vulture, Slender-billed

17 ✓= actually or likely qualifies area as Critical Habitat; ? = possibly qualifies area as Critical Habitat. Both based on available information.

18 Per ADB (2009), rather than IFC (2019).

Biodiversity type	Name	Critical Habitat criterion qualified[17]						Justification
		1	2	3	4	5	6[18]	
								Vulture, Gharial and Elongated Tortoise, and Endangered Tiger and Bengal Florican, and also qualifies as Critical Habitat for Indian Rhinoceros).
21. Site	Chitwan World Heritage Site						✓	Part of Chitwan National Park KBA (which actually or likely holds >0.5% of the global population of the Critically Endangered White-rumped Vulture, Slender-billed Vulture, Gharial and Elongated Tortoise, and Endangered Tiger and Bengal Florican, and also qualifies as Critical Habitat for Indian Rhinoceros).
22. Site	Chure Hills Environmental Protection Area						✓	An IUCN Category VI protected area which is partially overlapped by a number of sites of high importance for biodiversity, including the Dang Deukhuri Foothill Forests and West Rapti Wetlands KBA (which supports >0.5% of the global population of the Critically Endangered White-rumped Vulture, and likely also >0.5% of the global population of the Critically Endangered Slender-billed Vulture).
23. Site	Dang Deukhuri Foothill Forests and West Rapti Wetlands KBA						✓	Supports >0.5% of the global population of the Critically Endangered White-rumped Vulture, and likely also >0.5% of the global population of the Critically Endangered Slender-billed Vulture.
24. Site	Farmlands in Lumbini area KBA						✓	Likely to support >0.5% of the global populations of the Critically Endangered White-rumped Vulture and Slender-billed Vulture.
25. Site	Nawalparasi forests KBA						✓?	May support >0.5% of the global population of the Critically Endangered White-rumped Vulture.
26. Site	Parsa National Park Buffer Zone						✓	An IUCN Category VI protected area, and part of Langtang National Park KBA (which may support >0.5% of the global population of the Critically Endangered Elongated Tortoise).

Assessment of Natural Habitat

315. Where feasible, the presence of Natural Habitat in Project AoAs was assessed using the National Land Cover Monitoring System for Nepal, which is based on 2000-2019 Landsat data (FRTC 2022). In some cases, AoAs also overlap India. In those cases, FRTC (2022) data were supplemented with European Space Agency WorldCover data, based on 2020-2021 Sentinel data (Zanaga *et al.* 2022). Visual comparison of the two datasets for project areas in Nepal showed close alignment in classification. Based on these two datasets, the extent of Natural versus Modified Habitat within Project AoAs is shown in Table 62. Modified Habitat was considered to comprise cropland and built-up areas.

Table 61: Extent of Modified and Natural Habitat in the Project terrestrial AoAs

Modified Habitat		Natural Habitat	
Area within AoA (km^2)	% of AoA	Area within AoA (km^2)	% of AoA
509	30.34%	1168	69.66%

6.3.3 Flora

316. The vegetation within the project area is typical of the tropical bioclimatic zones in western Nepal but is also heavily influenced by the local habitat conditions and the exposure of the mountain slopes. The project site is located within a specific elevation range, ranging from 133m to 560m.

Forests

317. The NBTL traverses through five districts within Lumbini Province, with each district being further elaborated upon in detail regarding forests.

318. **Nawalparasi (West of Bardghat and Susta) District:** Nawalparasi-West District is situated in the Lumbini Province, with geographical coordinates ranging from latitude 27º21' to 27º47’ and longitude 83º36' to 84º25'. Its altitude varies from 91 meters to 1,936 meters above sea level. This district encompasses the lowlands, including the Terai region and Siwalik foothills, covering an area of 2,162 square kilometers. This area constitutes approximately 1.5% of Nepal's total land area (DFRS Nepal, 2015).

319. Within the district, around 55% (122,365 hectares) of the land is covered by forests. The dominant tree species found in these forests include Shorea robusta, Terminalia alata, Trewia nudiflora, and Garuga pinnata, among others. Notably, there are two collaborative forests named Madyabindu in Nabalpur and Buddhashanti in the Parashi district. Additionally, there are 105 community forests distributed across these districts.

320. **Rupandehi District:** Located in the Lumbini Province, the Rupandehi District stretches between latitudes 27º20'00” to 27º47'2” and longitudes 83º12'1” to 83º38'16”. With an area of approximately 1360 sqkm, the district's altitude ranges from 100m to 1129m above sea level (NSO, 2019). The district is covered by a total forest area of 25,105 ha, with 5-10% tree cover, accounting for 372 ha, while the remaining areas are occupied by shrubs and herbs (Rupandehi, DDC, 2021). The district is

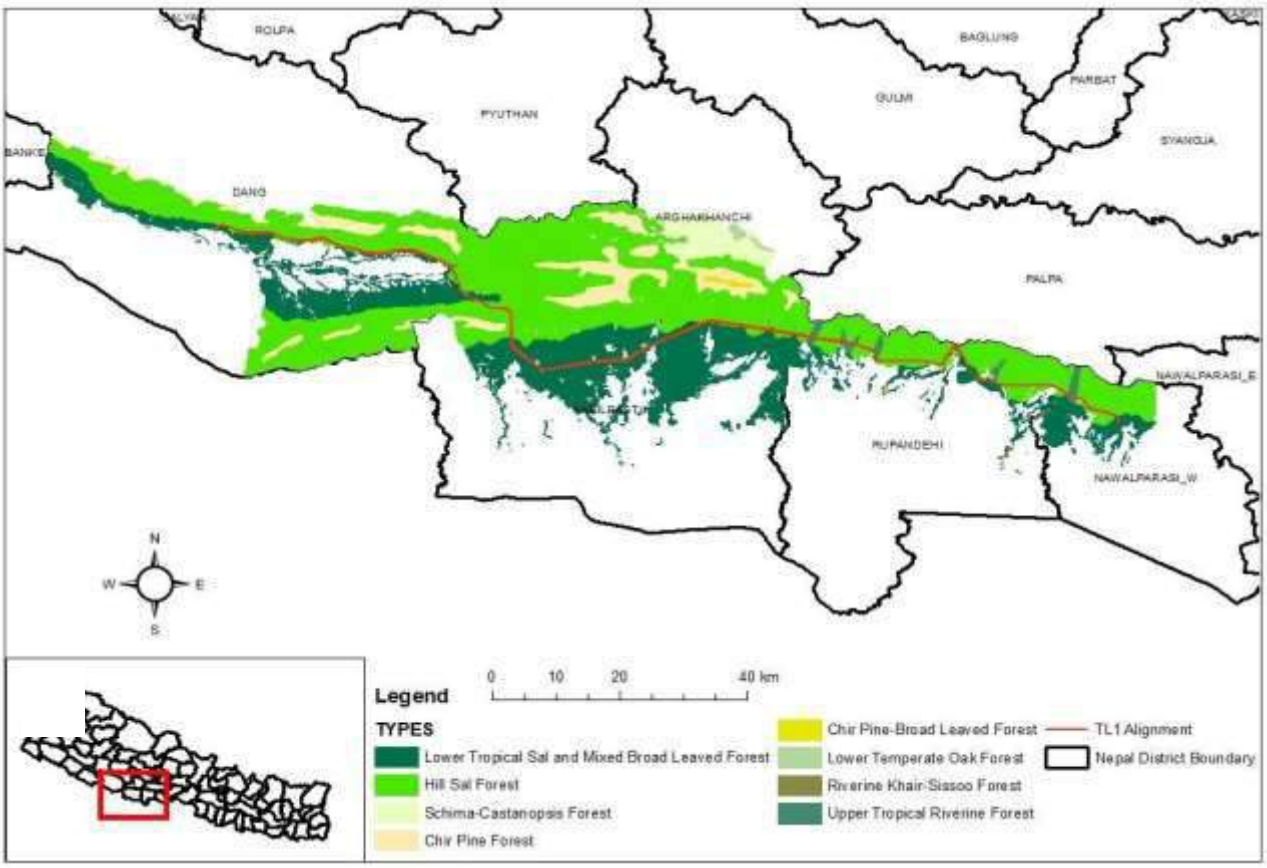
primarily dominated by species like Shorea robusta, Terminalia alata, Trewia nudiflora, Garuga pinnata, which are like those found in the neighboring Nawalparasi District.

321. **Kapilvastu District:** The Kapilvastu district covers an area of 1,738 square kilometers and has an elevation ranging from 93 m to 1,491m above sea level. Its topography can be classified into the low land plains of Terai and the low Chure Hills. The district is dominated by species such as Shorea robusta, Terminalia alata, Trewia nudiflora, and Garuga pinnata. The forest area in Kapilvastu spans 59,025 ha, and it is divided into six collaborative forests, including Tilaurakot Ka, Tilaurakot Kha, Kapilvastu, Gautam Budddha, Mayadevi, and Shivraj. Additionally, there are 105 community forests within the district.

322. **Arghakhanchi District:** Arghakhanchi District is rich in forest resources, with 54.37% of its land area covered by forests (DFO, 2069 BS). The forest and vegetation in the district are divided into Lower Mountain Hardwood Forest, Coniferous Forest, Sal Forest, Shrub-land, and Grassland. Of these, 71% of the area is covered by forests, 24% by shrub-land, and 5% by grassland. The district has 403 community forests, with every village having community forestry programs. The project construction site is situated in Argha village. The district comprises lower hills such as Chure, Bhawar, and Dun, as well as hilly areas. In the lower region, Sal (Shorea robusta) dominates along with Asana (Terminalia alata), Jamun (Syzyzium cuminii), Karma (Haldina cordifolia), Bot Dhaiyaro (Lagerstroemia parviflora), Rajbriksha (Cassia fistula), Tantari (Dillenia pentagyna), Barro (Terminalia bellirica), Amala (Phyllanthus emblica), and Pyari (Buchanania latifolia). However, Pinus roxburghii and Schima castanopsis are also found in hilly areas. (Source: District Development Committee, Arghakhanchi).

323. **Dang District:** The Dang District, located in the inner Terai region of Nepal, has an area of 2902.510 square kilometers with an elevation range of 213 to 2058 meters above sea level. More than 50% of the district is covered by forests, while the rest is dedicated to agriculture, water bodies, and other uses. The district is divided geographically into two parts: the Siwalik hills and the plain valley or Bhabar. It is bounded by the Mahabharat hills to the north and the outer Siwalik hills to the south. The soil in the hills is composed of loosely bound coarse sand, gravel, and conglomerates, while the soil in Dang and Deukhari valley is clay and sandy loam. The district has 508 community forests, and the dominant tree species include Sal (Shorea robusta), Asana (Terminalia alata), Jamun (Syzyzium cuminii), Karma (Haldina cordifolia), Bot Dhaiyaro (Lagerstroemia parviflora), Rajbriksha (Cassia fistula), Tantari (Dillenia pentagyna), Barro (Terminalia bellirica), Amala (Phyllanthus emblica), and Pyari (Buchanania latifolia). However, Pinus roxburghii and Schima castanopsis are also found in hilly areas.

Figure 79: Distribution of forest types in the project area



Source: ICIMOD

324. As mentioned earlier, 93% of the NBTL alignment passes through forested areas. These forested areas are either managed by the Divisional Forest as National Forests or by communities in the form of Community Forests and Collaborative Forests. The table provided below presented the recorded areas of 71 Community Forests, 5 Collaborative Forests, and 4 National Forests along the NBTL alignment.

Table 62: Management of the forested area along the NBTL alignment

#	Municipality	Ward no.	TL Length in the forested area [km]	Forest management types
1	Sunwal	4, 6, 7, 11, 13	22, 15	5 Community Forests – Mulpani, Adarsha, Bandevi, Bisasya, Badera National Forest
2	Devdaha	5, 6, 7, 9	7.33	6 Community Forests – Buddha, Shivalaya, Shmriti, Janapriya, Rohini Devdaha Collaborative Forest
3	Butwal	1, 2, 3, ,4, 6, 7, 12, 13	13.70	6 Community Forests – Butwal, Chure, Laxmi Adarsha, Shivanagar, Charpala, Jitwshwar National Forest

#	Municipality	Ward no.	TL Length in the forested area [km]	Forest management types
4	Sainamaina	1, 2, 3, 5, 6, 9, 10	17.40	7 Community Forests – Sainamaina, Bolbam, Paroha, Malmala, Inguriya, Barpani, Jhimjhimiya Bhulke[pani Shivaraj Collaborative Forest
5	Banganga	2, 7, 8, 9	17.73	2 Community Forests – Mayadevi and Manakamana Tilaurakot Collaborative Forest National Forest
6	Buddhabhumi	1, 3, 9	14.17	5 Community Forests – Kundra, Janakalyan, Janajagriti, Ram Laxman, Buddha Yashodhara Kapilvastu Collaborative Forest National Forest
7	Shivaraj	1, 3, 9	15.24	4 Community Forests – Surahi, Manakamana, Rahatawal, Devisthan Shivaraj Collaborative Forest National Forests
8	Gadhawa	1	4.85	3 Community Forests – Kalikhola, Bagdulla, Janasewa
9	Sitganga	8	2.62	2 Community Forests – Farkesalli, Jabunepani
10	Rapti	1, 2, 4, 5	12.77	7 Community Forests – Ramjaidi, Kasmdi, Shanti, Kalapani, Deukishankar
11	Lamahi	1, 3, 4, 5, 6, 7, 8, 9	27.25	24 Community Forests – Bhawani, Sundawari, Baken, Tikuligadh, Trishakti, Jakhera, Narayan Sori, Bangaun, Janata, Chappar Khola, Ajambari, Parijat, Nawa Shanti, Karichaulai, Kariwan Dhurse, Uchanimbu, Shivashakti Bakhra Bikas, Laxmi, Chitrapur, BHatarkunda, Upakar, Simpani, Jarpani, Bagarbaba
		Total	160.00	71 Community Forests 5 Collaborative Forests 4 National Forests

Source: IEE Study, 2023

Trees and Shrubs

325. Principal tree components found in different forest types are Sal (*Shorea robusta*), Asana (*Terminalia elliptica*), Jamun (*Syzyzium cumini*), Karma (*Haldina cordifolia*), Bot Dhaiyaro (*Lagestroemia parviflora*), Rajbriksha (*Cassia fistula*), Tantari (*Dillenia pentagyna*), Barro (*Terminalia bellirica*), Amala (*Phyllanthus emblica*), Pyari (*Buchanania latifolia*), Kumbhi (*Careya arborea*), Harro (*Terminalia chebula*), Sissoo (*Dalbergia sissoo*), Simal (*Bombax ceiba*), Saandan (*Ougeinia oojeinenssis*), Siris (*Albizzia* spp.), Tooni (*Toona ciliata*), Patmero (*Litsea monopetala*), Bhalayo (*Semecarpus anacardium*), Hallude (*Lannea coromandelica*), Kadam (*Anthocephalus chinensis*), Baanjhi (*Anoegissus latifolia*), Tantari (*Dillenia pentagyna*), Sindure (*Mallotus philippensis*), Kusum (*Schleichera oleosa*), Mouwa (*Englehardtia spicata*), Taki (*Bauhunia pupurea*), Datrungo (*Ehretia sp*.), Gineri (*Premna sp*.), Syalphosro (*Grewia optiva*), Churi (*Diploknema butyracea*), Parijat (*Nyctanghus*

arbor-tristis), Neem (*Azadirachta indica*), Chhativan (*Alstonia scholaris*), Masala (*Eucalyptus sp*.), Teak (*Tectona grandis*), *etc*.

326. Common shrubs and herbs found as ground vegetation are Simali (*Vitex negundo),* Dhaiyaro *(Woodfordia fruiticosa),* Badkaulo *(Casearia graveolens),* Kamini *(Murraya exotica),* Thakal *(Phoenix humilis),* Dhursul *(Colebrokia oppositifolia),* Asuro *(Justicia adhatoda),* Bhati *(Clerodendron sp.),* Aank *(Calotropis gigantea),* Siru *(Imperata cylindrica), Sonchus sp.,* Kaans *(Saccharum spontaneum), Euphorbia hirta,* Bhede Kuro *(Barleria cristata), Elephantopus scaber,* Kharuki *(Pogonantherum crinitum),* Babiyo *(Eulaliopsis binata),* Khar *(Themeda triandra),* Doobo *(Cynodon dactylon),* Banso *(Digitaria ciliaris),* etc. The transmission line alignment passes through various types of forests occurring in Nawalparasi (West of Bardghat and Susta), Rupandehi, Kapilvastu, Argakhanchi and Dang districts. There is not much differentiation of altitude and hence tropical bioclimatic zones prevail in the project alignment area.

327. Major forest types falling under the project alignment are Sal (*Shorea robusta*) forest, Sallo (*Pinus roxburghii*) forest, Mixed Sal (*Shorea robusta*) forest, Khayar (*Acacia catechu*) forest, etc. Principal tree components found in project alignment are Sal (*Shorea robusta*), Asana (*Terminalia alata*), Jamun (*Syzyzium cuminii*), Karma (*Haldina cordifolia*), Bot Dhaiyaro (*Lagestroemia parviflora*), Rajbriksha (*Cassia fistula*), Tantari (*Dillenia pentagyna*), Harro (*Terminalia chebula*), Sissoo (*Dalbergia sissoo*), Simal (*Bombax ceiba*) Siris (*Albizzia spp*.), Tooni (*Toona ciliata*), Patmero (*Litsea monopetala*), Bhalayo (*Semecarpus anacardium*), Hallude (*Lannea coromandelica*), Kadam (*Anthocephalus chinensis*), Baanjhi (*Anoegissus latifolia*), Tantari (*Dillenia pentagyna*), Sindure (*Mallotus philippensis*), Kusum (*Schleichera oleosa*), Churi (*Diploknema butyracea*), Neem (*Azadiractah indica*), Chhativan (*Alstonia scholaris*), Masala (*Eucalytpus sp*.), Wendlandia exerta, Semecarpus anacardium, Teak (*Tectona grandis*), Kadam (*Anthocephalus chinensis*) etc. Tilka (*Wendlandia exerta*), Bhalayo (S*emecarpus anacardium*), Teak (*Tectona grandis*), Kadam (*Anthocephalus chinensis*) etc. Common shrubs and herbs found as ground vegetation are Dhaiyaro (*Woodfordia fruiticosa*), Casearia graveolens, Kamini (*Murraya exotica*), Xeromphis spinosa Holarrena pubescens Thakal (*Phoenix humilis*), *Clerodendron sp., Calotropis gigantea, Flemingia strobilifera Urena lobata Imperata cylindrica, Saccharum spontaneum, Barleria cristata, Pogonantherum crinitum, Eulaliopsis binata, Themeda triandra, Cynodon dactylon, Chrysopogon zizanioides, Desmodium sp., Asparagus racemosus, Curculigo orchidioide,s Desmoctachys bipinnata,* etc. Common climbers are *Phanera vahlii, Choenomorpha fragrans*, etc. The area is found partly covered by invasive species such as *Mikania micrantha, Ageratum houstonianum, Chromolaena odorata*, *etc*.

Table 63: Plant species recorded in the TL alignment

#	Scientific Name	Local name	Life-form	Distribution pattern
1	Achyranthes aspera	Datiban	Herb	Common
2	Haldina cordifolia	Karam	Tree	Common
3	Adiantum sp.	**	Herb	Occasional
4	Aegle marmelos	Bel	Tree	Occasional
5	Agerarum conyzoides	Gandhe	Herb	Common
6	Agerarum houstonianum	Nilo Gandhe	Herb	Common
7	Albizzia spp.	Siris	Tree	Rare
8	Amaranthus spinosus	Lunde	Herb	common
9	Anogeissus latifolia	Baanjhi	Tree	Sparse
10	Artemisia indica	Titepati	Herb	Common
11	Artemisia sp.	Titepati	Herb	Common
12	Asparagus racemosus	Kurilo	Herb	Occasional

#	Scientific Name	Local name	Life-form	Distribution pattern
13	Azadiractah indica	Neem	Tree	Rare
14	Barleria cristata	Kuro	Herb	Occasional
15	Bauhinia variegata	Koiralo	Tree	Sparse
16	Bauhnia purpurea	Tanki	Tree	Occasional
17	Bidens pilosa	Kuro	Herb	Common
18	Brassiopsis hainla	Chuletro	Tree	Rare
19	Bridelia retusa	Gayo	Tree	Rare
20	Bombex ceiba	Simal	Tree	Rare
21	Buchanania latifolia	Pyari	Tree	Sparse
22	Butea minor	Bhuletro	Climber	Rare
23	Calopogonium mucunoides	Gahate Jhar	Creeping herb	Rare
24	Calotropis gigantea	Aank	Shrub	Sparse
25	Carex sp.	Ghaans	Herb	Sparse
26	Careya arborea	Kumbhi	Tree	rare
27	Carissa carandans	Karaunda	Shrub	Occasional
28	Caryopteris odorata	Baghmukhe	Shrub	Occasional
29	Cassia fistula	Rajbriksha	Tree	Occasional
30	Cassia tora	Taapre	Shrub	Common
31	Casearia graveolens	Badkaulo	Shrub	Common
32	Cheilanthus sp.	Rani Sinka	Herb	Common
33	Chenopodium album	Bethe	Herb	Common
34	Chromolaena odorata	Seto Banmara	Herb	Common
35	Cipadessa baccifera	Paileti	Shrub	Occasional
36	Cissampelos sp.	Batulpaate	Herb	Occasional
37	Clerodendron sp.	Bhati	Shrub	Common
38	Colebrokia oppositifolia	Dhurseuli	Shrub	Occasional
39	Crasssocephalum crepidioides	**	Herb	Common
40	Curculigo orcioides	Musali	Herb	Sparse
41	Cynodon dactylon	Dubo	Herb	Common
42	Cymbidium sp.	Sunakhari	Herb	Occasional
43	Cymbopogon	Kaagati Ghaans	Herb	Rare
44	Cynoglossum zeylanicum	Kuro	Herb	Occasional
45	Dalbergia sissoo	Sisau	Tree	Abundant
46	Dalbergia latifolia	Satisal	Tree	Rare
47	Delonix regia	Gul Mohar	Tree	Rare
48	Datura stramonium	Dhaturo	Shrub	Occasional
49	Dendrocalamus spp.	Bans	Tall grass	Sparse
50	Dendrocalamus hamiltoni	Tama Bans	Tall grass	Sparse
51	Desmodium sp.	Bhatamase	Shrub	Occasional
52	Diploknema butyracea	Chyuri	Tree	Occasional
53	Dioscorea deltoidea	Vhyakur	Climber	Rare
54	Dioscorea bulbifera	Gittha	Climber	Occasional
55	Diospyrus malabarica	Khaltu	Tree	Occasional
56	Diplazium esculentus	Niuro	Herb	Occasional
57	Dryopteris cochleata	Niuro	Herb	Occasional
58	Dryopteris biaurita	Mauro	Herb	Occasional
59	Ehretia laevis	Datrungo	Tree	Rare
60	Elephantopus scaber	**	Herb	Occasional
61	Emblica officinalis	Amala	Tree	Occasional

#	Scientific Name	Local name	Life-form	Distribution pattern
62	Eulaliopsis binata	Babiyo	Herb	Sparse
64	Euphorbia hirta	Dudhe jhar	Herb	Common
65	Falconeria insignis	Khirro	Tree	Sparse
66	Ficus cunia	Khaniyo	Tree	Rare
67	Ficus religiosa	Peepal	Tree	Rare
68	F. benghalensis	Bar	Tree	Rare
69	Ficus hispida	Khasreto	Tree	Rare
70	Ficus raceamosa	Dumri	Tree	Rare
71	Flemingia sp.	Bhatamaase	Shrub	Sparse
72	Galinsoga parviflora	**	Herb	Common
73	Garuga pinnata	Dabdabe	Tree	Occasional
74	Gnaphalium sp	**	Herb	occasional
75	Heteropogon contortus	Khar	herb	Common
76	Pogonantherum crinitum.	Kharuki	Herb	Abundant
77	Pinus roxburghii	Khotesalla	Tree	Rare
78	Holerrhena pubescens	Indra Jau	Shrub	Occasional
79	Imperara cylindrica	Siru	Herb	Sparse
80	Inula cappa	Gai Tihare	Shrub	Sparse
81	Jatropa curcus	Sajiban	Shrub	Sparse
82	Justicia adhatoda	Asuro	Shrub	Occasional
83	Kydia sp.	**	Shrub	Sparse
84	Lagestroemia parviflora	Budhdhaiyaro	Tree	Common
85	Lannea corromandelica	Hallude	Tree	Rare
86	Lantana camara	Banfaanda	Shrub	Sparse
87	Leea aspera	Galeni	Herb	Common
88	Litsea monopetala	Kutmiro	Tree	Rare
89	Lygodium sp.	Kukrjhar	Herb	Occasional
90	Madhuca longifolia	Mahuwaa	Tree	Rare
91	Mallotus philippinensis	Sindure	Tree	Common
92	Melia azadiractah	Bakenu	Tree	Occasional
93	Mimosa rubicaulis	Areli	Shrub	Sparse
94	Mimosa pudica	Lajjawati	Herb	Occasional
95	Murraya coenigi	Karipatta	Shrub	Common
96	Nephrolepis cordifolia	Pani Amala	Herb	Occasional
97	Nyctanthus arbo-tristis	Paarijat	Tree	Sparse
98	Onychium japonicum	Unyu	Herb	Sparse
99	Desmodium oogeinenssis	Sandan	Small tree	Occasional
100	Ophioglossum sp.	Jibresaag	Herb	Rare
101	Oplismenos sp.	**	Herb	Rare
102	Oroxylon indicum	Tatelo	Tree	Tare
103	Oxalis corniculata	Chariamilo	Herb	Occasional
104	Phanera vahlii	Bhorla	Large Climber	Occasional
105	Phoenix sp.	Thakal	Shrub	Common
106	Phyllanthus emblica	Amala	Tree	Occasional
107	Phyllanthus parviflora	Khareto	Shrub	Common
108	Pilea weightii	**	Herb	Occasional
109	Pogostemon benghalensis	Rudilo	Herb	Occasional
110	Premna sp.	Gineri	Tree	Rare
111	Pteris biaurita	Mauro	Herb	Sparse

#	Scientific Name	Local name	Life-form	Distribution pattern
112	Ricinus communis	Ader	Shrub	Sparse
113	Pterocarpus marsupium	Bijay Sal	Tree	Rare
113	Saccharum spontaneum	Kaans	Herb	Sparse
115	Scheichera oleosa	Kusum	Tree	Sparse
116	Schima wallichii	Chilaune	Tree	Rare
117	Semecarpus anacardium	Bhalayo	Tree	Common
118	Senegalia catechu	Khayar	Tree	Abundant
119	Shorea robusta	Sal	Tree	Abundant
120	Sida cordifolia	Herb	Shrub	Occasional
121	Smilax sp.	Kurkurdaino	Thorny climber	Occasional
122	Solanum xanthocarpum	Kantakaari	Herb	Sparse
123	Syzyzium cumini	Jamun	Tree	Common
124	Tectona grandis	Tik	Tree	Planted
125	Terminalia elliptica	Saaj	Tree	Common
126	Terminalia bellirica	Barro	Tree	Rare
127	Terminalia chebula	Harro	Tree	Rare
128	Themeda triandra	Khar	Herb	Common
129	Thysanolaena maxima	Amriso	Herb	Sparse
130	Trachelospermum sp.	Dudhe Lahara	Climber	Sparse
131	Urena lobata	**	Shrub	Occasional
132	Urtica dioca	Sisno	Herb	Occasional
133	Vitex negundo	Simali	Shrub	Sparse
134	Wendlandia coriacea	Tilka	Tree	Common
135	Woodfordia fruticosa	Dhainyaro	Shrub	Common
136	Zizyphus mauritiana	Bayar	Spreading shrub	Rare

Source: IEE Field Survey, 2021

Protected Plant Species

328. Based on the discussions with the local area communities, officials, and Division Forest Office, Community Forest User Groups, following plant species have been found in the project area that are reported as Protected, Endangered/Threatened category and supported from different standard publications (Nepal Rajpatra, Section 51, No. 36, 2058.9.16 B.S. and Nepal Rajpatra, Section 53, No. 31, 2060.8.1 B.S. and its amendment; DPR, MFSC 2012) They have also been verified from http://www.iucnredlist.org and http://www.cites.org No endemic plants were reported or found in the project study area (Rajbhandari et al. 2017).

Table 64: Protected plant species recorded along the NBTL alignment

#	Local name	Scientific name	Threat Category [1]			Remarks
			GoN	IUCN	CITES	
1	Sal	Shorea robusta	Protected	-	-	+++ Banned for felling, transport, and export
2	Satisal	Dalbergia latifolia	Protected			+++ Banned for felling, transport, and export
3	Vijaysal	Pterocarpus marsupium	Protected			+++ Banned for felling, transport, and export
4	Vyakur	Dioscorea deltoidea	-	NT	II	
5.	Sunakhari	Cymbidium sp.	-		II	

[1] GoN category: +++ Trees banned for transportation, export and felling
IUCN definitions: EN Endangered; VU Vulnerable; NT Nearly Threatened

CITES category:
CITES I Include species threatened with extinction. Trade in specimen of these species is permitted only in exceptional circumstances
CITES II Not necessarily threatened with extinction but trade must be controlled
CITES III Contains species that are protected in at least one country, which has asked other, CITES Parties for assistance in controlling the trade
Source: IEE Study

Traditional and Ethno-botanical Uses

329. The survey conducted on the traditional and ethno-botanical uses of plants found in and around the project area indicated that the locals relied to some extent on forest-based resources and non-timber forest products (NTFPs). Most locals use forest resources such as firewood, wild fruits, and vegetables to fulfill their daily needs. Moreover, some locals were also found to sell these products in the local markets as an additional source of income. Several plants have been identified as locally significant for the purposes:

Table 65: Ethnobotanical use of the plants recorded from the project area

#	Ethno botanical uses	Species	Remarks
1	Medical use	Titepati (Artemisia sp.)	Treating wounds and skin allergy
		Sinka (Aleuritopteris bicolor)	It is a fern species. Its leaves are used in treatment of respiratory problems such as asthma, bronchitis, and coughs. Its stems are used for ear piercing.
		Ghodtapre (Centella asiatica)	Brain tonic, treatment of gout, uric acid, fever and other.
		Harro (Terminalia chebula)	Treatment of cold and cough
		Khayar (Acacia catechu)	Khayar tree bark are used in traditional medicine as an astringent and antiseptic.
		Lajjawati (Mimosa pudica)	It has several medicinal uses – root and leaves are used to prepare decoction to treat epilepsy, paralysis, as well as treat urinary tract infection and other inflammatory conditions. The plant's extract has been shown to have antibacterial and antifungal quality as well.
		Amala (Phyllanthus emblica)	The fruit of Amala is rich in Vitamin C and is used to boost immunity and promote overall health.
		Peepal (Ficus religiosa)	Sacred tree in Hinduism and Buddhism.
		Dubo (Cynodon dactylon)	Dubo is commonly used in religious ceremonies. Sometime used to prepare garlands and often used to decorate temples.
		Black plum (Syzyzium cumini) - Jamun	In traditional medicine, various parts of the black plum are used to treat different ailments. The fruits, seed, bark, and leaves are used treat diabetes, diarrhea, dysentery, stomach disorders, and throat infections.
		Indrajau (Holarhena pubescens)	It is used in Ayurveda and folk medicine in Nepal. Different parts of the plant, such as the bark, leaves, roots, and seeds, are used for their medicinal properties. It is used as antidiabetic, antiparasitic, antipyretic, anti-inflammatory, and

#	Ethno botanical uses	Species	Remarks
			antimicrobial properties. The twigs of Indrajau are used as natural toothbrushes.
		Datiwan (Achyranthus aspera)	It is used in Ayurbeda and folk medicine in Nepal. Various parts of the plants- leaves, roots, and seeds, are used. Datiwan is believed to have antipyretic, anti-inflammatory, analgesic, and diuretic properties. It is used to treat ailments – fever, respiratory conditions, digestive disorders, skin diseases, urinary tract infections.
		Musali (Curculigo orchioides)	Musali is highly regarded as aphrodisiac properties. It is believed to boost fertility, improve stamina, and enhance overall sexual performance.
		Kurilo (Asparagus racemosus)	Kurilo is highly valued for its traditional use in supporting reproductive health, particularly for women. It is also believed to promote digestive health and improve gastrointestinal functions. Moreover, it is also used in traditional medicine to support respiratory health.
		Asuro (Justicia adhatoda)	The leaves of Asuro are widely used in traditional medicine to treat respiratory conditions such as asthma, cough, bronchitis, and common cold.
		Barro (Terminalia bellirica)-	Barro has been used in Ayurvedic and traditional medicine. It is used to improve digestion such as constipation, indigestion and gastric issues.
		Paarijaat (Nyctanthus arbor-tristis)-	Gout
		Titepaati (Artemisia dubia)	Treating wounds and skin allergy
		Dhayaro (Woodfordia fruiticosa)	Decoction of dried flowers is used to control dysentery.
2	Religious use	Bel (Aegle marmelos)	The Bel tree is considered sacred and often planted near temples. The leaves and fruits are used in traditional religious ceremonies.
		Chilaune (Schima wallichii)	Its timber is used to make various farm implements such as plows, yokes, and carts. It is also used to construct farmhouses, barns, fences, and storage sheds. Its leaves are also used as traditional herbal medicine to treat various ailments of animals.
		Kush (Desmostachya bipinnata)	Kush is considered sacred in Hinduism and is used in various religious rituals and ceremonies.
		Bar (Ficus benghalensis) – Banyan tree	It holds great religious and cultural significance in Nepal, and considered a sacred tree and is associated with various religious and spiritual practices.
3		Bhorla (Phanera vahii)	Making of rope, and local use its leaves as umbrella.

#	Ethno botanical uses	Species	Remarks
	Economic/ Fodder/ Agriculture implements	Sal (Shorea robusta)	Sal is one of the highly value tree species found in Nepal. Its wood is known for its durability, strength, and resistance to decay, thus extensively used in construction. Its leaves are also used a plates and bowls, which are often used for serving traditional meals during festivals, religious ceremonies.
		Simal (Bombax ceiba)	Simil tree is used as timber for furniture, construction, and boar-making. The wood is strong, usable, and resistant to decay.
		Babiyo (Eulaliopsis binata)	Making of ropes and broom
		Baans Dendrocalamus sp	Botanically it is a tall grass and commonly called bamboo. It is used as building materials for construction, including houses, bridges, and other structures. The bamboo is moderately strong, lightweight, and flexible, making it ideal for construction.
		Vyakur (Dioscorea deltoidea)	It is also known as Ban Tarul or Wild Yam. It is used as a culinary ingredient in traditional Nepali cuisine as a vegetable.
		Khanayo (Ficus cunia)	The leaves are used as a fodder for livestock. In some parts of Nepal, the fruits are eaten as delicious food.
		Karipatta (Murraya coenigi)	It is native to India and found in Nepal. It is widely used in Nepali cuisine for its aromatic flavor.
		Muse Kharuki (Pogonantherum crinitum)	Also known as Sano Chyante used as fodder
		Kabro (Ficus lacor)	The leaves of the Kabro tree are used as fodder for livestock.
		Badahar (Atrocarpus lakoocha)	Fodder
		Syalphusro (Grewia optiva)	Fodder
		Brassaiopsis hainla	Fodder
		Salla (Pinus roxburghii)	Salla wood is highly valued for its timber, and widely used for firewood. Resin produced by Salla trees, commonly known as “roxburghii resin” or “Sal dammar” is used as adhesive, and for making incense and varnishes.
		Kantakari (Solanum xanthocarpum)	It is used in Ayurveda. It is believed to have anti-microbial, anti-inflammatory, analgesic properties. It is also used to treat respiratory conditions, improve appetite, relieve indigestion, and alleviate abdominal discomfort.

Source: IEE Study

Invasive species

330. The project area also is invaded by several invasive species as found elsewhere in Nepal, such as Nilo Gandhejhar (*Ageratum houstonianun*), Seto Gandhejhar (*Ageratum conyzoides*), Lunde kande

(*Amaranthus spinosus*), Kaalo Kuro (*Bidens pilosa*), Seto Banmara (*Chromolaena odorata*), Saano Taapre (*Cassia tora*), Banfaanda (*Lantana camara*), Lajjaawatee Jhar (*Mimosa pudica*), Patijhar (*Parthenium hysterophorus*) and Bhede Kuro (*Xanthium strumarium*). Among these, the most invasive species that have wider coverage are Seto Banmara (*Chromolaena odorata*) and Banfaanda (*Lantana camara*).

Agro–diversity

331. The study area contains a significant expanse of land suitable for agricultural activities, which is primarily utilized for traditional farming practices. This agricultural system features an integrated crop-livestock production system that serves as a means of subsistence for the local households. The farmers cultivate crops in small, concentrated areas, with a focus on cereal crops such as paddy, maize, millets, wheat, pulses, mustard, and vegetables. Additionally, they cultivate some perennial crops such as fruits, fodder, and timber, primarily for household consumption.

Table 66: Major crops of the Project Area

#	Crops	Species
1	Cereals	Paddy (Oryza sativa), Maize (Zea mays), Kodo (Eleusine coracana), Bean (Phaseolus mungo), Chickpea (Cicer arietinum), Bodi (Vigna sinensis), Chana (Cicer arietinum), Masuro (Lens culinaris), Bakulla Vicia faba).
2	Pulses	Bean (Phaseolus mungo), Chickpea (Cicer arietinum), Bodi (Vigna sinensis), Gahat (Dolichus biflorus), Simi (Phaseolus vulgaris), Masuro (Lens culinaris)
3	Vegetables	Mustard (Brassica oleracia var. botrytis), Potato (Solanum tuberosum), Ghiraula (Luffa cylindrical), Dhaniya (Coriandrum sativum), Golbheda (Lycopersicon esculentum), Carrot (Daucus carota), Kakro (Cucumis sativum), Khursani (Capsicum frutescens), Adhuwa (Zinziber officinale), Mula (Raphnus sativus).
4	Cash crops	Ukhu (Saccharum officinaram), Banana (Musa paradisiaca), Aanp (Mangifera indica)
5	Fruits:	Litchi (Litchi chinensis), Aanp (Mangifera indica), Papaya (Carica papaya), Amba (Psidium guajava), Kagati (Citrus acida)

Source: IEE Study

6.3.4 Fauna

332. The proximity of the NBTL alignment to a busy highway has led to significant disturbances to the wildlife habitat. Consequently, there has been decreases in wildlife abundance, restricted movement, and reduced diversity, particularly among mammal species, in the project area. Several disturbances to wildlife habitat have been observed, which consisted of the utilization of local forests for cattle grazing, sand and soil mining, and frequent forest fires. Section of the NBTL AP 68 to AP 80 has been categorized as Lamahi Corridor in some literature while in others it is categorized as Lamahi Bottleneck, section AP 51 to AP 55 has been designated as potential wildlife corridor (39% is within 100m, 24% between 100-200m and 10% beyond 500m from East West Highway). The herpetofauna and mammals found in the project area are discussed below.

Amphibians and Reptiles

333. Initial surveys completed as part of the national IEE indicated a total of 46 species of herpetofauna have been recorded from the NBTL area and its surrounding areas. These recorded species of herpetofauna range from the status of Least Concern (LC) to Critically Endangered (CR). Notably, no endemic, migratory, or invasive species of herpetofauna were recorded within the TL area.

334. ***Frogs and Toads -*** The area has documented 10 amphibian species (see the Table below). During the field survey, it was observed that most of the amphibians in the area were not active, with a few exceptions. One notable species found in the area is the India bullfrog (*Hoplobatrachus tigerinus*), which is listed in Appendix II of CITES.

335. **Lizards, Turtles, and Snakes**. The project area has documented the following numbers of species:

a) 3 species of turtle

b) 14 species of lizard - During the field survey, it was observed that most of the recorded lizard species in the area were not active, except for a few skinks and common garden lizards.

c) 2 monitor lizards

d) 19 species of snakes - including 13 non-venomous and 6 venomous species. Among these, all species except the green pit viper are considered highly venomous. Noteworthy among the recorded snake species is the Burmese rock python, which is the largest non-venomous snake species in Nepal, and the King cobra, which is the largest venomous snake species in the world.

e) 1 species of crocodile - Notably, an adult Mugger Crocodile was observed last year in the Kothi river, located just below Kothipul (a bridge on the highway in Sainamaina Municipality, Rupandehi). The river eventually flows into an irrigation canal.

336. The area experiences a high number of incidents related to snakebites from both venomous and non-venomous snakes. While treatment with anti-snake venom serum is available in Butwal, it is common for victims to be locally treated using traditional methods, which often result in more harm than the snake bite itself.

337. Among the recorded herpetofauna three species are listed in Appendix I, 7 species in Appendix II, 2 species are included as protected priority species by Nepal Government's National Parks and Wildlife Conservation Act, 1973 and 1 species (Elongated tortoise*, Indotestudo elongata*) is included as Critically Endangered (CR), 4 species as Vulnerable (VU) and 14 as Least Concern (LC) in IUCN Red Data Book of Threatened Species.

Table 67: Conservation status of herpetofauna recorded from the project area

#	Scientific Name	Common Name	National Parks and Wildlife Conservation Act, 1973	IUCN Red List	CITES
Amphibians					
1.	Duttaphrynus melanostictus	Asian common toad		LC	
2.	Duttaphrynus stomaticus	Marbled toad		LC	
3.	Microhyla ornata	Ornate rice frog		LC	
4.	Zakerana nepalensis	Nepalese cricket frog		LC	
5.	Zakerana teraiensis	Tarai cricket frog		LC	

#	Scientific Name	Common Name	National Parks and Wildlife Conservation Act, 1973	IUCN Red List	CITES
6.	Euphlyctis cyanophlyctis	Skittering frog		LC	
7.	Hoplobatrachus crassus	Jerdon's bullfrog		LC	
8.	Hoplobatrachus tigerinus	Indian bullfrog		LC	II
9.	Sphaerotheca breviceps	Short headed burrowing frog		LC	
10.	Polypedates maculatus	Common Indian tree frog		LC	
Reptiles					
Lizards					
1.	Crocodylus palustris	Mugger crocodile		VU	I
2.	Indotestudo elongata	Elongated tortoise		CR	II
3.	Nilssonia gangeticus	Indian softshell turtle		VU	
4.	Lissemys punctata	Indian flapshell turtle		VU	II
5.	Calotes versicolor	Common garden lizard			
6.	Laudakia tuberculata	Himalayan rock lizard			
7.	Sitana sivalensis	Nepalese fan-throated lizard			
8.	Hemidactylus brooki brooki	Brook's house gecko			
9.	Hemidactylus flaviviridis	Yellow-bellied house gecko			
10.	Hemidactylus frenatus	Bridled house gecko			
11.	Asymblepharus sikimmensis	Sikkim skink			
12.	Eutropis carinata	Brahminy skink			
13.	Eutropis dissimilis	Stripped grass skink			
14.	Eutropis macularia	Bronze grass skink			
15.	Sphenomorphus maculatus	Spotted litter skink			
16.	Varanus bengalensis	Bengal monitor		LC	I
17.	Varanus flavescens	Golden monitor	P	LC	I
Snakes					

#	Scientific Name	Common Name	National Parks and Wildlife Conservation Act, 1973	IUCN Red List	CITES
18.	Indotyphlops braminus	Com. blind snake			
19.	Python bivittatus	Burmese rock python	P	VU	II
20.	Eryx johnii	Red sand boa			
21.	Ahaetulla nasuta	Common vine snake			
22.	Amphiesma stolata	Buff-striped keelback			
23.	Boiga forsteni	Forsten's cat snake		LC	
24.	Boiga trigonata	Common cat snake		LC	
25.	Chrysopelea ornata	Golden tree snake			
26.	Dendrelaphis tristis	Common bronzeback tree snake			
27.	Lycodon aulicus	Common wolf snake			
28.	Ptyas mucosus	Asiatic rat snake			II
29.	Sibynophis Sagittarius	Cantor's black headed snake			
30.	Fowlea piscator	Checkered keelback water snake			
31.	Naja naja	Common cobra			II
32.	Ophiophagus hannah	King cobra		VU	II
33.	Bungarus caeruleus	Common krait			
34.	Bungarus fasciatus	Banded krait		LC	
35.	Daboia russelii	Russell's viper			
36.	Cryptelytrops sp.	Green pit viper			

Legends: P = Protected, E= Endangered, V = Vulnerable, NT= Nearly Threatened, LC = Least Concern, DD = Data Deficient I, II = CITES Appendices
Source: IEE Study

338. Of particular concern is the Elongated Tortoise. Follow-up surveys were conducted by a national reptile specialist and a team of experts to further assess portions of the site, specifically around Shivapur Forest, for its presence (full survey can be found in Appendix E). The survey, which included consultation with communities in the survey area, also checked for the presence of turtles and monitor lizards, specifically:

- Elongated turtle
- Tricarinate hill turtle
- Siwalik sitana, and

- Yellow monitor lizard

339. The following summarizes the findings of the follow-up survey which was completed over a one-week period in May, 2024.

340. **Reptile Study Background** - Nepal's turtle fauna includes 18 species across 11 genera and three families: freshwater turtles (Geoclemydidae), land turtles or tortoises (Testudinidae), and softshell turtles (Trionychidae) (Rai et al., 2022). The only tortoise species in Nepal is the elongated tortoise (*Indotestudo elongata*), which inhabits low to mid-elevation areas, preferring evergreen and deciduous forests, grasslands, and secondary forests (Kästle et al., 2013; Schleich & Kästle, 2002), widely distributed across Southeast Asia. This medium-sized tortoise, known for its yellowish-brown carapace with black blotches, is omnivorous, feeding on a diverse diet including fruits, mushrooms, insects, and carrion (Ihlow et al., 2016). In Nepal, it is found primarily in Sal-dominated forests below 1000 meters elevation, with records from Jhapa to Shuklaphanta National Park (Aryal et al., 2010). The species is IUCN critically endangered, with a population decline of 80% due to habitat loss, hunting, and trade for food, traditional medicine, and religious purposes. This decline is exacerbated by pressures from local communities and collectors (Rahman et al., 2019). In the case, Tricarinate Hill-turtle (*Melanochelys tricarinata*) is distributed primarily in the Himalayan foothills and riverine grasslands, extending its range into the Sal (Shorea robusta) forests of Nepal (Kästle et al., 2013; Schleich & Kästle, 2002). In these regions, the species occupies diverse habitats including dense forests and areas near rivers, thriving in moist, leafy environments that provide ample cover and food resources (Schleich & Kästle, 2002). Despite its adaptability, *Melanochelys tricarinata* faces significant threats in Nepal, primarily due to habitat destruction from deforestation, agricultural expansion, and urbanization. Additionally, illegal collection for the pet trade and local consumption exacerbates the decline of this species and listed as IUCN red list of endangered species (Horne et al., 2020).

341. While both of them are legally protected under wildlife conservation acts 1974 (DNPWC, 1974), enforcement is often inadequate, leading to continued pressure on its populations. Conservation efforts are further hindered by the lack of comprehensive field studies, which are essential for developing effective management strategies to preserve this vulnerable turtle species in its natural habitat.

342. The Yellow Monitor Lizard (*Varanus flavescens*) and Siwalik Sitana (*Sitana sivalensis*), both native to Nepal, exhibit distinct ecological preferences and face common conservation challenges. *Varanus flavescens*, typically found in the Terai lowlands, thrives in wetland habitats, riverbanks, and agricultural fields, where it preys on small mammals, birds, and invertebrates (Schleich & Kästle, 2002). In contrast, *Sitana sivalensis*, a small agamid lizard, inhabits the dry, open grasslands and scrub forests of the Siwalik Hills (Schleich & Kästle, 1998). Both species face significant threats due to habitat loss from deforestation, agricultural expansion, and urban development. Additionally, the Yellow Monitor Lizard is heavily hunted for its skin and meat, exacerbating its population (Horne et al., 2020). *Sitana sivalensis* is also impacted by the fragmentation of its habitat, which limits its range and breeding opportunities (Das & Bhattarai, 2021).

343. **Reptile Survey Findings** - During the survey, the study team found one dead Hill turtle, likely due to a forest fire, three *Sitana sivalensis* (Siwalik lizards), eight dead carapaces of Hill turtle and one carapace of *lissymes punctata* from local areas that has been from adjacent villages. The team also documented one active and 40 passive forest fires for threat assessment and identified ten probable breeding pools for turtles and tortoises.

Figure 80: Survey Map

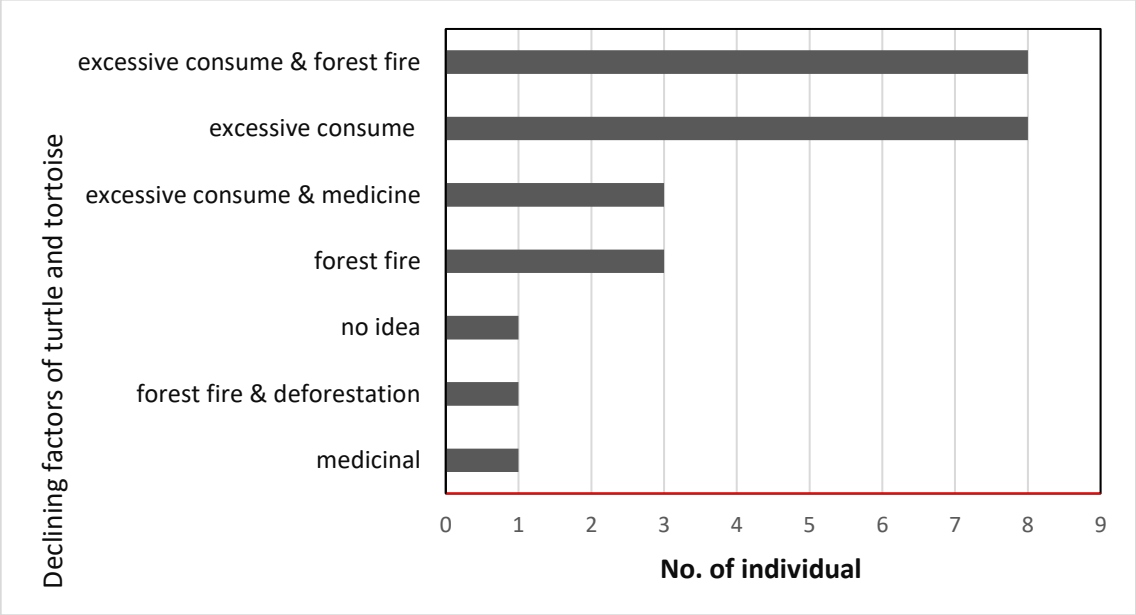
344. Figure 80 depicts the survey map, including records of *Sitana sivalensis*, instances of burned or dead turtle species, and locations of forest fires. It highlights three areas where questionnaires were distributed: the Gabdaha area, the Sonwagadh temple area, and the Mainpur/Bhulakia area. The red lines indicate the river network, while the blue lines represent the river network.

345. Survey team interviewed 25 individuals (15 males and 10 females). Among them, 8% (n = 2) identified the elongated turtle, 16% (n = 4) identified the Tricarinate hill turtle, and 72% (n = 18) identified both species. One individual (4%) could not identify any turtle species in the Sivapur Forest area.

346. Of the 20 individuals who spotted the elongated turtle, 65% (n = 13) located it in the forest, 25% (n = 5) in both forest and wetland areas, and 5% (n = 1) solely in wetland areas. Similarly, among the 22 individuals who spotted the tricarinate hill turtle, 13.6% (n = 3) saw it by the riverside, 9% (n = 2) in wetlands, and 77.2% (n = 17) in forest areas. Additionally, 12% were unaware of any turtle or tortoise killing incidents, while 88% reported having witnessed such incidents within the past five years. It was not possible to quantify the number of individuals killed over the past five years because most respondents did not provide exact numbers, and the interviews were conducted in limited areas, leading to potential overlap in the reported data. Additionally, the team not ask how many species they had collected or killed during this period.

347. Similarly, 32% (n = 8) reported that the major factors contributing to the decline of turtles and tortoises in the Sivapur area are excessive consumption and forest fires, and another 32% cited excessive consumption for food. Additionally, 12% (n = 3) attributed the decline solely to forest fires, and another 12% to meat and medicine. The remaining 8% mentioned medicinal purposes and forest fires combined with deforestation. One individual (4%) had no idea about the reasons for the decline of turtles (Figure 81).

Figure 81: Representing the major reason behind the turtle and tortoise declining in the Sivapur forest areas



348. **Survey Conclusions** - The population of turtles and tortoises was extremely scarce. The survey only recorded dead turtles, which were killed by forest fires and nearby residents. The number of carapaces found indicates a significant incidence of killings. Whenever people encounter turtles or tortoises, regardless of size, they consume them mainly for their meat. There is also evidence that the ethnic Tharu community kills them for medicinal purposes.

349. Most of the surveyed areas experienced forest fires within the past one or two years. These fires were primarily caused by human activities, either through negligence or intentional acts. However, natural or climatic factors such as extreme droughts, high temperatures, and wind could also have contributed to these fires. The ongoing forest fires not only kill the slow-moving turtles and tortoises but also affect their diet. These animals also rely on small pools for feeding, cooling off during heat, avoiding predators, and breeding (Schleich & Kästle, 2002). Many of these pools were polluted, filled with nutrient-rich ash from vegetation, causing high eutrophication and very low dissolved oxygen levels, which hinder their feeding and breeding of the turtle species.

350. Additionally, many small tracks created by humans for movement, fodder collection, berry picking, and fishing near the river. Cattle are also present in the forest, indicating a high level of human dependence on forest resources in the surveyed areas.

351. All the aforementioned information gathered points to excessive killing for consumption, constant forest fires harming the species and their habitats, and a lack of awareness among people, leading to a very low number of turtle and tortoise species.

352. **Mammals** - A total of 33 species of mammals were recorded from the NBTL and its surrounding areas. These recorded mammal species range from the status of Least Concern (LC) to Vulnerable (VU). According to the residents of Lalmatiya and Lamahi, wild elephants were observed in Bhaluwang

and Lalmatiya areas about a decade ago. However, there have been no recorded sightings of wild elephants in the entire stretch of the NBTL since then. Notably, no endemic, migratory, or invasive species of mammals have been recorded from the project area.

353. Out of 33 species of recorded mammal four species are included in Appendix I, 5 in Appendix II, 1 in Appendix III, 3 species are included as protected priority species by Nepal Government's National Parks and Wildlife Conservation Act, 1973 and 3 species as Vulnerable (VU), 5 species as Nearly Threatened (NT), 20 as Least Concern (LC) and 1 as Data Deficient (DD) in IUCN Red Data Book of Threatened species. According to The Status of Nepal's Mammals: The National Red List Series (Jnawali et al., 2011) 2 species as Endangered (EN), 9 species as Vulnerable (VU), 2 species as Nearly Threatened (NT), 14 as Least Concern (LC) and one as Data Deficient (DD) (see Table below).

Table 68: Conservation status of mammals recorded from the project area

#	Scientific Name	Common Name/ Local Name	National Parks and Wildlife Conservation Act, 1973	Red List		CITES
				National	Global/IUCN	
1	Lepus nigricollis	Indian Hare		LC	LC	
2	Funambulus pennanti	Northern Palm squirrel		LC	LC	
3	Petaurista petaurista	Red Giant Flying Squirrel/ Satabariya forest SF)		LC	LC	
4	Rattus sp.	Rat species				
5	Muss sp.	Mouse species				
6	Hystrix indica	Crested Porcupine		DD	LC	
7	Viverra zibetha	Large Indian Civet		NT	NT	
8	Viverricula indica	Small Indian Civet		LC	LC	
9	Paguma larvata	Masked Palm Civet/Dande ot		LC	LC	
10	Paradoxurus hermaphroditus	Asian Palm Civet		LC	LC	
11	Felis chaus	Jungle Cat		LC	LC	II
12	Prionailurus bengalensis	Leopard Cat	P	VU	LC	II
13	Panthera pardus	Common Leopard		VU	VU	I
14	Herpestes auropunctatus	Small Indian Mongoose/Nyauri muso		LC	LC	
15	Herpesters edwardsi	Indian Gray Mongoose		LC	LC	
16	Vulpes bengalensis	Bengal Fox		VU	LC	
17	Canis aureus	Asiatic Golden Jackal		LC	LC	
18	Hyaena hyaena	Striped Hyena	P	EN	NT	
19	Melursus ursinus	Sloth Bear		EN	VU	I

#	Scientific Name	Common Name/ Local Name	National Parks and Wildlife Conservation Act, 1973	Red List		CITES
				National	Global/IUCN	
20	Martes flavigula	Yellow-throated Marten/Maukhane		LC	LC	
21	Shrew spp.	Shrews				
22	Pteropus giganteus	Indian Flying Fox, LC/LC, II		LC	LC	II
23	Bat spp.	Bats				
24	Semnopithecus hector	Nepal Tarai Langur		LC	NT	I
25	Macaca mulatta	Rhesus Macaque		LC	LC	II
26	Macaca assamensis	Assamese Monkey	P	VU	NT	II
27	Boselaphus tragocamelus	Blue Bull		VU	LC	
28	Tetracerus quadricornis	Four Horned Antelope		VU	DD	III
29	Axis axis	Chital/Spotted deer		VU	LC	
30	Rusa unicolor	Sambar Deer		VU	VU	
31	Muntiacus vaginalis	Barking Deer		VU	LC	
32	Naemorhedus goral	Common Goral/ Ghoral		NT	NT	I
33	Sus scrofa	Wild Boar		LC	LC	

Legends: P = Protected, E= Endangered, V = Vulnerable, NT= Nearly Threatened, LC = Least Concern, DD = Data Deficient I, II, III= CITES Appendices

6.3.5 Avifauna

354. The NBTL alignment route passes through a region characterized by tropical Sal Forests and some farmlands, which are known to be habitats for a diverse range of bird species.

355. The IEE survey reported 112 species across the NBTL project alignment with 35 of them as migrants, eight altitudinal migrants, one vagrant and the rest 68 as residents. Parakeet species: Plum-headed Parakeet (*Himalayapsitta cyanocephala*), Alexandrine Parakeet (*Palaeornis eupataria*) and Slaty-headed Parakeet (*Himalayapsitta himalayana*) were observed most frequently across the NBTL alignment of the project area. The observed species has been listed in the table below.

Table 69: Observed avifauna in the project area[19]

SN	Common Name	Scientific Name	Conservation Status			CITES	Movement Pattern	Congregatory
			Global	National	NPWC			
1	Alexandrine Parakeet	Palaeornis eupataria	NT	NT		II	Resident	
2	Ashy Prinia	Prinia socialis	LC				Resident	
3	Asian Green Bee-eater	Merops orientalis	LC				Full Migrant	
4	Asian Openbill	Anastomus oscitans	LC	VU			Resident	Congregaty (and Dispersive)
5	Asian Pied Starling	Gracupica contra	LC				Resident	
6	Besra	Accipiter virgatus	LC			II	Altitudinal Migrant	
7	Black Bulbul	Hypsipetes leucocephalus	LC				Full Migrant	
8	Black Drongo	Dicrurus macrocercus	LC				Full Migrant	
9	Black Kite	Milvus migrans	LC			II	Full Migrant	
10	Black Redstart	Phoenicurus ochruros	LC				Full Migrant	
11	Black-hooded Oriole	Oriolus xanthornus	LC				Resident	
12	Black-naped Monarch	Hypothymis azurea	LC				Full Migrant	
13	Black-rumped Flameback	Dinopium benghalense	LC				Resident	
14	Black-winged Cuckooshrike	Lalage melascistos	LC				Full Migrant	
15	Black-winged Kite	Elanus caeruleus	LC			II	Resident	
16	Blue Rock Thrush	Monticola solitarius	LC				Full Migrant	

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SN	Common Name	Scientific Name	Conservation Status			CITES	Movement Pattern	Congregatory
			Global	National	NPWC			
17	Blue Whistling Thrush	Myophonus caeruleus	LC				Altitudinal Migrant	
18	Blue-throated Barbet	Psilopogon asiaticus	LC				Resident	
19	Cattle Egret	Bubulcus ibis	LC				Full Migrant	Congregatory (and Dispersive)
20	Chestnut-bellied Nuthatch	Sitta cinnamoventris	LC				Resident	
21	Chestnut-shouldered Bush-sparrow	Gymnoris xanthocollis	LC				Resident	
22	Chestnut-tailed Starling	Sturnia malabarica	LC				Resident	
23	Common Hawk Cuckoo	Hierococcys varius	LC				Full Migrant	
24	Common Iora	Aegithina tiphia	LC				Resident	
25	Common Kestrel	Falco tinnunculus	LC			II	Full Migrant	Congregatory (and Dispersive)
26	Common Myna	Acridotheres tristis	LC				Resident	
27	Common Stonechat	Saxicola Torquatos	LC				Full Migrant	
28	Common Tailorbird	Orthotomus sutorius	LC				Resident	
29	Coppersmith Barbet	Psilopogon haemacephalus	LC				Resident	
30	Crested Bunting	Emberiza lathami	LC				Altitudinal Migrant	
31	Crested Serpent Eagle	Spilornis cheela	LC			II	Resident	
32	Crimson Sunbird	Aethppyga siparaja	LC				Resident	
33	Eurasian Collared Dove	Streptopelia decaocto	LC				Resident	

SN	Common Name	Scientific Name	Conservation Status			CITES	Movement Pattern	Congregatory
			Global	National	NPWC			
34	Eurasian Tree Sparrow	Passer montanus	LC				Resident	
35	Golden-fronted Leafbird	Chloropsis aurifrons	LC				Resident	
36	Great Tit	Parus major	LC				Resident	
37	Greater Coucal	Centropus sinensis	LC				Resident	
38	Greater Racquet-tailed Drongo	Dicrurus paradiseus	LC				Resident	
39	Greater Yellownape	Picus flavinucha	LC				Resident	
40	Green Sandpiper	Tringa ochropus	LC				Full Migrant	Congregatory (and Dispersive)
41	Greenish Warbler	Phylloscopus trochiloides	LC				Full Migrant	
42	Grey Wagtail	Motacilla cinerea	LC				Full Migrant	
43	Grey-breasted Prinia	Prinia hodgsonii	LC				Altitudinal Migrant	
44	Grey-capped Woodpecker	Picoides canicapillus	LC				Resident	
45	Grey-headed Canary Flycatcher	Culicicapa ceylonensis	LC				Resident	
46	Grey-hooded Warbler	Phylloscopus xanthoschistos	LC				Resident	
47	Hair-crested Drongo	Dicrurus hottentottus	LC				Full Migrant	
48	Himalayan Bulbul	Pycnonotus leucogenys	LC				Full Migrant	
49	Himalayan Griffon	Gyps himalayensis	NT	VU		II	Full Migrant	Congregatory (and Dispersive)
50	House Sparrow	Passer domesticus	LC				Resident	
51	Indian Cuckooshrike	Coracina macei	LC				Resident	
52	Indian Grey Hornbill	Ocyceros birostris	LC				Resident	

SN	Common Name	Scientific Name	Conservation Status			CITES	Movement Pattern	Congregatory
			Global	National	NPWC			
53	Indian Peafowl	Pavo Cristatus	LC	NT		III	Resident	
54	Indian Pond Heron	Ardeola grayii	LC				Resident	Congregatory (and Dispersive)
55	Indian Roller	Coracias benghalensis	LC				Resident	
56	Indian White-eye	Zosterops palpebrosus	LC				Resident	
57	Jungle Babbler	Turdoides striata	LC				Resident	
58	Jungle Owlet	Glaucidium radiatum	LC			II	Resident	
59	Large Woodshrike	Tephrondornis varigatus	LC				Altitudinal Migrant	
60	Large-billed Crow	Corvus macrorhynchos	LC				Resident	
61	Lesser Adjutant	Leptoptilos javanicus	VU	VU			Resident	Congregatory (and Dispersive)
62	Little Cormorant	Microcarbo niger	LC				Resident	Congregatory (and Dispersive)
63	Little Egret	Egretta garzetta	LC				Full Migrant	Congregatory (and Dispersive)
64	Little Ringed Plover	Charadrius dubius	LC				Full Migrant	Congregatory (and Dispersive)
65	Long-tailed Minivet	Pericrocotus ethologus	LC				Full Migrant	
66	Long-tailed Shrike	Lanius schach	LC				Full Migrant	
67	Olive-backed Pipit	Anthus hodgsoni	LC				Full Migrant	
68	Oriental Honey Buzzard	Pernis ptilorhynchus	LC			II	Full Migrant	Congregatory (and Dispersive)
69	Oriental Magpie-robin	copsychus saularis	LC				Resident	

SN	Common Name	Scientific Name	Conservation Status			CITES	Movement Pattern	Congregatory
			Global	National	NPWC			
70	Oriental Pied Hornbill	Anthracoceros albirostris	LC	NT		II	Resident	
71	Paddyfield Pipit	Anthus rufulus	LC				Resident	
72	Pale-billed Flowerpecker	Dicaeum erythrorhynchos	LC				Resident	
73	Pale-chinned Flycatcher	Cyornis poliogenys	LC				Resident	
74	Pied Bushchat	Saxicola caprata	LC				Full Migrant	
75	Plain Prinia	Prinia inornata	LC				Altitudinal Migrant	
76	Plum-headed Parakeet	Himalayapsitta cyanocephala	LC			II	Resident	
77	Purple Sunbird	Cinnyris asiaticus	LC				Resident	
78	Red Avadavat	Amandava amandava	LC				Resident	
79	Red Turtledove	Streptopelia tranquebarica	LC				Migrant	
80	Red Junglefowl	Gallus gallus	LC				Resident	
81	Red Junglefowl	Gallus gallus	LC				Resident	
82	Red-billed Blue Magpie	Urocissa erythroryancha	LC				Altitudinal Migrant	
83	Red-headed Vulture	Sarcogyps calvus	CR	EN		II	Resident	Congregatory (and Dispersive)
84	Red-naped Ibis	Pseudibis papillosa	LC				Resident	Congregatory (and Dispersive)
85	Red-rumped Swallow	Cecropis daurica	LC				Migrant	
86	Red-vented Bulbul	Pycnonotus cafer	LC				Resident	
87	Red-whiskered Bulbul	Pycnonotus jocosus	LC				Resident	

SN	Common Name	Scientific Name	Conservation Status			CITES	Movement Pattern	Congregatory
			Global	National	NPWC			
88	Rock Dove	Columba livia	LC				Resident	
89	Rose-ringed Parakeet	Alexandrinus krameri	LC				Resident	
90	Ruddy Shelduck	Tadorna ferruginea	LC	NT			Full Migrant	Congregatory (and Dispersive)
91	Rufous Treepie	Dendrocitta vagabunda	LC				Resident	
92	Rufous Woodpecker	Micropternus brachyurus	LC				Resident	
93	Rusty-cheeked Scimitar-babbler	Erythrogenys erythrogenys	LC				Resident	
94	Scaly-breasted Munia	Lonchura punctulata	LC				Resident	
95	Scarlet Minivet	Pericrocotus flammeus	LC				Resident	
96	Shikra	Accipiter badius	LC			II	Full Migrant	
97	Slaty-headed Parakeet	Himalayapsitta himalayana	LC			II	Resident	
98	Slender-billed Vulture	Gyps tenuirostris	CR	CR		II	Resident	Congregatory (and Dispersive)
99	Steppe Eagle	Aquila nipalensis	EN	VU		II	Full Migrant	Congregatory (and Dispersive)
100	Taiga Flycatcher	Ficedula albicilla	LC				Full Migrant	
101	Velvet-fronted Nuthatch	Sitta frontalis	LC				Resident	
102	Verditer Flycatcher	Eumyias thalassinus	LC				Full Migrant	
103	Western Spotted Dove	Spilopelia suratensis	LC				Full Migrant	
104	White Wagtail	Motacilla alba	LC				Full Migrant	
105	White-bellied Drongo	Dicrucus caerulescens	LC				Resident	

SN	Common Name	Scientific Name	Conservation Status			CITES	Movement Pattern	Congregatory
			Global	National	NPWC			
106	White-bellied Drongo	Dicrucus caerulescens	LC				Resident	
107	White-bellied Redstart	Hodgsonius phaenicuroides	LC				Altitudinal Migrant	
108	White-browed Wagtail	Motacilla maderaspatensis	LC				Resident	
109	White-capped Bunting	Emberiza stewarti	LC				Vagrant	
110	White-rumped Vulture	Gyps bengalensis	CR	CR		II	Resident	Congregatory (and Dispersive)
111	White-throated Kingfisher	Halcyon gularis	LC				Resident	
112	Zitting Cisticola	Cisticola juncidis	LC				Resident	

356. Among the total recorded bird species in NBTL alignment, 5 species were found to be categorized as globally threatened species. Of these 3 species are in the Globally Critically Endangered category, 1 in Endangered and 1 in the Vulnerable Category. While 7 species are Nationally Threatened with 1 nationally Critically Endangered, one nationally Endangered and 4 are nationally Vulnerable Species. 1 species recorded during field study is nationally vagrant. None of the bird species observed in NBTL alignment fall in the protection list as per National Park and Wildlife Act, 1973. However, 18 bird recorded in NBTL alignment are regulated by the Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora. Of these, 17 species were listed in CITES Appendix-II and one species in CITES Appendix-III (Table below).

357. Besides the observed birds, other birds are expected to occur in the project area considering available habitat. The project area has good *Sal* Forest and farmlands, which can provide habitat for some of the globally threatened species, such as Great Slaty Woodpecker (*Mulleripicus pulverulentus*) and Egyptian Vulture (*Neophron percnopterus*) as well as nationally threatened species such as Black Stork (*Coconia nigra*) and Asian Woollyneck (*Ciconia episcopus*).

Table 70: Birds with conservation significance potentially present in the project area[20]

SN	Common Name	Scientific Name	Conservation Status				Movement Pattern	Congregatory
			Global	National	NPWC	CITES		
1	Great Slaty Woodpecker	*Mulleripicus pulverulentus*	VU	EN			Resident	
2	Black Stork	*Coconia nigra*	LC	VU	Protected	II	Migrant	Congregator (and dispersive)
3	Asian Woollyneck	*Ciconia episcopus*	NT	VU			Resident	Congregatory (and dispersive
4	Egyptian Vulture	*Neophron percnopterus*	EN	VU		II	Migrant	Congregatory (and dispersive)

358. Of the total bird species recorded, 44 species show some kind of migration. Of these 35 are full migrants, 8 species were altitudinal migrants and 1 is vagrant the list of migratory birds is presented in the table below. Besides the reported migratory birds, other full migrants were also expected in the project area, such as are listed from the literature. Bar-headed Goose (*Anser indicus*) and Egyptian Vulture (*Neophron percnopterus*).

359. **Vultures and other Raptors**. Vultures and other raptors were observed soaring/gliding in the NBTL alignment. It was noted that some vulture nests were found about 1 km away from the NBTL alignment. However, raptors including vultures are highly mobile having large foraging area. instances of avifauna reported used as migratory routes in the project area are briefed below. Approximately over 1km west of the proposed line in Lalmatiya of Dang District there is a Vulture Restaurant along the Right Bank of River Rapti. Vulture nests are located throughout the broad alignment corridor (see Figure 82). The locations of the nests from the proposed alignment is given in Table 71. Note these distances represent the distances to the updated alignment based on the alternatives assessed as part of this EIA.

360. West Rapti River was observed as the congregation for many species including large Raptors; Himalayan Griffon, Red-headed Vulture, Cinereous Vulture, Steppe Eagle, and waterfowl; Ruddy Shelduck.

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Figure 82: Vulture Nesting Sites

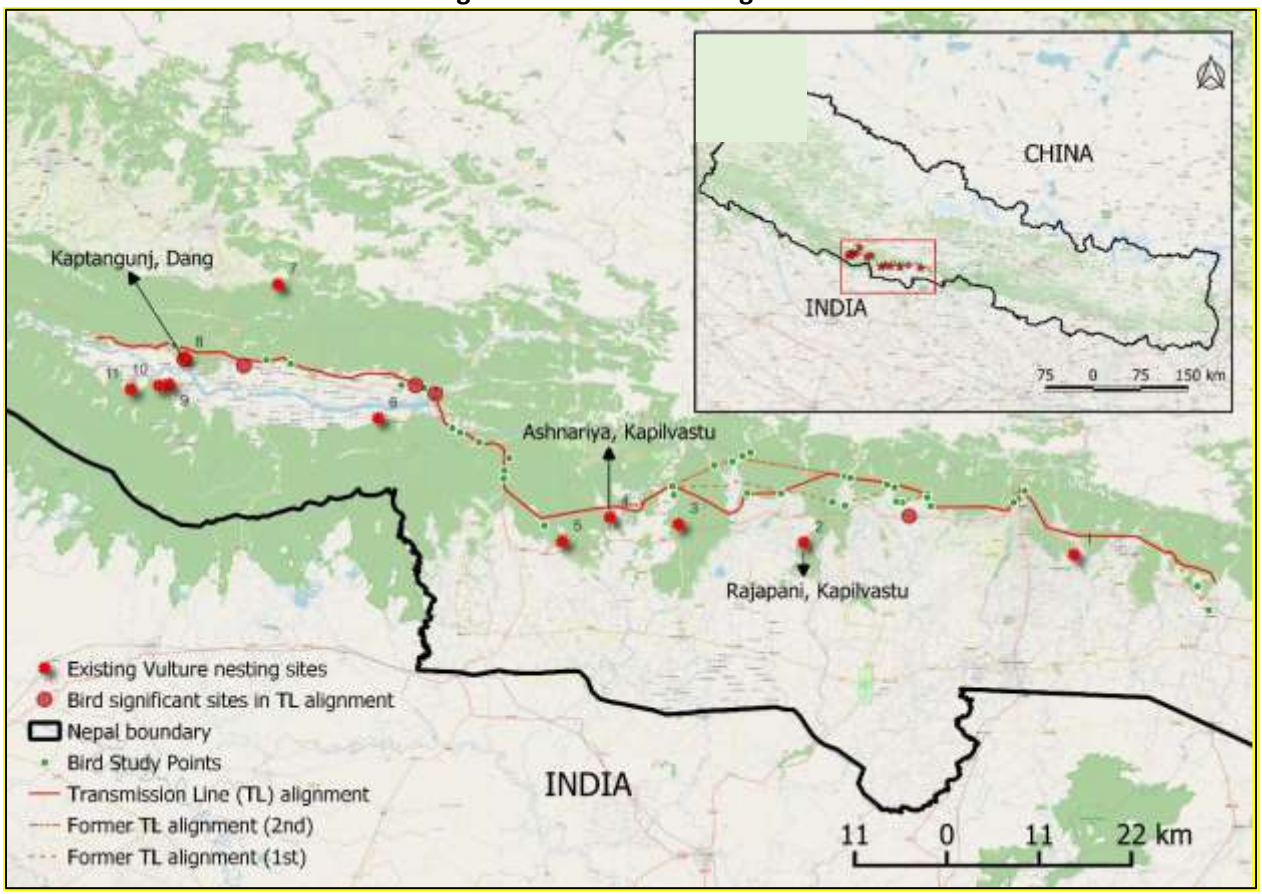


Figure 83: Congregated Vultures and Ruddy Shelduck at West Rapti River, Bhalubang

Table 71: Distance to NBTL from Sensitive Vulture Sites

Vulture Nesting Sites	Minimum Distance to Towers (m)	Tower Number
Ashnariya*	3600	237
Gorusinge	4347	207
Khairenipur	3568	254
Khardariya	5187	404

Vulture Nesting Sites	Minimum Distance to Towers (m)	Tower Number
Kulpani CF, Patringa	5986	341
Rajapani CF, Gajeheda	7266	AP31
Rajpur, Khardariya	5108	414
Ram Janaki CF, Roheniya	5683	421
Sakhaura Hariyali CF	2589	AP9
Sallikot CF, Rampur	9846	372
UchaNimbuCF-Kaptanganj*	1200	402
Vulture Feeding Location	Minimum Distance to Towers m	Tower Number
Bijauri	25621	431
Gaidahawa	14074	AP 18
Lalmatiya*	1200	328

*Based on alternative alignments adopted.

361. **Vulture Restaurants** - Despite of important role of vultures in the maintenance of ecosystem, their populations have been undergoing a global decline, confronting a myriad of threats that include habitat loss, poisoning, and the peril of collisions with power lines. To address this pressing conservation concern, a novel and effective concept known as "vulture restaurants" has emerged. This innovative approach seeks to provide much-needed assistance to these birds. The idea of "Vulture Safe Zone," developed in Nepal in 2009, gave birth to the concept of supplementary feeding through vulture restaurants. These vulture restaurants are designated to locations where carcasses are carefully provided to vultures in a controlled manner, offering a safe and reliable food source.

362. Moreover, Nepal's vulture restaurants are different in the sense that these are the pioneering examples of community-managed initiatives. This not only underscores the significance of local engagement but also serves as a beacon of hope for the conservation of these vultures.

363. **Lalmatiya, Dang** - Established on Kartik 22, 2065 BS, this site is nestled within the Kalika Community Forest in Lalmatiya, Dang district. It is situated adjacent to the Dang Deukhuri Forest Important Bird Area (IBA) and enjoys a close proximity to the towns of Bhalubang and Lamahi, conveniently located along the East-West highway. Notably, this site provides a vital habitat for the critically endangered White-rumped vulture.

364. In addition to its primary function as a vulture restaurant, this establishment also serves as an animal refuge camp, implementing sustainable practices by using deceased animals from the refuge to nourish the vulture population. The financial support required for its operation is provided by the local government and the Division Forest Office. The funds generated from this operation are

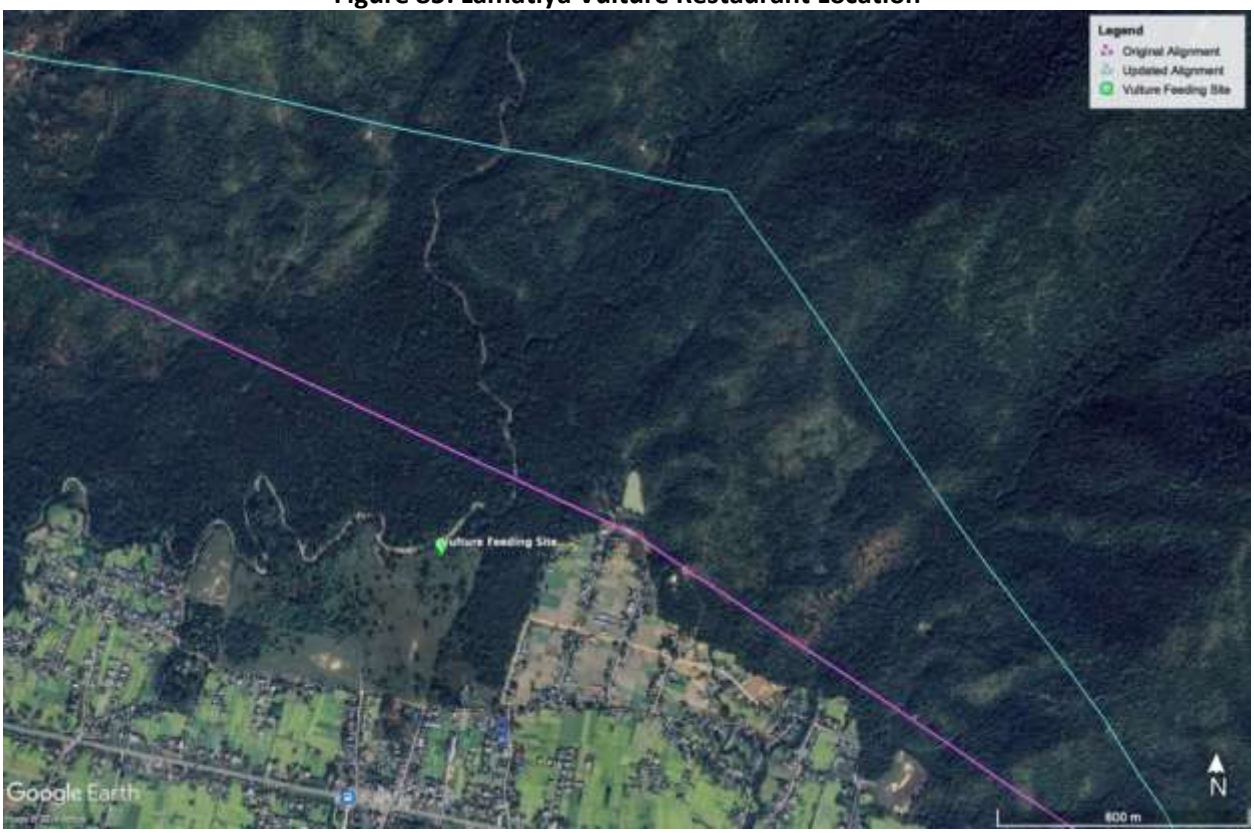
deposited in a bank, with the accrued interest serving as compensation for the dedicated staff members.

365. During feeding sessions, the site transforms into a sanctuary for 100 to 350 vultures. Documented vulture species include Egyptian Vulture, White-rumped Vulture, Long-billed vulture, Slender-billed Vulture, Cinereous Vulture, Himalayan Griffon, and Eurasian Griffon (ADB No Date). (Contact Person: Bhim Kanta Bhusal (9847861772))

Figure 84: Vulture Feeding Site, Lalmatiya

Source: EIA Team - 2024

Figure 85: Lamatiya Vulture Restaurant Location



Source: Google Earth / NEA

366. ***Further Assessment of Vultures*** – The EIA team, in consultation with BCN and other stakeholders identified three vulture sites as being of specific concern to the project due to their proximity to the NBTL:

- Lalmatiya Vulture Restaurant
- Ashnariya nesting site
- UchaNimbuCF-Kaptanganj nesting site

367. Further analysis of these sites was undertaken in May 2024 by ADB TA consultants with expertise in electricity infrastructure and avifauna. The following summarizes the findings of their site visits.

Site #1: Kaptanganj, Dang, Vulture Nesting Colony #8, Structures 402-403

368. Species: Ucha Nimbu Community Forest, Kaptanganj hosts a nesting colony of the critically endangered White-rumped Vulture (WRV) comprising 21 nests and one Slender-billed Vulture (SBV) nest, totaling 22 nests. The proposed transmission line is approximately 1.2 km north from the nearest nesting tree.

369. Habitat: The colony area consists of small agricultural plots planted with corn. Tall trees with nests are located within this small agricultural area. There are small homes scattered on the periphery of

the nesting trees. The Mahendra Highway is approximately .25km south of the colony and a dirt road exists within the colony and is used by villagers. The proposed 400kV line is proposed in forest habitat.

370. Power Lines: There are existing secondary lines feeding homes within the colony. There is no primary power within the colony area. An existing 132kV line is south of Mahendra Highway, as well as an 11kV distribution line. Both these lines are approximately .25km south of the colony. The transmission line is double circuit and supports 2 overhead ground wires which are unmarked. The bare conductor distribution lines are supported on steel crossarms supported by concrete poles and are thus considered high avian electrocution risk due to minimal phase-to-ground separations.

371. Proposed NBTL Route: The team walked to the proposed route. Denser vegetation was noted than within the nesting colony and there were fewer taller trees. The proposed alternate route to the north increases in elevation, thus elevating the wires including the overhead ground wires. According to NEA engineers, due to the elevated terrain, it is likely a long span would be needed to go from ridgeline to ridgeline at this location. This might be more impactful than the original proposed route because it places less visible ground wires higher into the air. BCN indicated vultures at this colony are foraging south towards the river and east to the vulture restaurant, thus away from the proposed line route.

Site #2: Ashnariya, Kapilvastu, Vulture Nesting Colony #4, Structure 236

372. Species: Ashnariya, Kapilvastu Forest, hosts a nesting colony of critically endangered White-rumped Vultures (WRV) with 34 nests. The proposed transmission line crosses a river approximately 3.6 km north/northwest of the nearest nesting tree.

373. Habitat: The colony area consists of a grove of trees located on the edge of agriculture. There are a couple of small homes on the periphery of the nesting trees. A dirt road exists, approximately 60 meters to the southwest of the colony. Construction truck traffic was noted during the site visit. The river drainage is located approximately .5km to the northeast of the colony. The proposed 400kV line to the north crosses this same river.

374. Power Lines: There are no power lines within the colony. There is an 11kV distribution line parallel to the south side of the dirt road. The bare conductor distribution lines are supported on steel crossarms supported by concrete poles and are thus considered high avian electrocution risk due to minimal phase-to-ground separations.

375. Proposed TL Route: Vultures at this colony are likely foraging west towards the vulture restaurant, and along the river drainages.

Figure 86: White-rumped Vulture Chick, Ashnariya

Source: EIA Team, May 2024

Site #3: Vulture Restaurant, Structure 328

376. Species: The Kalika Community Forest in the Lalmatiya, Dang district includes a vulture restaurant adjacent to the Dang Deukhuri Forest Important Bird Area (IBA). This site provides vital habitat for the critically endangered vultures and the area serves as an animal refuge camp for approximately 200 cows. During vulture feeding sessions, the site can attract from 100 to 350 vultures of seven species, including the Egyptian Vulture, White-rumped Vulture, Long-billed vulture, Slender-billed Vulture, Cinereous Vulture, Himalayan Griffon, and Eurasian Griffon. The proposed transmission line is approximately 1.2 km north from the feeding site.

Figure 87: Egyptian Vulture, Lalmatiya

Source: EIA Team, May 2024

377. Habitat: The feeding area consists of an open field with scattered small trees. It is used for a variety of community activities such as football matches and motorcycle riding. The field also supports cattle as part of the animal refuge camp. There are numerous homes scattered on the southern periphery of the field .4km from the feeding area, along with a dirt road. An existing 132kV power line runs through the field. The proposed 400kV line is proposed in forest habitat to the north.

378. Power Lines: An existing 132kV power line runs through the vulture restaurant field .3km to the south of the feeding area. The transmission line is double circuit and supports 2 overhead ground wires which are unmarked. A 2012 historic vulture collision record with this line exists. A vulture (species unknown) was reported to have collided with this line and suffered a wing fracture. The bird was captured for rehabilitation but subsequently died. Since then, no other incidents have been reported. An existing 11kV distribution line runs along the south end of the field. The bare conductor distribution lines are supported on steel crossarms supported by concrete poles and are thus considered high avian electrocution risk due to minimal phase-to-ground separations.

379. Proposed TL Route: Vultures at this site are being attracted from a variety of nesting colonies, and thus directions. Although vultures are typically at low risk of collision with wires, the number of vultures which may be present (at times hundreds), the precedence of a collision with the existing 132kV line which is similar in distance from the proposed line to the feeding area.

Human Wildlife Conflict

380. Approximately 34.4km section of forest of Sainamaina, Buddhabhumi and Banganga Municipalities between towers 135 to AP35 (among these towers 135 to 165 are in dense forest) and towers 194 to 235 have high probability of occurrence of tiger21 with siting at Highway 45km south at the East West Highway in January 2024 of the same forest stretch and existing 132kV TL is close and parallel to the East West Highway and proposed East West Railway Line is 900m south of the highway in the forest (it has proposed a 25.5mX5.3m big wildlife crossing at this forest).

381. AP 195 to 235 (Banganga and Buddhabhumi Municipalities forests west of Motipur SS) has also been recorded to have high probability of occurrence of tigers (however the forest condition here has been classified as Moderate.

382. During National IEE field assessment no presence of Elephant (Elephas maximus) was recorded and during the consultation as well no presence of it was informed. However, based on publication in Journal Environmental Management 2022 have recommended through habitat suitability model that habitat at Chure Foothills are suitable to allow optimism for connectivity of the East elephant population at Chitwan National Park to West Population of Banke National Park22. Their findings mention that Elephant have not been recorded in Nawalparasi West and Rupandehi Districts since 1950's. Based on their projections of forest agricultural mosaic and least cost path movement potential for Human Elephant Conflict have been categorized as high in 6% of the alignment, moderate at 46% of the alignment (these are projections based on habitat suitability).

6.4 Socio-economic Environment

383. Nepal is a nation with population of 2,91,12,480 with 48.96% male and 51.04% Female[23]. The 10 years census indicates a 10.18% growth in population and decrease in the family size to 4.32 from 4.88. It ranks as the 49 most populous nation in the world[24] (with highest 53.66% in Terai Region and lowest of 6.09% in Mountains). The average population density being 198 persons/km^2 (ranking 51st most densely populated nation in the world decreasing from 48th position in 2011). According to 2021 census data in 36 municipalities there are altogether 2,369,415 persons. The average national literacy rate is 76.2% (Male 83.6% and Female 69.4%). Bagmati Province has the highest literacy rate with 82.1% while with 54.7% Madhesh Province has the lowest. The proportion of household headed by women were the highest for Gandaki Province with 41% and lowest with Madhesh Province with 21.7%.

6.4.1 Administrative Set Up

384. The alignment of the transmission line spans 160 km and passes through 49 wards of 11 municipalities in the 5 districts of the Lumbini Province. The NBTL alignment originates from the New Butwal Substation in the Nawalparasi – West District, traverses through Rupandehi and Kapilvastu, and terminates at the proposed Lamahi Substation in Dang District.

[21] Dhakal, Maheshwar; Karki (Thapa), Madhuri; Jnawali, Shant Raj; Subedi, Naresh; Pradhan, Narendra Man Babu; Malla, Sabita; Lamichhane, Babu Ram; Pokheral, Chiranjibi Prasad; Thapa, Gokarna Jung; Oglethorpe, Judy; Subba, Samundra Ambuhang; Bajracharya, Pankaj Ratna and Yadav, Hemanta (2014). Status of Tigers and Prey in Nepal. Department of National Parks and Wildlife Conservation, Kathmandu, Nepal. Downloaded from National tiger book.indd (dnpwc.gov.np)

[22] Dinesh Neupane, S. B.-A. (2022). Broad scale functional connectivity for Asian elephants in the Nepal-India transboundary region. Journal of Environmental Management, 321. doi:https://doi.org/10.1016/j.jenvman.2022.115921

[23] Central Burea of Statistics, National Population Census 2021, Preliminary Results.

[24] https://tinyurl.com/mrmdcbbu

Figure 88: Municipalities of the Alignment

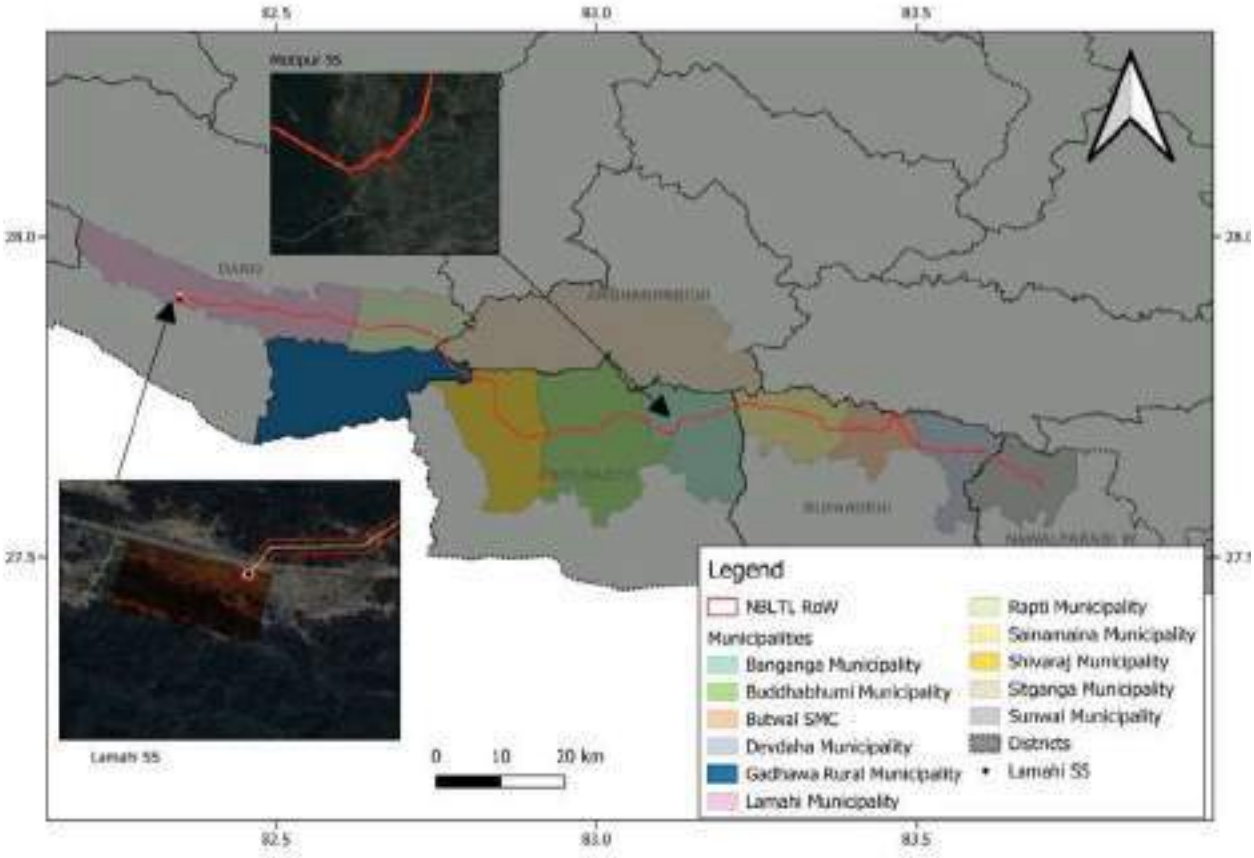


Table 72: NBTL chainage through the project municipality

TL Alignment [Chainage]	Length [km]	Municipality	District
0.00 - 10.32	10.32	Sunwal	Nawalparasi – West
10.32 – 22.55	12.24	Devdaha	Rupandehi
22.55 – 39.39	16.84	Butwal	Rupandehi
39.39 – 57.23	17.83	Sainamaina	Rupandehi
57.23 – 76.75	19.52	Banganga	Kapilvastu
76.75 – 93.23	16.48	Buddha Bhumi	Kapilvastu
93.23 – 112.30	19.07	Shivraj	Kapilvastu
112.30 – 117.16	5.22	Gadhwa	Dang
117.16 – 120.45	2.93	Sitganga	Arghakhanchi
120.45 – 134.71	14.26	Rapti	Dang
134.71 – 160.00	27.90	Lamahi	Dang

6.4.2 Demographics

385. According to the census 2021, Nepal's total population stands at 29.16 million. The country has an average annual population growth rate of 0.92 percent, and the average household size is 4.37 persons per household. The table below presents the general demographic information for the districts affected by the project.

Table 73: Demographic information for the six districts affected by the TL[25].

Administrative Unit	Population	Number of HHs	Average Household Size	Area (km2)	Population Density (person/km2)	Sex Ratio
Nepal	29,164,578	6,666,937	4.37	147,181	198	95.59
Ecological Zone						
Mountain	1,772,948	409,799	4.33	51,817	34	97.28
Hill	11,757,624	2,949,056	3.99	61,345	192	94.65
Terai	15,634,006	3,308,082	4.73	34,019	460	96.11
Province						
Lumbini	5,122,078	1,141,902	4.49	22,288	230	92.0
District						
Nawalparasi - west	386,868	82,738	4.68	2,162	527	94.71
Rupandehi	1,121,957	238,320	4.71	1,360	825	96.33
Kapilvastu	682,961	121,946	5.60	1,738	393	96.10
Dang	674,993	162,316	4.16	2,955	228	90.45
Arghakhanchi	177,086	48,465	3.65	1,193	148	83.67

6.4.3 Languages

386. Based on the Census 2021, the linguistic diversity within the project districts was notable. Most of the population, accounting for approx. 49% speaks the Nepali language. Nepali is the official language of Nepal and serves as a *lingua franca* in many parts of the country, including the project area. The second most widely spoken language in the project district is Bhojpuri, with approx. 11% of the population using it as their primary language. Bhojpuri is an Indo-Aryan language spoken by communities in various regions of Nepal, particularly in the Terai region. Tharu, with around 9% of the population, is another prominent language in the project districts. The Tharu community, an indigenous group primarily residing in the Terai region, has its own distinct language and cultural identity. Avadhi, spoken by around 9% of the population, is another language observed in the project districts. Avadhi is a dialect of Hindi spoken mainly in the central and eastern regions of Nepal. Magar, accounting for approx. 4% of the population, represents another significant linguistic group in the area. The Magar community, predominantly found in the hills of western Nepal, has its own language and cultural heritage. The remaining population, around 11.5%, encompasses various other languages spoken by smaller communities within the project districts. Some of these languages include Kumal, Bote, Khash, Rai, Sherpa, Newari, Ghale, and Hindi

Table 74: Languages spoken in the project district[26]

Mother Tongue	Percent of Population					
	Nawalparasi	Rupandehi	Kapilvastu	Arghakhanchi	Dang	Total
Nepali	40.94	36.89	17.15	97.43	66.65	49.02
Bhojpuri	29.03	36.59	0.24	0.04	0.07	11.00
Magar	13.61	4.18	1.69	1.35	0.96	3.82
Tharu	9.78	6.28	11.30	0.06	28.12	9.26

[25] CBS, 2021
[26] CBS, 2021 IEE

Mother Tongue	Percent of Population					
	Nawalparasi	Rupandehi	Kapilvastu	Arghakhanchi	Dang	Total
Maithili	1.91	3.54	0.85	0.02	0.12	1.08
Gurung	1.53	1.20	0.09	0.00	0.05	0.48
Newari	1.00	1.32	0.20	0.23	0.16	0.52
Tamang	0.57	0.08	0.03	0.00	0.03	0.12
Avadhi	0.02	6.38	49.78	0.02	1.86	9.68
Sign Language	0.03	0.01	0.01	0.01	0.01	0.01
Urdu	0.09	2.56	17.79	0.21	0.39	3.51
Others	1.49	0.97	0.87	0.63	1.57	11.52

6.4.4 Literacy and Educations

387. According to Census 2021, the overall literacy rate in Nepal was recorded at 76.3%. This indicates that a significant portion of the population had acquired basic reading and writing skills. However, there was a notable gender disparity in literacy rates. The male literacy rate stood at 83.6%, while the female literacy rate was comparatively lower at 69.4%. The report also highlighted variation in literacy rates across different districts. The district with highest literacy rate was Kathmandu, recording an impressive 96.88%. This can be attributed to the district's status as the capital city and its relatively better access to educational resources and opportunities.

388. In the context of the project, it is worth noting that the literacy rates in all five project districts were higher than the national average. This suggests that educational opportunities and literacy initiatives have had a positive impact on these districts. Higher literacy rates can potentially contribute to improved socio-economic conditions, increased awareness, and better access to opportunities for the local population.

Table 75: Literacy rate of the project districts[27]

	Total [%]	Female [%]	Male [%]
Province			
Lumbini	78.1	71.7	85.2
District			
Nawalparasi (Bardaghat Susta West)	78.0	70.2	86.3
Rupandehi	81.2	74.4	88.4
Kapilvastu	71.8	64.4	79.6
Dang	81.4	75.7	87.9
Arghakhanchi	80.0	73.8	87.7
Average	78.48	71.7	85.98

6.4.5 Ethnic Groups

389. Nepal is the most common home for 126 caste/ethnic groups with multi-cultural, multi-language, and multi-religious characteristics. In 2002, the government of Nepal categorized a total of 59

[27] CBS, 2021 IEE

caste/ethnic groups as indigenous groups (Aadibasi/Janjati) that have distinct cultures, distinct languages, and at the same time belief systems. Similarly, the Nepal Federation of Indigenous Nationalities (NEFIN) is the umbrella organization of the indigenous people voicing for the political, economic, social, and cultural rights of the indigenous people in Nepal in the context of state transformation. The indigenous groups have been categorized into 5 broad categories by the NEFIN following their population, and other socioeconomic variables such as literacy, housing, land holdings, occupation, language, and area of residence at present as a) Endangered Group (10); b) Highly Marginalized Group (12); c) Marginalized Group (20); d) Disadvantaged Group (15), and e) Advanced Group 2. For more detail categorization of Indigenous People of Nepal is given in Table 7 below.

Table 76: Categorization of Indigenous Adibasi/ Janajati people of Nepal

Category	Ethnic Groups
Endangered Groups	Bankariya, Kusunda, Kushbadia, Raute, Surel, Hayu, Raji, Kisan, Lepcha, Meche (10 groups)
Highly Marginalized Groups	Santhal, Jhangad, Chepang, Thami, Majhi, Bote, Dhanuk (Rajbansi), Lhomi (Singsawa),Thudamba, Siyar (Chumba), Baramu, Danuwar (12 groups)
Marginalized Groups	Sunuwar, Tharu, Tamang, Bhujel, Kumal, Rajbansi (Koch), Gangai, Dhimal, Bhote, Darai, Tajpuria, Pahari, Dhokpya (Topkegola), Dolpo, Free, Magal, Larke (Nupriba), Lhopa, Dura, Walung (20 groups)
Disadvantaged Groups	Jirel, Tangbe (Tangbetani), Hyolmo, Limbu, Yakkha, Rai, Chhantyal, Magar, Chhairotan, Tingaunle Thakali, Bahragaunle, Byansi, Gurung, Marphali Thakali, Sherpa (15 groups)
Advanced Groups	Newar, Thakali (2 groups)

Source: NEFIN, Nepal

390. The Indigenous Peoples (Aadibasi/Janjati) are not confined only within a certain ecological territory such as mountain, hill, or Terai, and are also not limited within the boundaries of rural or urban areas. Conversely, the concentration of such indigenous people is higher in rural areas of Nepal than the urban areas. Raute, and Kusunda are the roving type of people, and are categorized as the most endangered people in Nepal. Subsistence farming is the main source of livelihood for most of the indigenous people. Most of the indigenous people are deprived of their social, economic, cultural, and political rights despite several policies, and legal measures are there implied by the government for inclusion in the mainstream of nation-building.

391. From the household survey completed as part of the RIPP and consultation with affected IPs, these households will neither experience physical displacement nor a reduction in their income opportunities. Among these, only one household will be affected by land acquisition for the construction of the tower foundation, belonging to the Darlami Magar IP group located in Jaluke, Sitganga of Argakhanchi district and the remaining 28 households will be affected by RoW of transmission line. Tharu, Magar and Gurung Indigenous Peoples have distinct social, and cultural norms/traditions. All 3 IP groups commonly use the Nepali language for day-to-day communication with other different linguistic groups, and harmonically assorted with other castes/ethnic groups in the project area. Municipality wise distribution of affected IPs households is given in Table 77 below.

Table 77: Details of Indigenous Peoples in the project area

Municipality	IP groups			Total
	Magar	Gurung	Tharu	

	HHs	Pop	HH	Pop	HH	Pop	HH	Pop
Butwal	0	0	0	0	0	0	0	0
Devdaha	2	10	0	0	0	0	2	10
Gadawa	9	54	1	3	0	0	10	57
Lamahi	5	21	0	0	4	14	9	35
Rapti	0	0	0	0	0	0	0	0
Sainamaina	1	7	0	0	0	0	1	7
Shivaraj	1	12	2	11	2	14	5	37
Sitganga	2	12					2	12
Total	20	116	3	14	6	28	29	158

Source: HH survey, NBL-TL, 2021

392. Consultation with affected Indigenous Peoples confirms that these communities self-identify as indigenous and that they have their own languages and cultural institutions. During consultation with affected persons, other local people, and separately with Indigenous Peoples, stakeholders were asked about distinctive habitats or ancestral territories or natural resources that are used by Indigenous Peoples or others living in the project area. Consultations confirmed that none of the areas to be impacted by the project are characterized by distinctive habitats or ancestral territories. Land is not collectively owned in the project corridor of impact.

6.4.6 Vulnerable People

393. Upon a thorough examination of information pertaining to indigenous peoples and vulnerable groups in the project area, several distinct categories emerged as deserving special consideration within the study. These vulnerable groups encompassed indigenous people, Dalits, female-headed households, households who lost more than 10% of total land or productive assets, households below national poverty line and elderly-headed households were considered as a vulnerable group. Based on the parameter the study result reveals that single households are facing multiple cases of vulnerability. Among the total affected HHs only 28% (16) households are facing single vulnerable cause and remaining 39% (22), 19% (11) and 4% (2) households are experiencing dual, triple and multiple causes of vulnerability respectively. Municipality wise details or causes of vulnerability have been presented in Table 78 below.

Table 78: Vulnerability situation of affected households

Particulars	Extent of Vulnerability				
	Vulnerable (Single Cause)	Vulnerable (Dual Causes)	Vulnerable (Triple Causes)	Vulnerable (Multiple Cause)	Institution & unidentified
Butwal	0	3	0	0	1
Devdaha	0	2	0	0	
Gadhwa	3	5	6	2	
Lamahi	5	6	2	0	
Rapti	2	0	0	0	3
Sainamaina	1	1	0	0	
Shivraj	4	5	1	0	
Sitganga	1	0	2	0	
All	16	22	11	2	4

Particulars	Extent of Vulnerability				
	Vulnerable (Single Cause)	Vulnerable (Dual Causes)	Vulnerable (Triple Causes)	Vulnerable (Multiple Cause)	Institution & unidentified
%	28%	39%	19%	4%	7%

Source: Field Survey, NBL-TL, 2021.

6.4.7 Economy

394. According to the collected data as part of the RIPP social survey, out of the total 674 people in project affected families (PAF) 299 (44%) individuals have reported being employed in some form of job. This indicates that a significant portion of the population in the project area is actively participating in the workforce.

395. Among the employed individuals, the majority are engaged in private job (32.11%) either operating own or engaged to other's enterprising affairs. Involving in the agriculture sector is about 18% which is almost half of the involvement in agriculture sectors. It indicates that the people are being reluctant to be engaged in the agriculture. Though, the agriculture was an important sector in many areas, especially in rural communities, and was often served as the primary source of livelihood for a significant portion of the population but decline in the involvement in this sector denotes that people are no more interested to agriculture which is a very critical. The reliance on agriculture can be attributed to factors such as availability of arable land, local forming traditions, and the economic importance of agriculture in the region.

396. The employment in the government sector job stands at the third position comprising about 14% and in-country laborers make up a significant portion (12.37%) of the employed population. In-country laborers are individuals who engage in various forms of manual labor within the country, often involving construction, infrastructure development, or other physical works. About 5% people are engaged in the foreign employment.

Table 79: Employment status of the PAF [28]

Sector	Sex		
	Male	Female	Total
Government	24	19	43
Private	51	45	96
Agriculture	34	20	54
Laborer	25	12	37
Foreign Labor	13	1	14
Business	18	11	29
Others	17	9	26
Total	182	117	299

397. The income data collected from the RIPP social survey has categorized 2 main sources of income – (a) income from agricultural sources and (b) income from non-agricultural sources. Similarly, the

[28] NBLTL IEE

expenditure was also categorized into (a) expenses for food items, (b) expenses for non-food items, to provide insights into how PAF allocate their resources for different purposes.

398. The income items such as selling of agricultural produces like cereal crops, legumes, vegetable, livestock, milk products, eggs and poultries are categorized under the sources of the income agriculture whereas the items out of agriculture source such as remittances, pension, business, salary, and entrepreneurship are categorized under the sources of the nonagricultural income.

399. The annual per capita income of the PAF was NRs 121,499 with 22% coming from agriculture sources and 78% coming from non-agricultural sources. Similarly, the annual per capita average expenditure is NRs 95,520, with about 41% of which is spent on food items here as remaining 59% goes on non-food items. The data indicates that in overall the people have a surplus of NRs 25,979, suggesting that their total income exceeds their total expenditures.

400. Despite, the project area could be considered as the area having surplus income but there is nearly 2 out of 5 households have been facing money scarcity to meet their day-to-day life throughout the year. The data revealed that 45 households are having a deficit balance.

401. It was observed that agriculture was no longer the primary source of income for the PAF. This shift had indicated a change in the economic activities and livelihoods of the population. Furthermore, PAF were found to spend more on non-food items than on food items, which implied that their priorities and consumption patterns have shifted towards non-food items, possibly due to changing lifestyles and economic opportunities.

402. Both the income and expenditure figures in the project area are lower than the national average. This suggested that the economic status of PAF was relatively lower compared to the overall average income and expenditure levels in the country.

Table 80: Per capita income of PAF [29]

Districts	Municipalities	Wards	Annual Per capita Agri Income	Annual Per capita Non Agri Income	Annual Per capita Gross Income
Arghakhanchi	Sitganga	8	20,043	56,926	76,969
Dang	Gadhwa	1	21,815	90,381	112,196
	Lamahi	8	24,007	86,493	110,500
	Rapti	2	11,602	70,895	82,496
		5	15,454	30,621	46,075
Kapilvastu	Banganga	7	26,792	77,009	103,801
	Shivraj	1	20,615	80,521	101,136
		3	47,421	26,081	73,503
Rupandehi	Butwal	3	13,375	119,263	132,638
	Devdaha	6	32,744	128,228	160,972
	Sainamaina	3	6,528	79,659	86,187
Overall			27,007	94,492	121,499

[29] NBLTL IEE

Table 81: Annual per capita expenditure of PAF [30]

Districts	Municipalities	Wards	Annual Per capita Food Expenditure	Annual Per capita Nonfood Expenditure	Annual Per capita Gross Expenditure
Arghakhanchi	Sitganga	8	36,779	12,665	49,444
Dang	Gadhwa	1	37,593	24,192	61,785
	Lamahi	8	38,475	44,752	83,227
	Rapti	2	37,762	14,756	52,518
		5	45,071	330,779	375,850
Kapilvastu	Banganga	7	41,942	42,500	84,442
	Shivraj	1	39,109	25,290	64,398
		3	37,679	25,704	63,382
Rupandehi	Butwal	3	37,370	26,131	63,500
	Devdaha	6	38,206	20,710	58,917
	Sainamaina	3	37,241	12,803	50,045
Overall			39,243	56,276	95,520

Table 82: Surplus/ Deficit of the PAF [31]

District	Municipalities	Wards	Annual Per capita Gross Income	Annual Per capita Gross Expenditure	Annual Per Capita Saving/Deficit
Arghakhanchi	Sitganga	8	76,969	49,444	27,525
Dang	Gadhwa	1	112,196	61,785	50,411
	Lamahi	8	110,500	83,227	27,272
	Rapti	2	82,496	52,518	29,979
		5	46,075	375,850	-329,775
Kapilvastu	Banganga	7	103,801	84,442	19,358
	Shivraj	1	101,136	64,398	36,737
		3	73,503	63,382	10,121
Rupandehi	Butwal	3	132,638	63,500	69,138
	Devdaha	6	160,972	58,917	102,056
	Sainamaina	3	86,187	50,045	36,142
Overall			121,499	95,520	25,979

[30] NBLTL IEE
[31] NBLTL IEE

Table 83: Households with deficit balance [32]

Municipalities	Deficit HH		Saving HH		Both	
	Numbers	%	Numbers	%	Numbers	%
Banganga	6	33.3%	12	66.7%	18	100.0%
Buddha Bhumi	14	36.8%	24	63.2%	38	100.0%
Butwal	3	30.0%	7	70.0%	10	100.0%
Devdaha			2	100.0%	2	100.0%
Gadhwa	3	17.6%	14	82.4%	17	100.0%
Lamahi	7	53.8%	6	46.2%	13	100.0%
Rapti	4	66.7%	2	33.3%	6	100.0%
Sainamaina	1	50.0%	1	50.0%	2	100.0%
Shivraj	5	50.0%	5	50.0%	10	100.0%
Sitganga	1	33.3%	2	66.7%	3	100.0%
Total	45	37.2%	76	62.8%	121	100.0%

6.4.8 Gender

403. The RIPP social survey has revealed that there were no major cases of discrimination, although some minor levels of discrimination between men and women were observed. Despite of the existence of underlying issues related to gender discrimination, Nepal has been actively working towards promoting gender equality.

Table 84: Division of labour between men and women[33]

Municipality	Ward	Jobs		Business		Agricultural Activities		HH Works		Outreach		Overall	
		Men's Responsibility	Women's Responsibility	Men's Responsibility	Women's Responsibility	Men's Responsibility	Women's Responsibility	Men's Responsibility	Women's Responsibility	Men's Responsibility	Women's Responsibility	Men's Responsibility	Women's Responsibility
Banganga	7	69	31	69	31	60	40	49	51	57	43	61	39
Buddha Bhumi	1	64	36	66	34	64	36	46	54	59	41	60	40
	3	77	23	58	42	64	36	48	52	56	44	61	39
	9	50	50	68	32	63	37	42	58	57	43	56	44
Butwal	3	71	29	73	27	60	40	52	48	58	42	63	37
Devdaha	6	75	25	80	20	60	40	44	56	45	55	61	39
Gadhwa	1	72	28	76	24	63	37	47	53	58	42	63	37

[32] NBLTL IEE

[33] NBLTL IEE

Municipality	Ward	Jobs		Business		Agricultural Activities		HH Works		Outreach		Overall	
		Men's Responsibility	Women's Responsibility	Men's Responsibility	Women's Responsibility	Men's Responsibility	Women's Responsibility	Men's Responsibility	Women's Responsibility	Men's Responsibility	Women's Responsibility	Men's Responsibility	Women's Responsibility
Lamahi	8	75	25	59	41	62	38	49	51	58	42	61	39
Rapti	2	65	35	43	58	55	45	54	46	58	42	55	45
	5	75	25	55	45	63	38	50	50	52	48	59	41
Sainamaina	3	85	15	65	35	66	34	44	56	63	37	65	35
Shivraj	1	80	20	68	32	62	38	44	56	56	44	62	38
	3	70	30	60	40	65	35	49	51	68	32	63	37
Sitganga	8	50	50	73	27	58	42	54	46	61	39	59	41
Overall		69	31	67	33	62	38	49	51	58	42	61	39

404. In the project area, it was observed that most matters related to personal household activities are resolved through the joint involvement of both men and women. This indicates a collaborative approach in decision-making within households, where both genders have a role to play.

405. However, despite the joint decision-making process, the status of women within the family remains under the dominance of male characters. On average, only 11 responses indicated that women play a significant role in the decision-making process.

406. This suggests that while women are involved in household decision-making to some extent, their participation and influence in important matters may be limited. The dominance of male characters in decision-making reflects traditional gender roles and power dynamics that persist within the project area.

407. Such gender disparities in decision-making can have significant implications for women's empowerment, agency, and their ability to exercise control over their lives. It can perpetuate unequal distribution of resources, reinforce stereotypes, and restrict women's opportunities for personal and professional growth.

Table 85: Role of women in HH decision making process

Decision On	Responsibility			Total
	Man	Woman	Both	
Clothing	7	21	93	121
Education	14	7	100	121
Food	8	42	71	121
Health Care	6	8	107	121

House Repair	53	8	60	121
Household Expenditure	24	15	82	121
House Install	48	12	61	121
Land Selling and Buying	51	9	61	121
Outreach Meetings	43	17	61	121
Selling Products	36	15	70	121
Average	29	15	77	121

Source, NBTL IEE

6.4.9 Land Use

408. Most of NBTL's RoW is situated in the regions of Rupandehi, Kapilvastu, and Dang Districts, accounting for about 30% in each of these districts. Nawalparasi-West encompasses around 7%, while Arghakhanchi only has a small portion, roughly 2% of the total RoW area.

409. The project components foreseen to have an influence on a combined land area of 759.34 ha. Within this span, the NBTL's RoW, encompassing both the NBTL route and its associated tower sites situated within the RoW, constitute 95.47% of the affected land.

Table 86: Land use of the NBTL RoW and tower

	Nawalparasi - West	Rupandehi	Kapilvastu	Arghakhanchi	Dang	Total [ha]	Total [%]
Forest	47.79	206.82	230.72	12.29	210.60	708.22	95.91
Cultivated land	-	0.80	2.15	-	1.78	4.72	0.64
Settlement	-	-	0.22	-	2.36	2.59	0.35
Road	0.17	0.29	3.18	0.07	2.64	6.34	0.86
River	1.34	6.68	5.47	1.68	1.40	16.57	2.24
Total [ha]	49.30	214.58	241.75	14.04	218.78	738.44	100.00
Total [%]	6.68	29.06	32.74	1.90	29.63	100	

Source, NBTL IEE

6.4.10 Electricity Supply

410. In the project areas, there is access to electricity through connections with the national grid. This source of electricity serves the purpose of lighting up homes and powering electronic gadgets. It has been reported that almost all HHs, except for 1 specific HH of Sainamaina RM of Rupandehi has reported having no electricity connected from the national grid. The HH reporting without connection to the national grid might have other alternative sources for lighting like solar.

411. The availability of electricity through the national grid is a significant development in the project areas. It brings numerous benefits to the HHs, including improved living conditions, enhanced safety,

and increased productivity. With electricity, HHs can illuminate their living spaces, making it easier to carry out daily activities, study, and work even after sunset.

412. Moreover, access to electricity enables the use of various electronic gadgets and appliances, such as refrigerators, fans, television, and mobile phones. These devices contribute to a higher quality of life and offer opportunities for entertainment, communication, and convenience.

Table 87: Access to the electricity of PAF

District	Municipality	Ward	Source of Electricity for lighting and electronic gadgets		Total
			National Grid	No Light	
Arghakhanchi	Sitganga	8	3		3
Dang	Gadhwa	1	17		17
	Lamahi	8	13		13
	Rapti	2	4		4
		5	2		2
Kapilvastu	Banganga	7	18		18
	Shivraj	1	8		8
		3	2		2
Rupandehi	Butwal	3	10		10
	Devdaha	6	2		2
	Saina Maina	3	1	1	2
Total			80	1	81

Source, NBTL IEE

413. When it comes to cooking, the majority of HHs – 71% in the project area reported using firewood as their primary energy source. This preference for firewood can be attributed to its easy availability within the vicinity. Many HHs are members of the Community Forests, and have access to forests, where they can gather firewood for cooking purposes.

414. The use of firewood for cooking is a traditional practice that has been prevalent in Nepal for generations. It is often seen as a cost-effective and accessible option, especially in areas where alternative energy sources like gas may be less readily available or more expensive. However, it's important to consider the environmental and health implications of relying heavily on firewood for cooking. It is reported in the Biological Section of this report that extensive use of forest products has contributed to degraded conditions of the forests.

415. On the other hand, approximately 29% of HHs reported using gas as their primary energy source for cooking. It offers several advantages over firewood. It is a cleaner burning fuel that produces fewer indoor air pollutants and contributes less to deforestation. Gas also provides more convenience and control in cooking, as it allows for adjustable heat levels and quicker cooking times.

416. The use of gas for cooking is often associated with higher socio-economic status, as it requires access to gas cylinders, burner, and the necessary infrastructure for distribution and refilling. The availability and affordability of gas can vary depending on the area.

Table 88: Energy source for the cooking purpose (Source: IEE Study Survey)

Districts	Municipalities	Wards	Electricity uses for cooking sources		Total
			Wood	Gas	
Arghakhanchi	Sitganga	8	3		3
Dang	Gadhwa	1	10	7	17
	Lamahi	8	10	3	13
	Rapti	2	2	2	4
		5	2		2
Kapilbastu	Banganga	7	18		18
	Shivraj	1	8		8
		3	2		2
Rupandehi	Butwal	3	1	9	10
	Devdaha	6	1	1	2
	Sainamaina	3		2	2
Total			57	24	81

6.4.11 Waste Management

417. Most of the alignment traverses through the forest area avoiding settlement. The solid waste management practices in the project area primarily rely on simple methods such as burning and burying the waste. A significant number of households in the area practice waste segregation at the source, while the remaining waste is collected and either sent to designated landfill sites or collected periodically.

6.4.12 Social Infrastructure & Utilities

Sanitation

418. When examining the sanitation facilities in the project area, we find that a significant portion of households prioritize clean sanitation practices. The data reveals that 89.47% of households excluding institutional have adopted different types of toilets (commode and pit toilet) as their primary sanitation solution.

419. Out of surveyed HHs 3.51% households reported that they have no toilets and use open for toilets. This indicates that these households do not have built toilets within their premises and practice open defecation in various locations, such as agricultural lands, riverbanks, or forest areas. The national data of 2021 in this regards revels that out of the total households 95.5 percent of the households use one or the other type of toilet facility, while 4.5 percent of them do not have access to any toilet facility while as per the 2011 census had shown that 38.2 percent of the total households did not have access to any toilet facility. It means that that in the project area households are aware of sanitation and gradually improving the toilet users.

420. It is worth highlighting that despite the varying sanitation facilities, found that all were aware of the importance of using toilets for personal hygiene and environmental sanitation. The findings of the survey regarding household level sanitation are presented in Table 89 below.

Table 89: Households having Toilets

Municipality	Households having toilets			Total
	Having toilets	Others	Institution/ Unspecified	
Butwal	3	0	1	4
Devdaha	2	0	0	2
Gadhawa	16	1	0	17
Lamahi	13	0	0	13
Rapti	3	0	3	6
Sainamaina	2	0	0	2
Shivraj	9	1	0	10
Sitganga	3	0	0	3
Total	51	2	4	57
%	89.47	3.51	7.1	100

Source: HHs survey, NBL-TL, 2021.

421. During survey and consultation, it was observed that about half of the population practiced waste disposal through burning, which involved incinerating solid waste. Additionally, it was also observed that local population practiced direct disposal of liquid waste, including cow dung into agricultural lands.

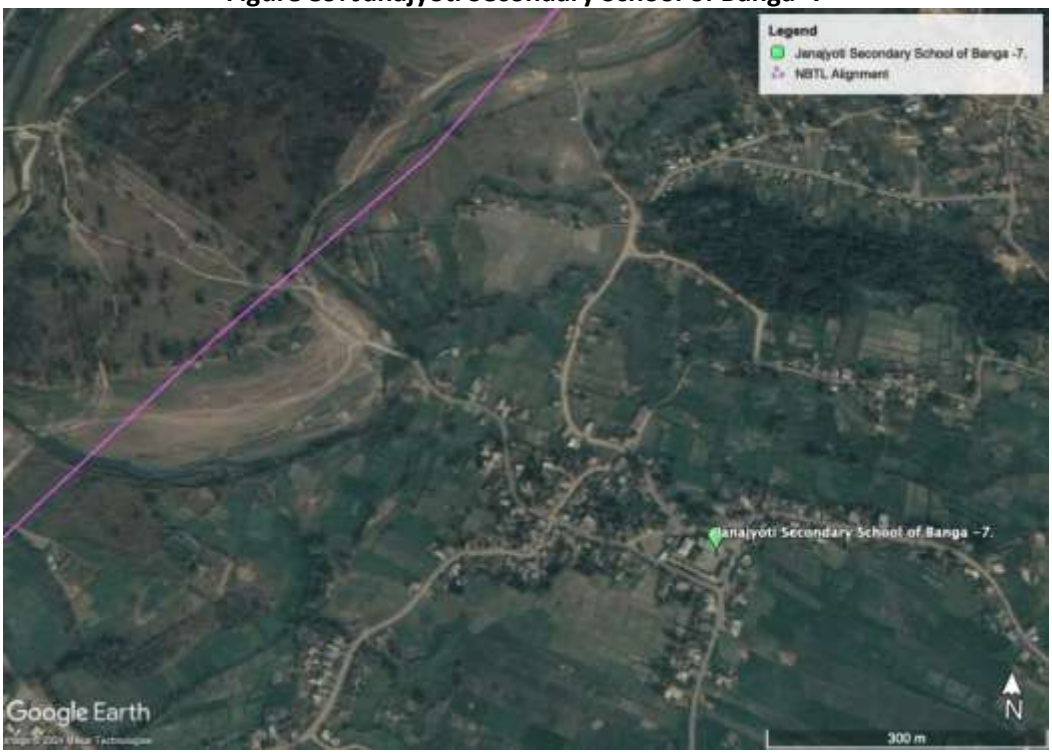
Roads

422. Apart from the main highways in the project municipalities road conditions are generally poor. As noted in the Project Description section, access roads to the alignment and tower sites is patchy and mainly comprise partially paved and mostly unpaved narrow roads winding through small villages to the forested areas where most of the alignment is situated. In the forest areas only unmade tracks are present. Access to the SS is better being situated adjacent to the main highway.

Healthcare & Educational Facilities

423. No healthcare facilities have been identified by the national IEE in close proximity to the NBTL or the SS. One school has been identified by the national IEE and RIPP as being potentially affected by project activities close to Motipur SS – Janajyoti Secondary School of Banga -7, 660m from the alignment.

Figure 89: Janajyoti Secondary School of Banga -7



Source: Google Earth

6.4.13 Cultural Heritage

424. The physical cultural heritage baseline study was performed through a combination of desktop research and infield site visits. The desktop study consisted of a review of publicly available academic journals, books, and online publications about the history, archaeology, anthropology, historic and traditional architecture, and religious practices in Nepal, with a focus on central and southern Nepal.

425. The desktop study included a review of publicly available information on the reported locations of physical cultural resources in Google Earth Pro. During the Google Earth Pro review, a physical cultural resource expert was provided with a .kmz file overlay of the proposed Project centerline, transmission tower locations, and construction right-of-way. The physical cultural resources expert examined a 5 km wide corridor centered on the proposed Project centerline (i.e., extending approximately 2.5 km on either side of the centerline) searching for physical cultural resource uploaded by the public to the Google Earth Pro "places" map layer.

426. The satellite imagery around each uploaded point was examined to confirm the presence or absence of structures or any other evidence of the presence of a physical cultural resource as well as any pictures that may have been uploaded by the individual(s) logging the location. If there was sufficient satellite imagery/photographic evidence to suggest a resource may be present, the location was recorded as a potential physical cultural resource and incorporated into the baseline and impact assessment. While the locational accuracy of publicly recorded physical cultural resources could not always be independently confirmed through the satellite imagery review, most potential locations were recorded as potential physical cultural resources out of an abundance of caution.

427. As part of the physical cultural resources baseline study, a sample of ten (10) of the potential physical cultural resources identified during the desktop study were visited by a physical cultural resources expert. During the site visit to each potential resource, the expert confirmed the location of the resource and recorded the site features using narrative notes and digital photographs. If possible, the expert engaged stakeholders caring for or using the site to collect information including, but not limited to, the site name; religious or cultural affiliation; primary use; types of activities conducted at the site; number of daily, weekly, monthly, and yearly visitors; types of stakeholders that use/visit the site (local, regional, national, international, etc.); presence of permanent occupants; and whether the culturally significant component of the site is considered movable or immovable cultural heritage by stakeholders.

428. The Google Earth Pro review identified sixty-five (65) previously recorded and/or potential physical cultural heritage resources within 2.5 km of the proposed Project centerline (Figure 90 to Figure 99 and Table 90). The identified resources included four (4) previously recorded archaeological sites, two (2) potential-built heritage resources, and fifty-nine (59) previously recorded and potential built/living heritage resources.

Table 90: Physical Cultural Resources Identified During the Baseline Study

Site #	Category	Site Type	Site Description	Cultural Affiliation	Distance to RoW (m)
1	Built/Living Heritage	Temple	Cow Refuge (श्री बगार बाबा गोरक्ष गौ: धाम)	Hindu	20
2	Built/Living Heritage	Shrine	Shrine	Hindu	83
3	Built/Living Heritage	Temple	Didik Ghar	Hindu	283
4	Built/Living Heritage	Temple	Durga Temple	Hindu	256
5	Built/Living Heritage	Temple	Pashupati Mandir	Hindu	97
6	Built/Living Heritage	Pond	Khauraha Baba Taal - Swimming Lake	Hindu	360
7	Built/Living Heritage	Park	Harshedadha Park (Temple and Pond)	Hindu	12
8	Built/Living Heritage	Temple	Siddheshwar Temple (सिद्धेश्वर मन्दिर)	Hindu	205
9	Built/Living Heritage	Temple	Supa Deurali Temple 2	Hindu	264
10	Built/Living Heritage	Church	Galgatha Church (Jurauni)	Christian	168
11	Built/Living Heritage	Temple	Shiva Mandir Guffa Dhankhola	Hindu	0
12	Built/Living Heritage	Temple	Dhankhola Temple	Hindu	100
13	Built/Living Heritage	Temple	Devi Mandir (Lower Basti) (देवी मन्दिर (तल्लो बस्ती))	Hindu	1,670
14	Built/Living Heritage	Temple	Durga Mandir Gabdahawa	Hindu	1,041

Site #	Category	Site Type	Site Description	Cultural Affiliation	Distance to RoW (m)
15	Built/Living Heritage	Temple	Durga Temple Dubiya -03 (दुर्गा मन्दिर दुबिया -०३)	Hindu	400
16	Built/Living Heritage	Temple	Supa Deurali Temple Taku	Hindu	1,195
17	Built/Living Heritage	Temple	Ram Laxman Temple	Hindu	1,996
18	Built/Living Heritage	Temple	Shiva Temple	Hindu	390
19	Built/Living Heritage	Temple	Changathinia Devi Temple	Hindu	895
20	Built/Living Heritage	Temple	Badilwa Samya Mata Mandir	Hindu	1,400
21	Built/Living Heritage	Temple	Changhatchanghat Mata Temple, Tikkar (चङ्घाट माता मन्दिर, टिक्कर)	Hindu	1,594
22	Built/Living Heritage	Temple	Sani dev Mandir	Hindu	1,293
23	Built/Living Heritage	Historic Site	Ramdatiwan Historic Site	Unknown	1,640
24	Built/Living Heritage	Temple	Kapildham Temple (कपिलधाम)	Hindu	300
25	Built/Living Heritage	Church	Beriya Bible Church, Chaubah	Christian	1,330
26	Built/Living Heritage	Temple	Supadeurali Temple Motipur Kapilbastu Nepal (सुपादेउरालि मन्दिर मोतिपुर कपिलबस्तु नेपाल)	Hindu	770
27	Built/Living Heritage	Temple	Om Supa Deurali Temple Mormi (ॐ सुपा देउराली मन्दिर मोर्मी)	Hindu	45
28	Built/Living Heritage	Temple	Mushi Cave - Hindu temple	Hindu	450
29	Built/Living Heritage	Temple	Madhuvan dham	Hindu	450
30	Built/Living Heritage	Meditation Centre	Dhamma nandan - Meditation center	Unknown	335
31	Built/Living Heritage	Temple	Roka Shiv Mandir	Hindu	1,078
32	Built/Living Heritage	Multi-component	Sahitya Tirtha	Buddhist	0
33	Built/Living Heritage	Temple	Shiva Mandir	Hindu	1,258
34	Built/Living Heritage	Temple	Darkashi	Hindu	1,440
35	Built/Living Heritage	Temple	Bhairava Temple (भैरव मन्दिर)	Hindu	35
36	Archaeological	Archaeological Site	Sainamaina Archaeological Site	--	25

Site #	Category	Site Type	Site Description	Cultural Affiliation	Distance to RoW (m)
37	Built/Living Heritage	Monastery	Buddha Gumba	Buddhist	580
38	Built/Living Heritage	Temple	Bhairava Temple (भैरब मन्दिर)	Hindu	100
39	Archaeological	Archaeological Site	Manimukunda Sen Park/ Phulbari Archaeological site	--	0
40	Built/Living Heritage	Temple	Pari Butwal	Hindu	250
41	Built Heritage	Historic Site	Lathe Gadi - Historical landmark	--	1,692
42	Built Heritage	Park	Ramapithekash Park (रामापिथेकश पार्क)	--	40
43	Built/Living Heritage	Temple	Shree Siddhababa Dham, Butwal	Hindu	170
44	Built/Living Heritage	Church	Butwal Jyoti Church	Christian	148
45	Built/Living Heritage	Temple	Durga Mandir	Hindu	0
46	Built/Living Heritage	Temple	Basanta Dada Dewata Khani Mandir	Hindu	224
47	Built/Living Heritage	Monastary	Buddha Mandir	Buddhist	103
48	Built/Living Heritage	Temple	Jeetutemple	Hindu	150
49	Built/Living Heritage	Temple	Sri Shiva Paschimaanchal Swargadwari Temple (श्री शिव पस्चिमाअन्चल स्वर्गद्वारी मन्दिर)	Hindu	780
50	Built/Living Heritage	Temple	Baje Bajai Mandir	Hindu	575
51	Built/Living Heritage	Shrine	Buddha Park (बुद्ध पार्क)	Buddhist	290
52	Built/Living Heritage	Temple	Durga Temple	Hindu	76
53	Built/Living Heritage	Temple	Baraily Kul Temple	Hindu	83
54	Built/Living Heritage	Temple	Karawakeli Temple (करवाकेली मन्दिर)	Hindu	186
55	Built/Living Heritage	Pond	Devdaha Kund (देवदह कुण्ड)	Buddhist	75
56	Built/Living Heritage	Park	Gautam Buddha Park	Buddhist	0
57	Built/Living Heritage	Temple	Pangeni Kul Mandir	Hindu	450
58	Built/Living Heritage	Church	New Life Gospel Church	Christian	544
59	Built/Living Heritage	Pond	108 Pipal Tree	Buddhist	125

Site #	Category	Site Type	Site Description	Cultural Affiliation	Distance to RoW (m)
60	Built/Living Heritage	Temple	Baba Bardgoria Temple	Hindu	866
61	Built/Living Heritage	Temple	Khanal Kshetri Kula Deity Temple (खनाल क्षेत्री कुल देवता मन्दिर)	Hindu	2,091
62	Archaeological	Fortress	Jitgadi Fort National Heritage Site	--	725
63	Built/Living Heritage	Temple	Devi Temple	Hindu	1,627
64	Built/Living Heritage	Park	Naryanpur mandir (Temple and Pond)	Hindu	5
65	Built/Living Heritage	Park	Jakhera Tal - जखेरा ताल (Temple and Pond)	Hindu	320

429. The fifty-seven (57) potential built/living heritage resources consist of structures and/or features that appear to be actively used religious sites that could be culturally significant due to the historic, aesthetic, and/or architectural characteristics of the structure (i.e. built heritage) and/or culturally significant due to their religious value to stakeholders.

430. In addition to the sixty-three (63) previously recorded or potential physical cultural resources identified during the Google Earth Pro review, the desktop study indicates there is the potential for previously undiscovered archaeological, paleontological, and living heritage resources within the proposed Project right-of-way and additional built/living heritage resources within 2.5 km of the Project centerline.

431. The following sections provide summary information on the previously recorded and potential physical cultural resources identified during the baseline study as well as an assessment of the potential for additional undiscovered resources.

Figure 90: Physical Cultural Resources Baseline Study Results, Detailed Map 1 of 10

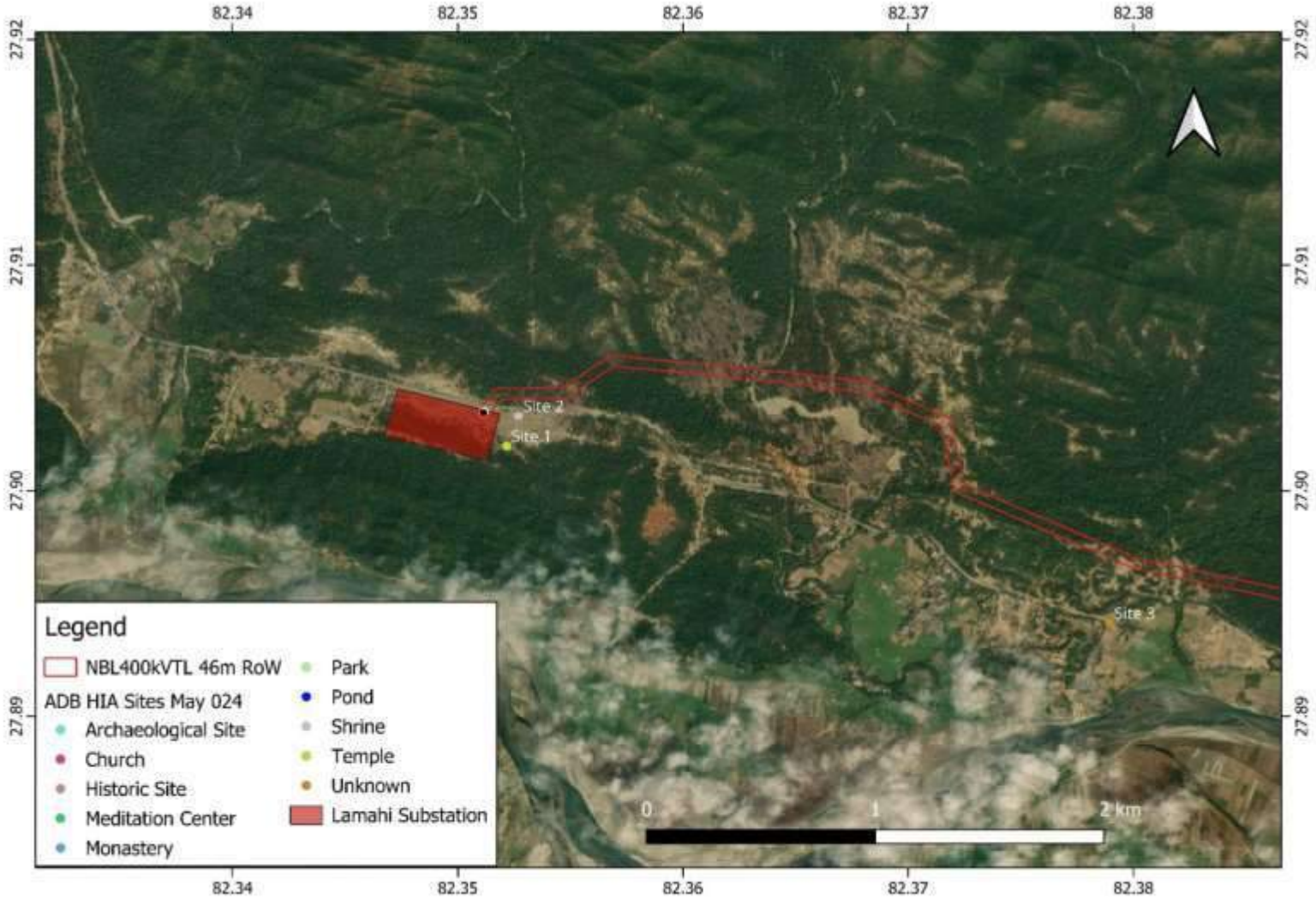


Figure 91: Physical Cultural Resources Baseline Study Results, Detailed Map 2 of 10

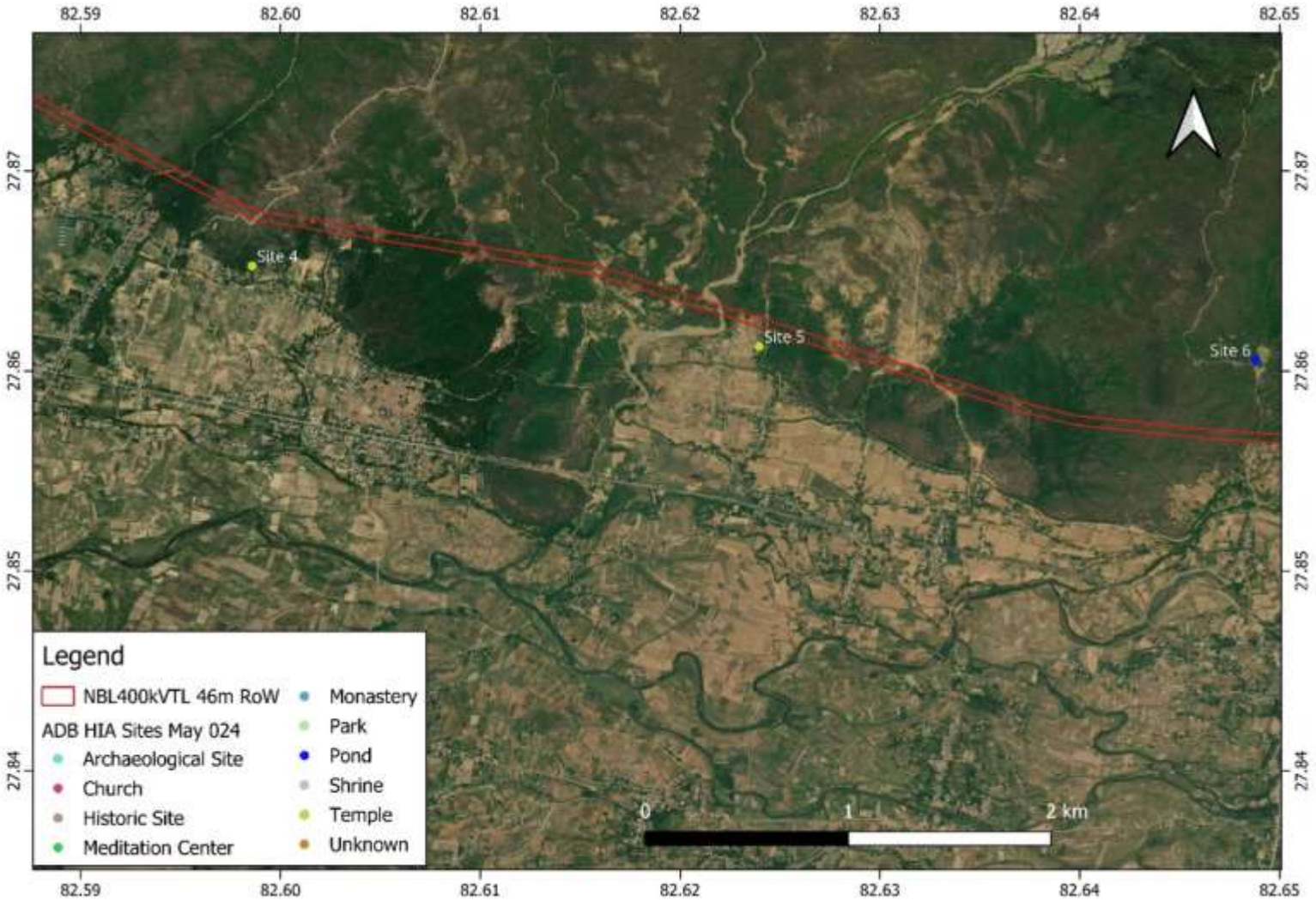


Figure 92: Physical Cultural Resources Baseline Study Results, Detailed Map 3 of 11

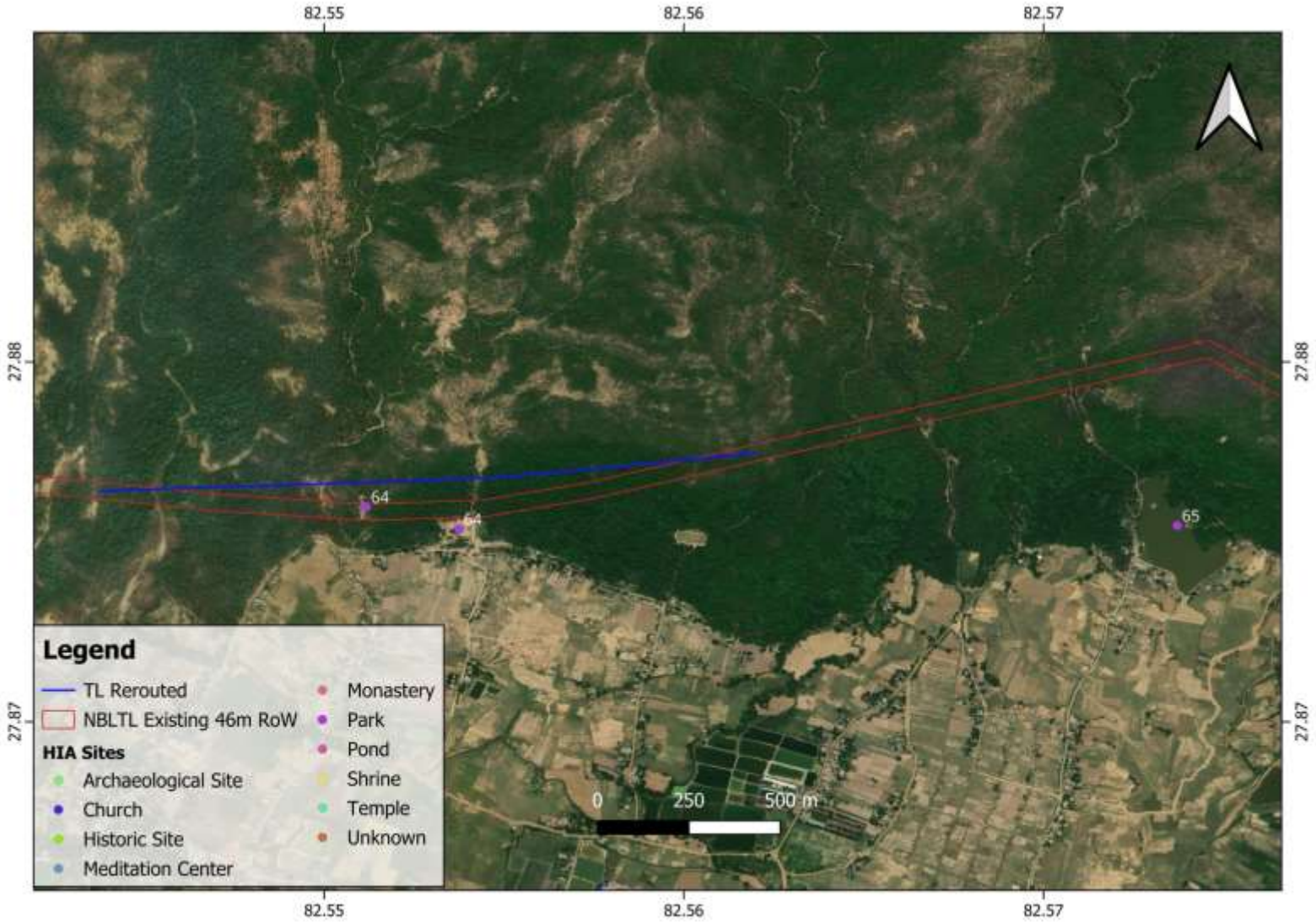


Figure 93: Physical Cultural Resources Baseline Study Results, Detailed Map 4 of 11

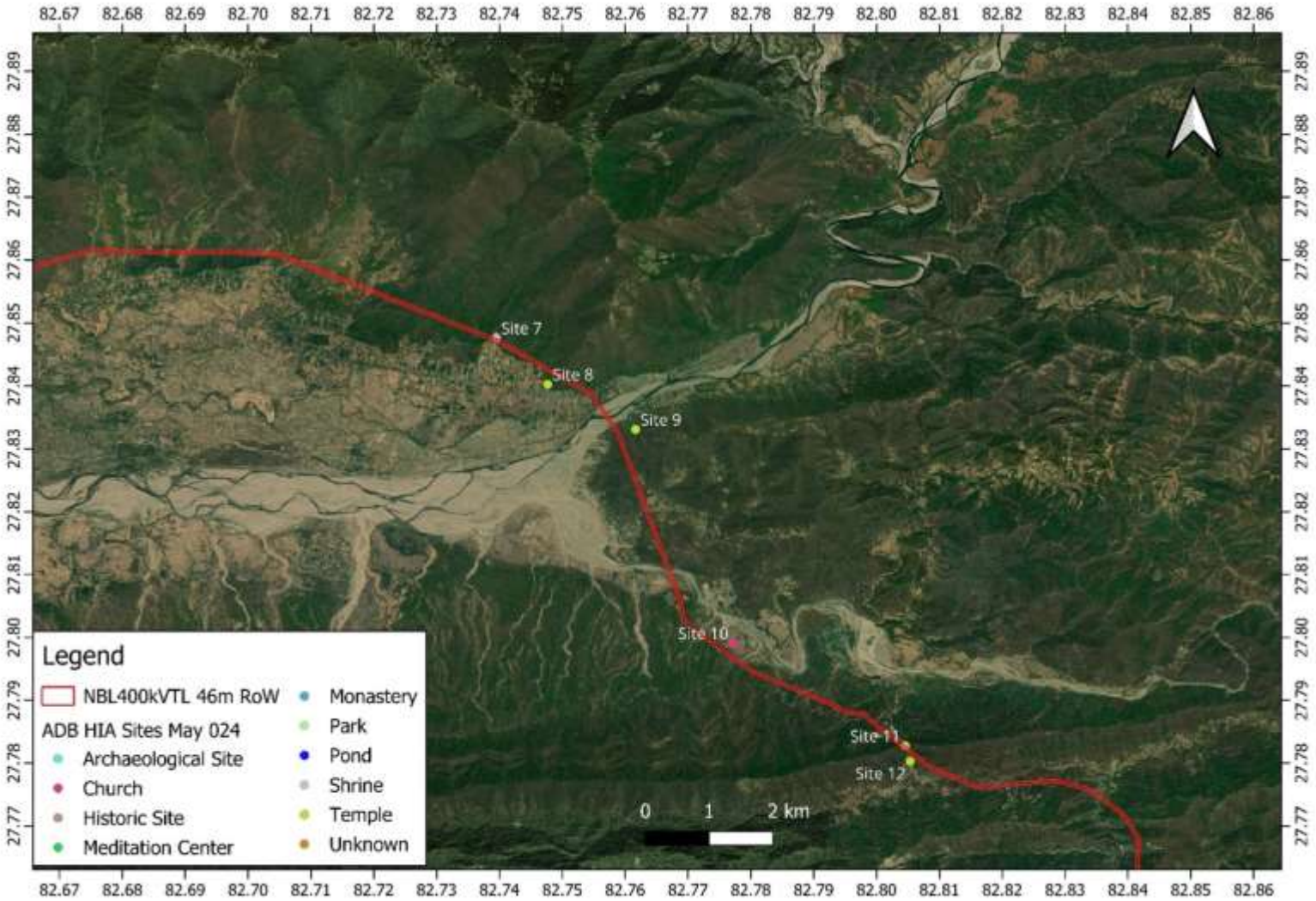


Figure 94: Physical Cultural Resources Baseline Study Results, Detailed Map 5 of 11

Figure 95: Physical Cultural Resources Baseline Study Results, Detailed Map 6 of 11

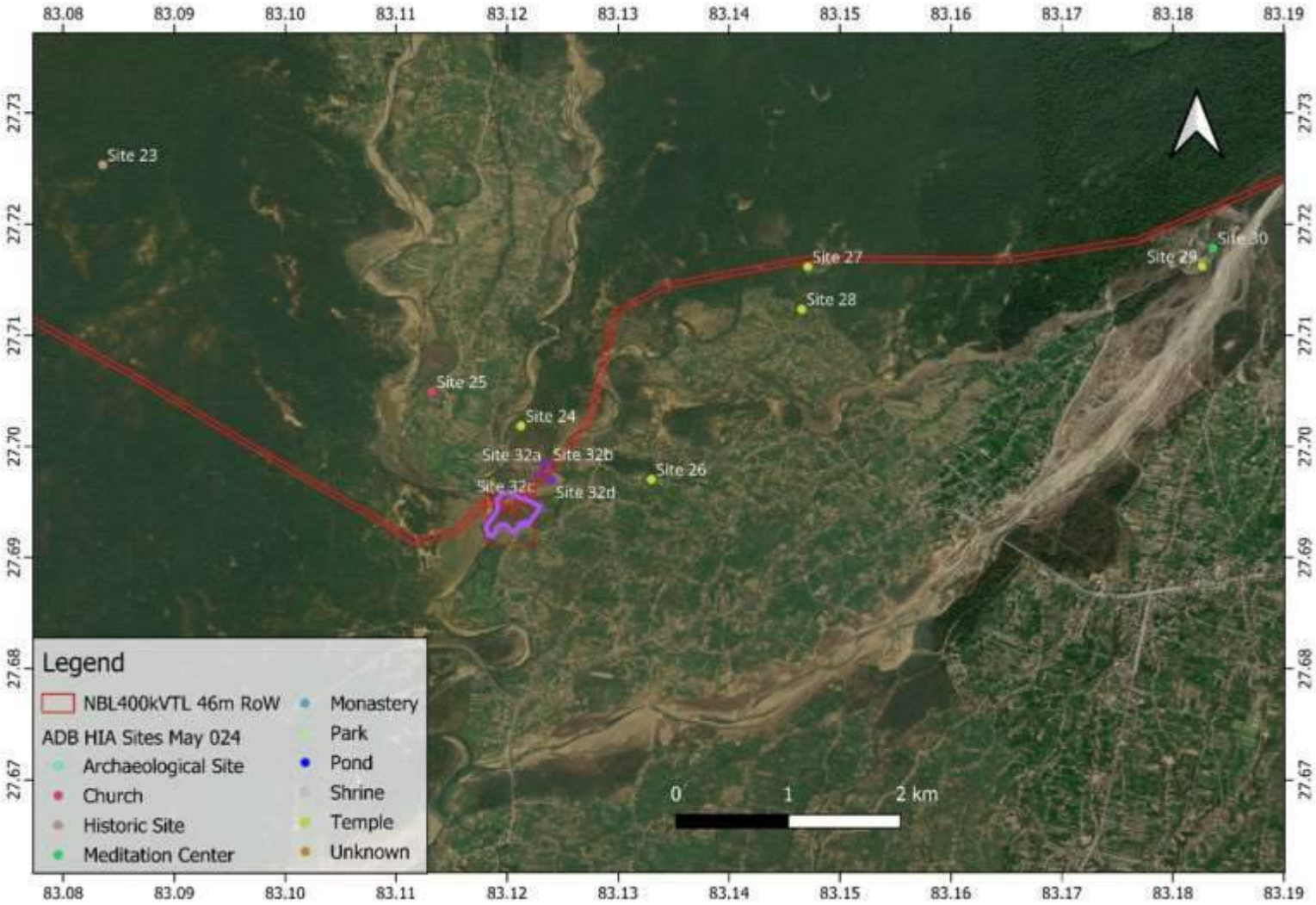


Figure 96: Physical Cultural Resources Baseline Study Results, Detailed Map 7 of 11

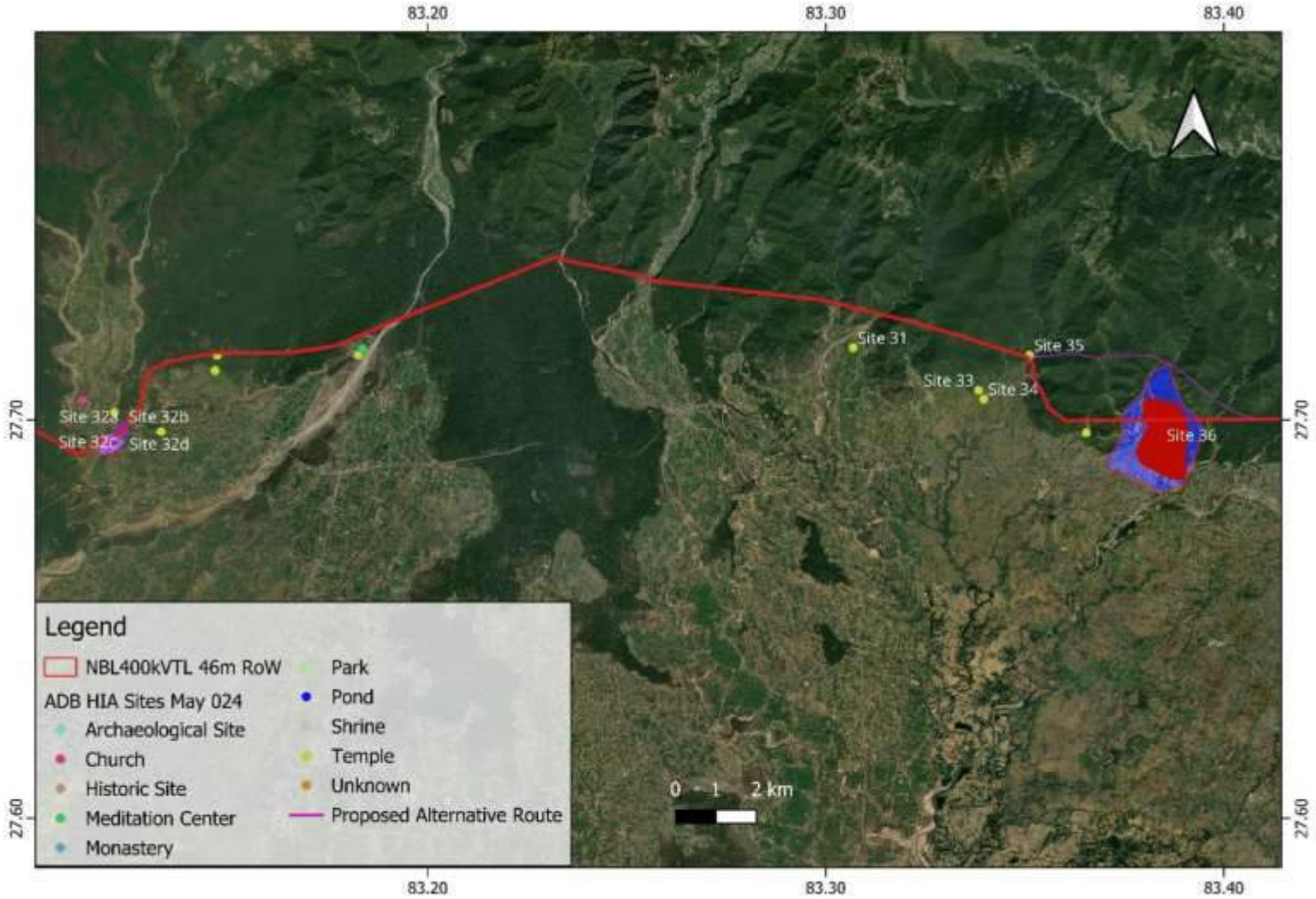


Figure 97: Physical Cultural Resources Baseline Study Results, Detailed Map 8 of 11

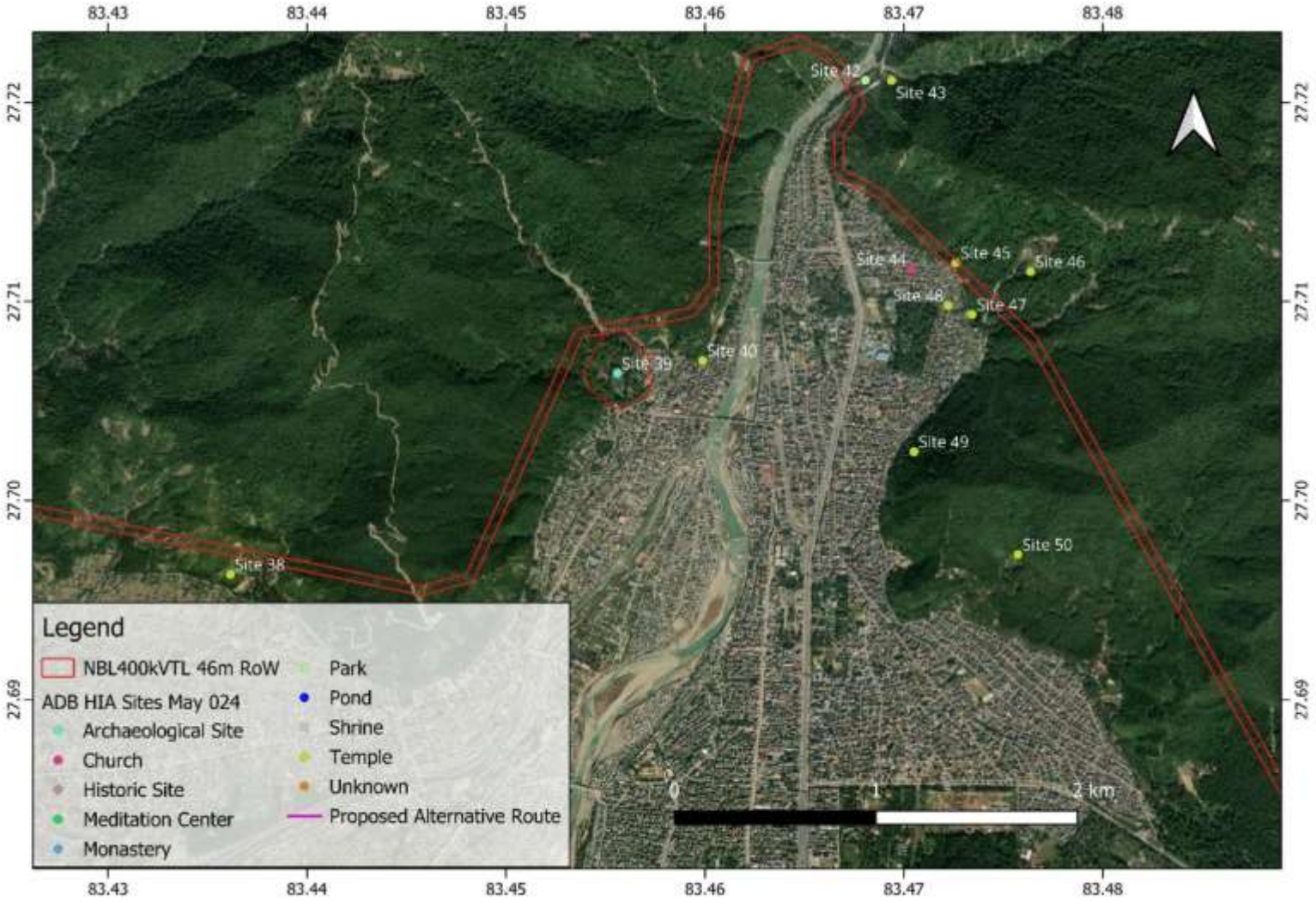


Figure 98: Physical Cultural Resources Baseline Study Results, Detailed Map 9 of 11

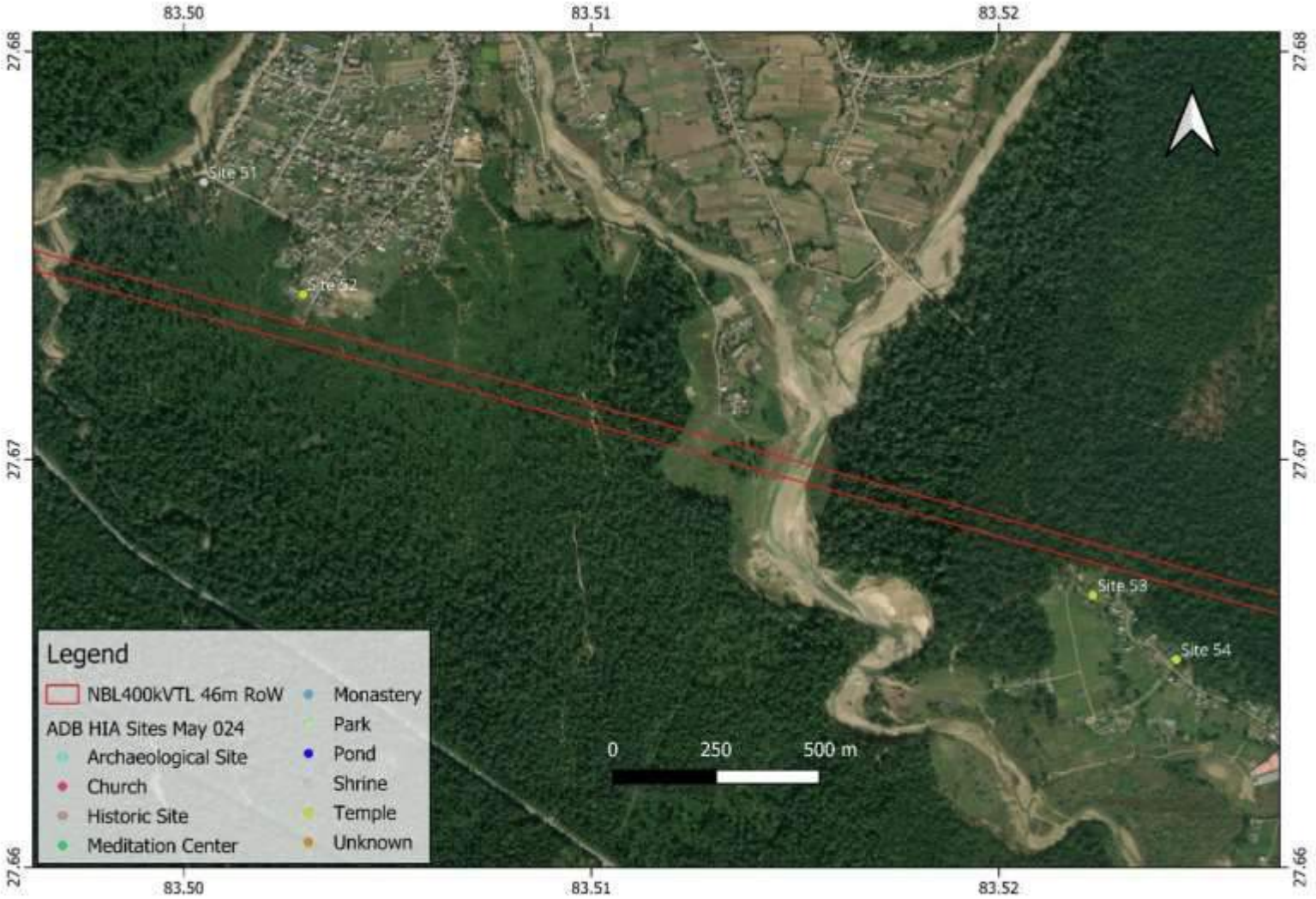


Figure 99: Physical Cultural Resources Baseline Study Results, Detailed Map 10 of 11

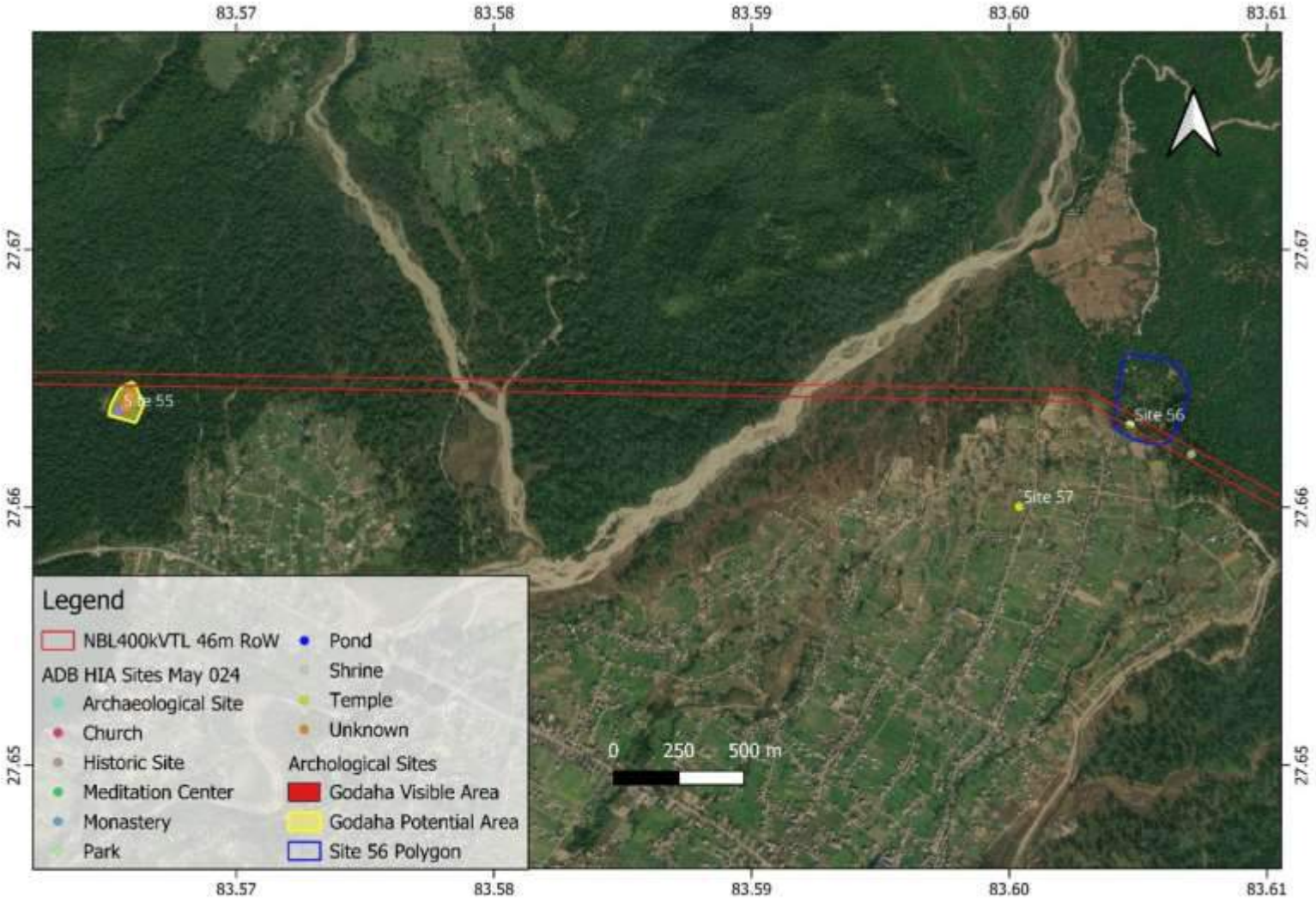
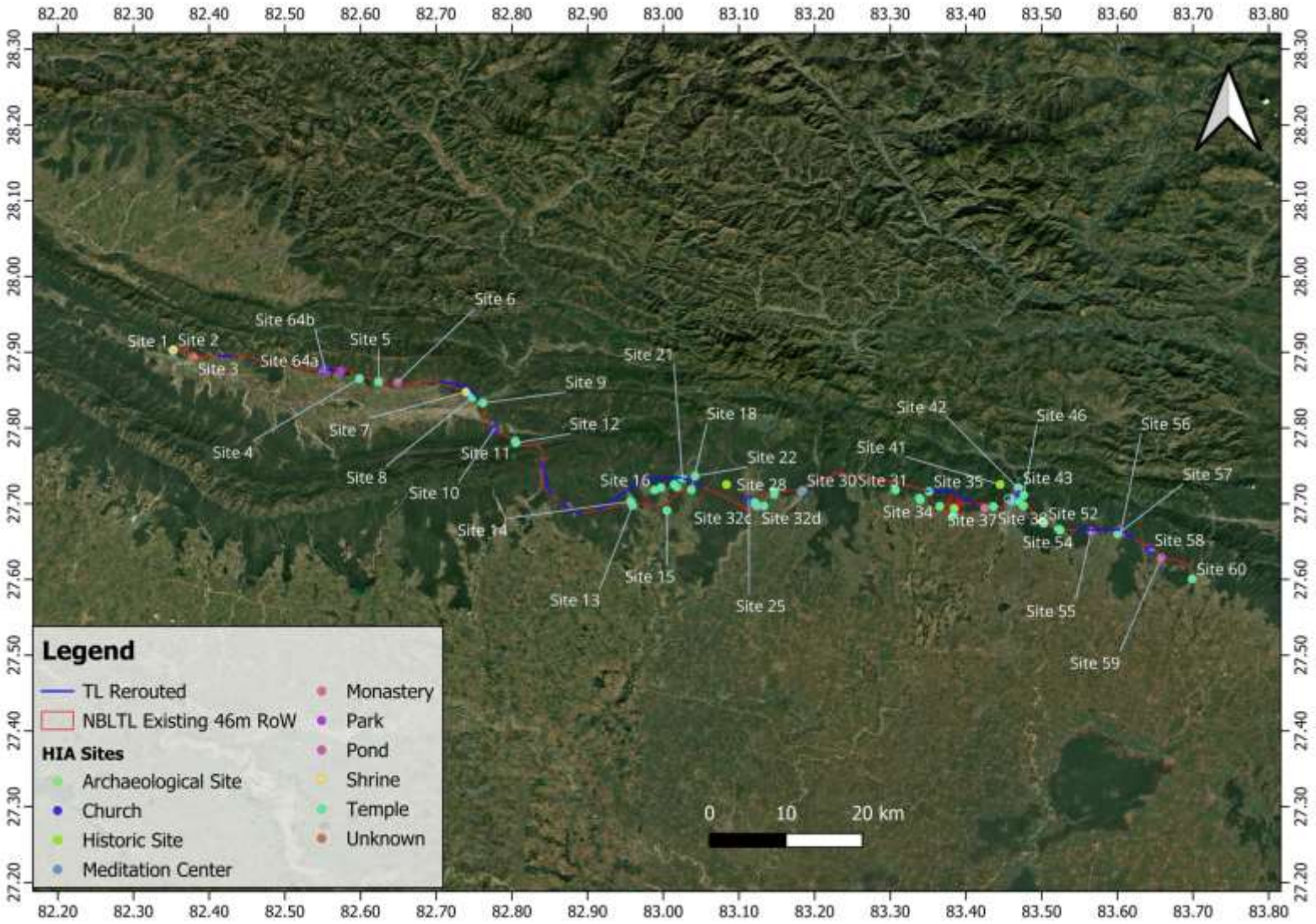


Figure 100: Physical Cultural Resources Baseline Study Results, Detailed Map 11 of 11



Archaeological and Paleontological Resources

432. The archaeological and paleontological record in southern and central Nepal extends back millions of years. In 1932, paleoanthropologist G. Edward Lewis discovered the fossil remains of an extinct species of ape on the banks of the Tinaau River in Palpa District, Nepal. Lewis originally named the discovery *Ramapithecus*, but later research determined that Lewis' discovery was an example of *Sivapithecus* which had been discovered in the Sivalik Hills of India. *Sivapithecus* would have been roughly 1.5 m tall, similar in size to an orangutan and lived during the Miocene Period approximately 10-12.2 million years ago (Klein 2009).

433. The discovery of the *Ramapithecus/Sivapithecus* remains in the Tinaau River valley is a significant and important scientific discovery, but it appears to be an important historical event within the local communities in the vicinity of the proposed Project. The proposed Project will cross the Tinaau River north of the city of Butwal. A small park commemorating the discovery of *Ramapithecus* in the Tinaau River valley called "Ramapithecus Park " (Site 42) is located approximately 40 m north of the proposed Project centerline. The park consists of a long, narrow terrace of manicured lawn, paved walking paths, trees, and a statue of *Ramapithecus.*

Figure 101: Statue of Ramapithecus in Ramapithecus Park (Site 42), Papal District, Nepal

Source: Google Earth

434. The primary data set used to identify previously recorded archaeological resources and to assess the potential for undiscovered resources was the results of the Greater Lumbini Area (GLA) archaeological survey (LDT 2019). The GLA was defined as part of a research program to better understand the archaeological and historical context the United Nations Educational, Scientific, and Cultural Organization (UNESCO) World Heritage Site of Lumbini. The GLA, which is also referred to as the Natal Landscape of the Historic Buddha, is located in Province 5 in the western Terai area of Nepal. The GLA covers an area measuring approximately 80 x 25 km and incorporates the historic Sakya Republic of Gautama Siddhartha's father to the Koliya Kingdom of Gautam Siddhartha's mother (LDT

2019; Weise 2012). The northern boundary of the GLA runs along the Mahendra Highway (H01) which is located to the south of the proposed Project, running roughly parallel to the Project centerline at a distance of 0.3 to 3.0 km depending on location.

435. The Lumbini site, located approximately 28 km south of the proposed Project and outside the anticipated Project viewshed, is the birthplace of Siddhartha Gautama, the Lord Buddh, in 623 B.C. The Lumbini UNESCO World Heritage Site consists of multiple extant structures and archaeological ruins including the Shakya Tank; the remains within the Maya Devi Temple consisting of brick structures in a cross-wall system dating from the 3rd century BC to the present century; the sandstone Ashoka pillar with its Pali inscription in Brahmi script; the excavated remains of Buddhist viharas (monasteries) from the 3rd century BC to the 5th century AD; and the remains of Buddhist stupas (memorial shrines) from the 3rd century BC to the 15th century AD (UNESCO 2024a).

436. The GLA includes two additional archaeological sites that have been nominated to the UNESCO World Heritage tentative list by the government of Nepal: Tilaurakot and Ramagrama. Tilaurakot, is located 3 km north of Taulihaw and approximately 15 km south of the proposed Project centerline. The site consists of a fortified 'citadel' covering and area 500 m x 400 m, surrounded by a series of associated monuments including a monumental gateway, the twin stupa of the Buddha's parents, King Suddhodana's palace, earthen ramparts, brick fortifications, water tanks, residential suburbs, and one of the region's largest monasteries, among other finds from the period 900 BCE to 400 CE (UNESCO 2024b). The site is interpreted as the remains of the capital city of the ancient Shakya kingdom where Siddhartha Gautama lived until he was 29 years old. Archaeological investigations at the site have documented archaeological deposits dated from 8th century BCE to the 10th century CE (Coningham 2018; Davis et al. 2016; Weiss 2012). The site also hosts the annual Tilaurakot–Kapilavastu Heritage Festival which celebrates the region's tangible and intangible heritage (UNESCO 2024c).

437. Ramgram stupa is in Nawalparasi district approximately 12.5 km south of the eastern end of the proposed Project. The stupa was built in the 6th or 5th century BCE to house relics of Gautama Buddha after his Mahaparinirvana and is an active pilgrimage site for Buddhists. The Ramgram stupa is the only stupa of the original eight stupas built to contain relics of the Gautama Buddha that has not been opened and is believed to still contain its original relic. The other seven original stupas were opened in the 3rd century BCE by Emperor Asoka with the goal of distributing the relics amongst the eighty-four thousand stupas the emperor planned to build during his reign (Weiss 2012).

438. In addition to these large complex sites, archaeological surveys conducted across the GLA have identified 235 archaeological sites within the 80 x 25 km survey area. The archaeological sites include small surface scatters of artifacts (i.e., potsherds, brickbats, chipped stone, metal objects, brick, etc.); small to large mound sites and associated artifact scatters; historic structures; and associated artifact scatters around active Hindu temples (University of Tokyo 2017).

439. Four archaeological sites identified during surveys in the GLA are located within 2.5 km of the proposed Project centerline: Sainamaina, Manimukunda Sen Park, Jit Gadhi Fort, and the Devdaha sites (Table 91).

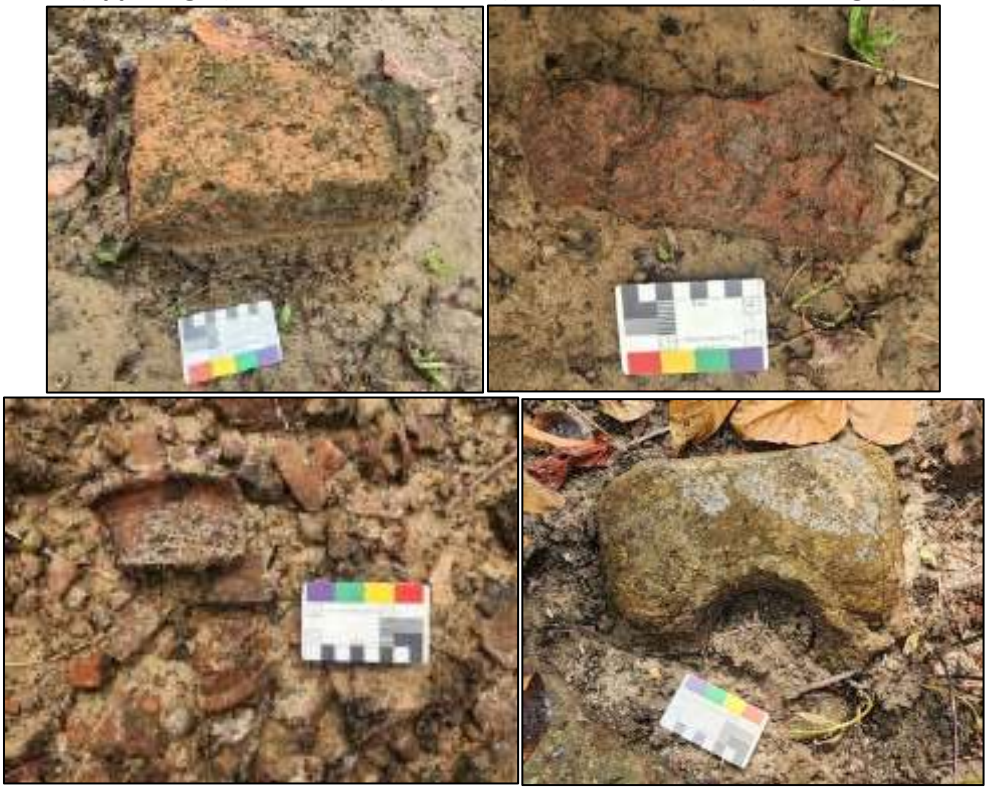
Table 91: Archaeological Sites Identified within 2.5 km of the Proposed Project

Site #	Site Description	Cultural Affiliation	Distance to RoW (m)
36	Sainamaina Archaeological Site	--	25

39	Manimukunda Sen Park/ Phulbari Archaeological site	--	0
62	Jit Gadhi Fort National Heritage Landmark	--	725
55	Devdaha Kund (देवदह कुण्ड)	Buddhist	75

440. Sainamaina (Site 36) is a large archaeological site located approximately 12 km west of Butwal, on the north side of the Mahendra Highway in Ranbagiya, Nepal. The mapped boundaries of the site cover approximately 215 hectares of agricultural land and forested hill slope. The GLA survey mapped an additional area of archaeological potential around the core area, extending from the Mahendra Highway in the south and up the slopes of the surrounding hillsides to the north and east (Giri 2024; University of Tokyo 2017). The site is called Sāmagāma and Mainapur town in historic Buddhist texts and is believed to be the site of Kapilavastu of Śākyas. The core of the Sainamaina site contains the remains of multiple structures including four ancient ring-wells built of stone and bricks and the ruins of a Sikhara style temple. The site is covered by an artifact scatter including potsherds, cut stone, and brick (Figure 102). Artifacts previously recovered from the site include a stone image of Buddha, an inscribed stone pillar, stone cartwheels, stone images of a goddess, pendant bell–shaped kalāśa, coins, stone and metal instruments, and terracotta human and animal figurines (Giri 2024).

Figure 102: Surface Artifacts Identified During Site Visit to Sainamaina: Cut Stone (upper left); Brick (upper right); Potsherds (lower left); and Carved Stone (lower right).



Source: EIA Team – May 2024

441. The original alignment of the proposed project passed through the northern edge of this large, complex, and multi-component archaeological site. A subsequent reroute moved the proposed Project centerline to the north of the site, passing roughly 20 m north of the area of archaeological potential around the site core.

442. Mani Mukunda Sen Park site (Site 39) in Butwal consists of the remains of the winter Palace of Mani Mukunda Sen who ruled during 15-16th century CE. The site is currently a mix of archaeological ruins and modern park infrastructure. The archaeological ruins include a free-standing northern wall and other parts of a ruined palace within a brick enclosure (Figure 103; Williams 2016). More modern elements of the site include paved walkways, manicured lawns, tree plantings, and a modern statue of Mani Mukunda Sen (Figure 104). The proposed Project right-of-way runs along the northern mapped boundary of the Mani Mukunda Sen archaeological site with the right-of-way abutting the site boundary established by the GLA survey.

Figure 103: Free Standing Wall Ruin in Mani Mukunda Sen Archaeological Site

Source: EIA Team – May 2024

Figure 104: Modern Statue of Mani Mukunda Sen in the Mani Mukunda Sen Park

Source: Google Earth

443. Jit Gadhi Fort (Site 62) is located approximately 725 m southeast of the proposed Project right-of-way (Figure 105). Documentary evidence suggests the presence of a fort at the site as early as the 9th century CE. The fortress was the site of a historically significant battle during the Anglo-Nepalese War (1814-1816). During the Battle of Jitgadhi in 1814, the Nepalese Colonel Ujir Singh Thapa defeated an East India Company force under the command of John Sullivan Wood (CT 2020). The Battle of Jitgadhi remains an important historical event locally and nationally. In April 2019, the Butwal Sub-metropolitan City in Rupandehi district organized a celebration at the Jit Gadhi Fort site to commemorate the Battle of Jitgadhi. The event was attended by Prime Minister KP Sharma Oli, Deputy Prime Minister and Defense Minister Ishwor Pokhrel, Chief Minister of Province 5 Shankar Pokhrel. During the event Prime Minister Oli raised a Nepali flag over the site and unveiled a statute of Colonel Ujir Singh. The local newspaper quoted Prime Minister Oli as saying "Jitgadhi is a symbol of nationality and our identity. It is the best example of our ancestors' bravery and contribution to the nation. Jitgadhi should be preserved and developed to make it popular all over the world (Anmol 2019)."

Figure 105: Jit Gadhi Fort

Source: Google Earth

444. Devdaha site (Site 55) was identified during the GLA archaeological survey and consists of a large pond covering approximately 1.2 hectares. The GLA inventory refers to an archaeological site around the pond as "Ghodaha Daha", while the pond is referred to as the "Dewdaha" or "Devdaha" which translates to "God Pond" (Figure 106). During the GLA survey, local informants stated that the pond and the stream that feeds it have been present since "ancient times". During the site visit conducted during the physical cultural resources baseline study, a local goatherd told the physical cultural resources expert that members of the local community use the pond to carry out rituals and ritual bathes. The pond has recently been enlarged by the construction of a dam along its southwest edge and a picnic pavilion has been built to the northeast of the pond. The current Project right-of-way passes through the northern edge of the site, with the south edge of the right-of-way passing within 5 m of the northern edge of the pond.

Figure 106: Devdaha Pond at Site

Source: EIA Team – May 2024

445. Three of the four previously recorded archaeological sites within 2.5 km of the proposed Project are considered locally, regionally, and nationally significant physical cultural resources. The Sainamaina and Mani Mukunda Sen Park sites are large, complex, multi-component archaeological sites which likely contain scientific information significant to the national and international scientific community with the potential to provide valuable information about the history of Nepal and early Buddhism. The Jit Gadhi Fort is an archaeological and built heritage site of national importance as the site of the Battle of Jitgadhi, a historical event that contributes to Nepalese national identity.

446. The Devdaha Pond site is considered a site of local cultural significance. The limited evidence available suggests it is locally associated with the life of Gautama Buddha and that local stakeholders use it for ritual bathing. The site does not, however, appear to be well known or used by stakeholders outside the local community.

447. The results of the physical cultural resources baseline study suggest there is high probability that additional, undiscovered archaeological and paleontological resources are present within the proposed Project right-of-way. The GLA archaeological surveys have identified 250 archaeological sites across the GLA survey area, documenting over 2,500 years of human occupation in the region. While the GLA surveys were focused on the relatively flat, lowing lying, agriculturally productive landscape to the south which was likely more densely populated than hill country where the proposed Project has been sited, the presence of the Sainamaina and Mani Mukunda Sen Park sites demonstrate the potential for large, complex sites within or adjacent to the proposed Project right-of-way. In addition to large complex sites, the right-of-way is likely to contain additional smaller sites that supported these large centers such as homesteads, villages, and camps. The presence of numerous, modern religious shrines in the hills surrounding the proposed Project right-of-way (see sections below) suggests there is the potential for encountering the archaeological remains of previous shrines, temples, monasteries, etc. within the Project right-of-way.

Built/Living Heritage Resources

448. The physical cultural resources baseline identified fifty-seven (57) resources considered to be both built and living heritage resources. Most of these resources are religious structures associated with local Hindu (44), Buddhist (6), and Christian (4) communities. The religious or cultural affiliation

of the remaining three (3) built/living heritage resources could not be determined. The following sections provide summary information on the types of religious built/living heritage resources identified during the baseline study as well as an assessment of the types of religious/cultural practices typically associated with these types of resources.

449. ***Hindu Religious Structures*** - The forty-seven (47) possible Hindu religious structures identified during the physical cultural resources baseline study were described as temples (42), one (1) shrine, three (3) parks and one pond (1) by the individuals who recorded their locations in Google Earth Pro (Table 92).

Table 92: Possible Hindu Built/Living Heritage Sites Identified within 2.5 km of the Proposed Project

Site #	Site Type	Site Description	Cultural Affiliation	Distance to RoW (m)
1	Temple	श्री बगार बाबा गोरक्ष गौ: धाम (Cow Refuge)	Hindu	20
2	Shrine	Shrine	Hindu	83
3	Temple	Didik ghar place of worship	Hindu	283
4	Temple	Durga Temple	Hindu	256
5	Temple	Pashupati Mandir	Hindu	97
6	Pond	Khauraha Baba Taal - Swimming Lake	Hindu	360
7	Park	Harshedadha Park (Temple and Pond)	Hindu	12
8	Temple	Siddheshwar Temple (सिद्धेश्वर मन्दिर)	Hindu	205
9	Temple	Supa Deurali Temple 2	Hindu	264
11	Temple	Shiva Mandir Guffa Dhankhola	Hindu	0
12	Temple	Dhankhola Temple	Hindu	100
13	Temple	Devi Mandir (Lower Basti) (देवी मन्दिर (तल्लो बस्ती))	Hindu	1,670
14	Temple	Durga Mandir Gabdahawa	Hindu	1,041
15	Temple	Durga Temple Dubiya (दुर्गा मन्दिर दुबिया)	Hindu	400
16	Temple	Supa Deurali Temple Taku	Hindu	1,195
17	Temple	Ram Laxman Temple	Hindu	1,996
18	Temple	Shiva Temple	Hindu	390
19	Temple	Changathinia Devi Temple	Hindu	895
20	Temple	Badilwa Samya Mata Mandir	Hindu	1,400
21	Temple	Changhatchanghat Mata Temple, Tikkar (चङ्घाट माता मन्दिर, टिक्कर)	Hindu	1,594
22	Temple	Sani dev Mandir	Hindu	1,293
24	Temple	Kapildham Temple (कपिलधाम)	Hindu	300
26	Temple	Supadeurali Temple Motipur Kapilbastu Nepal (सुपादेउरालि मन्दिर मोतिपुर कपिलबस्तु नेपाल)	Hindu	770
27	Temple	Om Supa Deurali Temple Mormi (ॐ सुपा देउराली मन्दिर मोर्मी)	Hindu	45
28	Temple	Mushi Cave	Hindu	450
29	Temple	Madhuvan dham	Hindu	450
31	Temple	Roka Shiv Mandir	Hindu	1,078
33	Temple	Shiva Mandir	Hindu	1,258
34	Temple	Darkashi	Hindu	1,440
35	Temple	Bhairava Temple (भैरव मन्दिर)	Hindu	35

Site #	Site Type	Site Description	Cultural Affiliation	Distance to RoW (m)
38	Temple	Bhairava Temple (भैरब मन्दिर)	Hindu	100
40	Temple	Pari Butwal	Hindu	250
43	Temple	Shree Siddhababa Dham, Butwal	Hindu	170
45	Temple	Durga Mandir	Hindu	0
46	Temple	Basanta Dada Dewata Khani Mandir	Hindu	224
48	Temple	Jeetutemple	Hindu	150
49	Temple	Sri Shiva Paschimaanchal Swargadwari Temple (श्री शिव पस्चिमाअन्चल स्वर्गद्वारी मन्दिर)	Hindu	780
50	Temple	Baje Bajai Mandir	Hindu	575
52	Temple	Durga Temple	Hindu	76
53	Temple	Baraily Kul Temple	Hindu	83
54	Temple	Karawakeli Temple (करवाकेली मन्दिर)	Hindu	186
57	Temple	Pangeni Kul Mandir	Hindu	450
60	Temple	Baba Bardgoria Temple	Hindu	866
61	Temple	Khanal Kshetri Kula Deity Temple (खनाल क्षेत्री कुल देवता मन्दिर)	Hindu	2,091
63	Temple	Devi Temple	Hindu	1,627
64	Park	Naryanpur mandir (Temple and Pond)	Hindu	5
65	Park	Jakhera Tal - जखेरा ताल (Temple and Pond)	Hindu	320

450. Key features of Hinduism that determine how the Hindu temples, shrines, and ponds identified during the baseline study are likely used by stakeholders include its polytheistic nature, lack of a single authoritative religious text resulting in variations in religious practice locally, regionally, and nationally and across different castes; and the prevalence of informal religious practice outside of official institutions such as large temples. Hinduism does not have one single, authoritative text but rather, is based on multiple texts composed by different authors, in different places, at different points in time, and with different goals/objectives (Williams and Moktan 2019). Hinduism also lacks a single authoritative, religious leader or governing body capable of defining religious practice or resolving doctrinal conflicts. Local or family pandits (priests) are typically charged with defining religious practice and their interpretations often vary on regional, sectarian, and other bases (Adhikari and Gellner 2016; Williams and Moktan 2019).

451. Hindu worship and ritual practices are not restricted or confined to specific buildings such as temples but can occur in multiple places, spaces, and buildings with many Hindu rituals and practices taking place inside private homes or performed in public places like parks (Williams and Moktan 2019). Typically, Hindu temples are built to house religious icons of various deities for individual- or family-based veneration, ceremonies, and/or ritual rather than functioning as gathering places where the entire religious community regularly meets to hear messages from a religious leader (Chakrabarti 2001; Williams and Moktan 2019).

452. Individual rural villages often contain a wide variety of sacred places such as a piece of red cloth tied to a big tree; small heaps of stone as a reminder of the presence of a deity or another; an icon worshipped by people after they bathe in a nearby pond; or a small whitewashed modern temple with Siva's phallic stone inside worshipped by crowds on auspicious dates for Siva but otherwise underused

(Chakrabarti 2001). Due to this variability, anywhere a statue or other religious iconography is present in any physical setting can become a small shrine or temple suitable for Hindu worship (Williams and Moktan 2019). Often local village temples may be modern constructions atop an ancient inner sanctum below the contemporary ground level containing an image or statue dating from over a thousand years, demonstrating that the site, while modified through time, has retained its sacredness since its original establishment (Chakrabarti 2001).

453. Hindu religious practice varies widely from region to region, with different regions, areas, and even villages across South Asia worshipping their own local deity through unique rites/rituals (Adhikari and Gellner 2016; Williams and Moktan 2019). In Nepal, religious observance is governed by the concept of *dharma* or 'a correct lifestyle' which can be achieved through performing and participating in religious activities. Most religious rituals are recurrent ceremonies which occur either daily; periodically, according to an annual program of festivals; or occasionally, to observe a significant life event. During such ceremonies, one or more deities are worshipped using actions and products prescribed by religious texts, religious specialists, and local tradition (Ingles 1995). In the rural hills of central and western Nepal, clan deity worship (*kul)* is a central part of the ritual and cultural life among Nepali Bahun (Brahman) and Chhetri (Kshatriya) householders. *Kul puja or kul deuta puja* (worship of the clan deity) is often performed publicly by a family group or clan and can be highly variable in practice. More private and regular ancestor worship is directed by a qualified priest, usually one's household priest (*purohit)* through a scriptural sraddha (śrāddha) ritual (Adhikari and Gellner 2016).

454. The potential Hindu built/living heritage resources identified during the baseline study represent a wide variety of potential Hindu religious structures. The potential resources identified include small shrines, temples, individual statues, caves, or individual buildings (Figure 107); larger temples or temple complexes consisting of larger and more elaborate structures (Figure 108); ponds with associated temple buildings (Figure 109); and at least one large, gated temple complex consisting multiple buildings and an artificial pond (Site 24: Kapildham Temple). The densest concentrations of potential Hindu build/living heritage resources are located within and in the hillsides surrounding the larger towns and villages with more remote or isolated shrines found along major roadways. All the identified sites appear to be actively maintained and used by local stakeholders.

Figure 107: Small Hindu Temples within 2.5 km of the Proposed Project: Site 3 Shrine (upper left); Shiva Mandir Guffa Dhankhola Cave (Site 11, upper right); Changhatchanghat Mata Temple (Site 21, lower right); and Mushi Cave (Site 28, lower right).

Source: Google Earth

Figure 108: Larger, more complex Hindu Temples within 2.5 km of the Proposed Project: Dhankhola Temple (Site 12, upper left); Bhairava Temple (Site 38, upper right); Devi Temple (Site 63, lower left); Shree Siddhababa Dham (Site 43, lower right).

Source: Google Earth

Figure 109: Ponds and Associated Hindu Temples: Temple to Kalika at Harshedadha Park and Pond (Site 7).

Source: EIA Team – May 2024

455. Based on the general characteristics of Hinduism and Hindu ritual practice, each of the potential Hindu temples identified during the baseline study likely houses a locally significant deity and associated modern, historic, or ancient religious icons (i.e. images, statues, sculpture, etc.) of the deity. The sites are likely used by individuals, families, or extended families regularly for worship, rituals, and other devotional activities, including for biannual and occasional *kul puja or kul deuta puja* ceremonies, possibly guided by a local or household pandit. The smaller temples, pond and temple sites, and temple caves are likely used by local individuals and/or families on a regular basis and based on a ritual/ceremonial schedule/calendar that is determined at the individual or family level. It is not anticipated that these smaller temples are used for regular rituals or ceremonies attended by large groups or for larger, community level ceremonies, rituals, or festivals.

456. The larger, more ornate, and complex temples are also likely used by individuals and families for regular, devotional activities but may also host larger, community level religious events on specific dates throughout the year. All the potential Hindu temple sites identified during the baseline should be considered locally significant physical cultural resources with some of the larger and more ornate sites potentially being regionally significant sites. Additional stakeholder engagement is necessary to fully understand the range of stakeholders that use the sites; the frequency of use; the types of rituals, ceremonies, festivals, etc. that occur at the sites; and the cultural significance of the sites to local communities.

457. The park/pond sites identified during the physical cultural heritage impact study are the most likely of the identified built/living heritage resources to host large, multi-family or community level religious rituals, ceremonies, festivals, and/or events. Sites of this type include the Harshedadha Park (Site 7), Naryanpur Mandir (Site 64), and Jakhera Tal (जखेरा ताल; Site 65) resources. These sites consist of a Hindu temple and an adjacent or nearby pond. Based on information provided local informants, individuals, families, and community groups use the temples for ritual, devotional, and ceremonial purposes and use the lakes for ritual bathing. For example, local informants stated that the Harshedadha Park (Site 7) temple-pond complex is used by members of the local indigenous Tharu community to take holy bathes in the pond and worship in the temple during the yearly Maghe Sankranti Festival on Magh 1 (January 14).

458. ***Buddhist Religious Structures*** - The six (6) potential Buddhist religious structures identified during the physical cultural resources baseline study were described as one (1) monastery, three (3) parks, one (1) shrine, and one (1) temple by the individuals who recorded their locations in Google Earth Pro (Table 93).

Table 93: Possible Buddhist Built/Living Heritage Sites Identified within 2.5 km of the Proposed Project

Site #	Site Type	Site Description	Cultural Affiliation	Distance to RoW (m)
32	Park	Sahitya Tirtha	Buddhist	0
37	Monastery	Buddha Gumba	Buddhist	580
47	Monastery	Buddha Mandir	Buddhist	103
51	Shrine	Buddha Park (बुद्ध पार्क)	Buddhist	290
56	Park	Gautam Buddha Park	Buddhist	0
59	Park	108 Pipal Tree Park	Buddhist	125

459. Buddhist practice in Nepal is predominately based on the Mahayana Buddhist tradition and is described as *tantric* or highly ritualistic (Sihle 2006). Nepalese Buddhism is focused on practices that typically involve the visualization of transcendent deities, the repetition of their mantras, and sometimes particular hand movements (*mudra*), to allow the practitioner to activate the power of these deities (Sihle 2006). The scale of the rituals performed can vary from the simple recitation of the Mani, the mantra *Om mani peme hung* associated with the bodhisattva of compassion, to large rituals such as the masked dances (*cham*) performed at monasteries as a communal exorcism at the end of the year. While most Buddhist traditions in Nepal are based on the Mahayana tradition, Theravada Buddhism with its emphasis on the division of lay and monastic practices and individual spiritual enlightenment is slowly gaining importance in Nepal (Sihle 2006).

460. In the dominant form of Buddhism practiced in Nepal, Buddhist religious specialists are most commonly nonmonastic householder priests often called *lama*. A striking feature of traditional Buddhism in Nepal is the absence of celibate monks, with most householder priests being married men who inherited their position. These hereditary household priests do, however, practice some elements of a monasticism, as they are organized into religious communities based on institutions called *baha* or *bahi* 'monasteries' that in their architecture and ritual practice show similarities to more traditional monastic Buddhism (Sihle 2006).

461. Buddhist religious structures are typically divided into three types of monuments: *stupa* or 'mound'*, griha or* 'sanctuary'*, and vihara* or 'monastery'. While numerous subtypes of structures have been identified within these broad categories, most archaeologists and architectural historians accept these three broad types of structures (Coningham 2001; Deva 1974).

462. The *stupa* is the oldest and most common type of Buddhist monument in South Asia. A *stupa* consists of a solid mound of soil, brick, or earth built over or containing a relic of the Buddha. S*tupas* can be subdivided into four subtypes based on the type of relic they contain: 1) those containing corporeal remains of the Buddha, his disciples, or Buddhist saints; 2) containing objects of used by the Buddha; and 3) those commemorating incidents from the Buddha's life or places visited by him; and 4) votive stupas built by pilgrims, *Bhikkhus* or 'monks' and *Bhikkhunis* for 'obtaining religious merit (Coningham 2001).

463. *Grih* are typically an apsidal, circular, or quadrilateral hall containing an object of worship. *Griha* halls can contain objects of worship or be built around and incorporate one or more *stupas*. The original *griha* ranged from simple, unadorned structures to large buildings containing multiple niches containing sculptures of the Buddha and a large *stupa* at one end (Coningham 2001; Deva 1974). Sub-types of *grih* include the *bodhi-griha* or 'Bodhi-tree sanctuary' and *Buddha-griha* or 'Buddha image sanctuary' (Coningham 2001).

464. The *vihara* or 'monastery' is a residence for monks that also serves as a center for religious work, meditation, and Buddhist teaching (Coningham 2001). Historically, a traditional Buddhist monastery in Nepal was modelled after the domestic household, consisting of a quadrangular structure with an open courtyard in the middle and a group of buildings on all four sides. The principal shrine of the monastery faces the entrance to the courtyard with the buildings on the other three sides used as library, comunity hall, kitchen, refectory and storage room. These buildings are often two stories, with the monk's living quarters on the upper floors and storage rooms are on the ground floor (Deva 1974).

465. In addition to these three traditional types of Buddhist structures, Nepal is known for the construction of *chaitya*, a monumental shrine consisting of an elaborately ornamented stupa-like shape on top of a plinth, four to eight feet in height (Harle 1994). *Chaityas* are typically placed in the open air, often in religious compounds, and are erected as memorials to a deceased individual by his or her family. *Chaityas* are found across Nepal but are most common amongst Sherpa, Magar, Gurung, Tamang, and Newar communities. Beginning in the 20th century, Newars of the Kathmandu Valley began to incorporate images of the four *Tathagatas* on the *chaitya's* four directions (Harle 1994).

466. The six (6) potential Buddhist sites identified during the physical cultural resources baseline do not appear to fit neatly into the four principal Buddhist architectural types identified during the baseline study but do share some characteristics that allow for an interpretation of how they may be used by local stakeholders.

467. Site 37 is located 580 m south of the proposed Project right-of-way and is labeled in Google Earth Pro as a "Buddha Gumba". In Nepal, a g*umba* is a sacred Buddhist spiritual compound similar to a *vihara* where Buddhist teachings may be given and lineage sādhanās or ' tantric liturgy or liturgical manual' are stored (Deva 1974; Harle 1994). If the site is a local Buddhist learning center and library for sādhanās it is likely a locally, and possibly regionally significant, physical cultural resource for the Buddhist community.

468. Site 32 is labeled ' साहित्य तीर्थ' (Sahitya Tirtha) in Google Earth Pro and is a multi-component site consisting of a series of busts on pedestals that appear to commemorate famous/important Nepalese authors and was established by the local government as a "literature pilgrimage place" (Figure 110); a *chautara* or 'rest area' constructed of a series platforms shaded by a row of planted Pipal trees (Figure 111); a fenced in area has a sign with information on a planned project for the *Sri Triratna Buddha Vihara* (monastery; Figure 112); and a *gaushala* or 'cow-shelter' recently built by the local community to care for bulls and cows in the area.

Figure 110: Line of Commemorative Busts at the Literature Pilgrimage Park at Site 32

Source: EIA Team – May 2024

Figure 111: Site 32 Chautara of Raised Platforms and Pipal Trees

Source: EIA Team – May 2024

Figure 112: Planned Location of the Sri Triratna Buddha Vihara at Site 32 (left) and Sign Depicting Proposed Monastery Layout (right)

Source: EIA Team – May 2024

469. Site 32 appears to include both Hindu and Buddhist elements/structures and could represent a locally significant resources to both religious communities. It is included in the Buddhist built/living heritage category due to the proposed Buddhist monastery at the site. The Literature Pilgrimage Park could also represent a locally significant physical cultural resource due to its celebration of historic literature and culture. Based on the current proposed Project alignment, portions of the chautara are located within the proposed Project right-of-way while the commemorative busts, proposed *Sri Triratna Buddha Vihara* monastery, and *gaushala* are located just outside of the right-of-way

470. Site 47 is recorded on Google Earth Pro as a "Buddhist Mandir" which translates to "Buddhist Temple". Mandir is typically used to describe a Hindu temple so this label could be the result of a mistranslation. The satellite imagery for the Google Earth Pro point shows a large, rectangular building with a pitched roof and a nearby tower with a domed rough topped by a spire. Based on the size and characteristics of the structure marked by the Google Earth Pro point, this "Buddhist Mandir" may denote the location of a local Buddhist *vihara*. If the site is a Buddhist monastery, it would likely be a locally and potentially regionally important physical cultural resource for the Buddhist community.

471. Site 51 is labeled in Google Earth Pro as a " Buddha Park (बुद्ध पार्क)" and consists of a small, outdoor Buddhist shrine consisting of a small Buddhist statue on a plinth surrounded by a fenced concrete patio (Figure 113). The site appears to be entered through a small gate and associated portico. Based on the size and rural location of the shrine, it appears to be a locally important physical cultural resource, likely used by members of the local Buddhist community for individual or family religious practices. While the site does not appear to be a traditional *stupa* it may serve some of the same devotional functions for the local Buddhist community.

Figure 113: Site 51 Buddha Park

Source: Google Earth

472. Site 56 is the largest Buddhist physical cultural resource identified during the baseline study. The resource is the Gautam Buddha Park which covers an area of roughly 8.5 hectares on the northern

edge of the Shivalaya Tole of Devdaha Municipality. The park consists of gravel and tamped earth walkways through forested hillslopes connecting a series of picnic areas, a woodcarving workshop, an arts display run by Lalitkala, and a small, yellow and red painted *stupa* (Figure 114). During the site visit, local informants stated that large crowds gather at the park on weekends and holidays.

Figure 114: Gautama Buddha Park: Walkways (upper left); Picnic Area (upper right) and Stupa (lower)

Source: EIA Team – May 2024

473. The large size of the Gautam Buddha Park, the presence of a stupa, and its association with Gautam Buddha, and the information provided by the local informants suggest the site is a locally and likely regionally important physical cultural resources for the Buddhist community. The original alignment for the proposed Project passed through the southern end of the Gautam Buddha Park. After the site visit, the proposed Project alignment was altered to pass to the north of the park. The new alignment remains close to the park, with the proposed right-of-way abutting the northern edge of the park.

474. Site 59 is referred to locally as the 108 Pipal Tree Pond. The site consists of a modern irrigation pond, a small Buddhist shrine and 108 pipal trees (*Ficus religiosa*), which are religiously significant in Buddhism as Gautama Buddha is believed to have attained enlightenment under a pipal tree (Figure

115). Local informants interviewed during the stie visit stated that the site is used by local families for picnics but there are no major festivals or melas (celebrations) held at the site.

Figure 115: 108 Pipal Tree (Site 59). Pond and Pipal Trees (left) and Buddhist Shrine (right)

Source: Google Earth

475. ***Christian Religious Structures*** - The physical cultural resources baseline study identified four (4) potential Christian churches within 2.5 km of the proposed Project right-of-way (Table 94; Figure 116). All four are located within villages and towns along the proposed right-of-way. Satellite imagery analysis suggests churches are housed in relatively small, modern looking structures, which do not appear to be large, historic churches. The names of churches in Google Earth Pro suggest all four are evangelical Protestant denominations.

Table 94: Possible Christian Built/Living Heritage Sites Identified within 2.5 km of the Proposed Project

Site #	Site Type	Site Description	Cultural Affiliation	Distance to RoW (m)
10	Church	Galgatha church (Jurauni)	Christian	168
25	Church	Beriya Bible Church, Chaubah	Christian	1,330
44	Church	Butwal Jyoti Church	Christian	148
58	Church	New Life Gospel Church	Christian	544

Figure 116: Site 44, Butwal Jyoti Church

Source: Google Earth

476. Christian religious practices are typically characterized by regular, weekly religious services on Saturday and/or Sunday that involve the entire local religious community. In addition to weekly services, yearly feast days such as Christmas or Easter services can occur outside of or aligned with the weekly religious services. Based on their relatively small size, all four potential churches are considered locally significant physical cultural resources to the local Christian community.

Living Heritage Resources

477. Living heritage physical cultural resources can include culturally significant environmental resources and natural landscape features. In Hinduism and Buddhism, specific plant and tree species are considered manifestations or symbols of deities and other supernatural forces and/or associated with the life of the Buddha and, as a result, are the focus of ceremonies, rituals, and other devotional activities (Ingles 1995). Many plant species are considered sacred due to their role in Hindu legends; the use of their flowers, fruits, and foliage in religious rituals; and/or they are believed to have medicinal value. In Nepal, a variety of plant species are associated with deities and celestial bodies such as the relatively common *Ficus religiosa* as well as lesser-known species (Ingles 1995).

478. In addition to venerating or using individual plant species in specific rituals, many rituals take place within forests resulting in the designations of certain areas as religious forests and the establishment institutions and organizations concerned with the protection and management of religious forests. In Nepal, religious trees and forests can be found across the rural landscape and range from small groups of several trees to large areas of forested land (Ingles 1995).

479. The biological environment studies conducted for the proposed Project's Initial Environmental Examination (IEE) identified several culturally significant plant species that could be impacted by vegetation clearance in the proposed Project right-of-way during construction. The report stated that removal of culturally significant plant species could impact local traditional ecological knowledge and impact the ability of local communities to use certain culturally plants for medicinal and religious

purposes. Culturally significant plant species identified during the IEE studies identified 24 culturally important plant species: 17 species used in traditional medicines and 7 used for religious purposes.

480. Medicinal plants identified during the biological environment studies include Titepati (*Artemisia sp*.), Sinka (*Aleuritopteris bicolor*), Ghodtapre (*Centella asiatica*), Harro (*Terminalia chebula*), Khayar (*Acacia catechu*), Lajjawati (*Mimosa pudica*), Amala (*Phyllanthus emblica*), Black plum (*Syzyzium cumini*), Indrajau (*Holarhena pubescens*), Datiwan (*Achyranthus aspera*), Musali (*Curculigo orchioides*), Kurilo (*Asparagus racemosus*), Asuro (*Justicia adhatoda*), Barra (*Terminalia bellirica*), Paarijaat (*Nyctanthus arbor-tristis*), Titepaati (*Artemisia dubia*), and Dhayaro (*Woodfordia ruiticosa*). Religious or sacred trees identified during the study include Vijay Sal (*Pterocarpus marsupium*), Peepal (*Ficus religiosa*), Dubo (*Cynodon dactylon*), Bel (*Aegle marmelos*), Chilaune (*Schima wallichii*), Kush (Desmostachya bipinnata), and Bar (*Ficus benghalensis*).

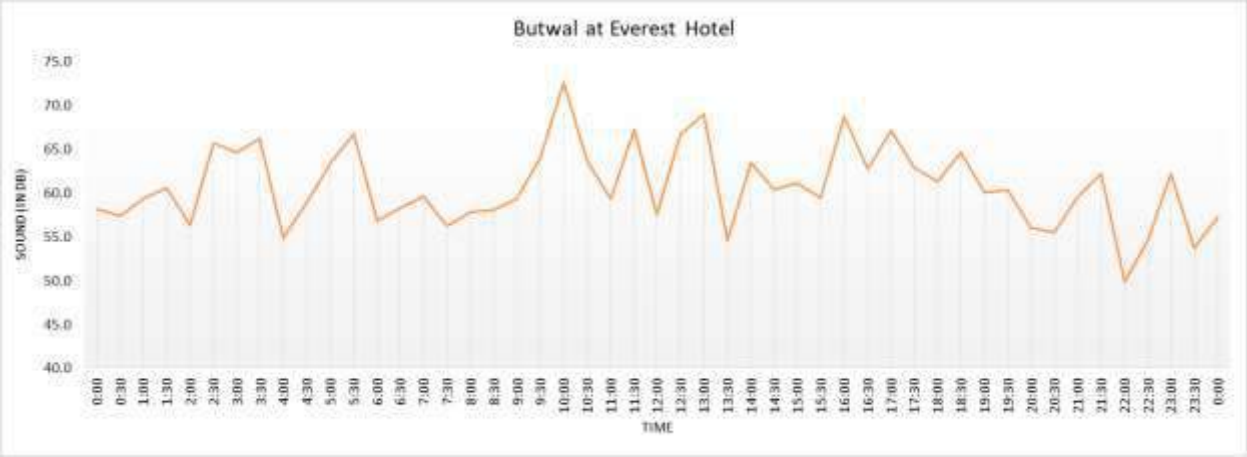
481. All 24 of these plant species are considered locally significant physical cultural resources due to their use in local medicinal traditions and the traditional ecological knowledge and practices associated with their use; their use in traditional religious practices; and, in the case of sacred trees, as focuses of devotion, rituals, and ceremonies. Forested portions of the proposed Project right-of-way could potentially contain areas used by local communities to collect medicinal plants and individual or stands of sacred trees. Stakeholder engagement is necessary to identify specific, geographically defined areas where medicinal plants are collected and the location of individual or groups of sacred trees.

6.4.14 Noise

482. As part of the national IEE a comprehensive analysis of sound quality was conducted at the locations depicted in Figure 32. The main sources of noise pollution is the project area are vehicle and their horn, and construction activities, which have generated noise levels of up to 85 dB during equipment operations. Away from the main roads, noise levels are low, as would be expected in rural villages and forest areas. The graph below illustrates sound data collected from various project locations, revealing low noise levels. The primary source of noise pollution was identified as vehicular movement, which falls within the permissible limit outlines in the guidelines.

Figure 117: Noise level of Gorusinghe[34]

Figure 118: Noise level of Butwal at Everest Hotel[35]



[34] NBLTL, IEE
[35] NBLTL, IEE

Figure 119: Noise level at Sainamaina[36]

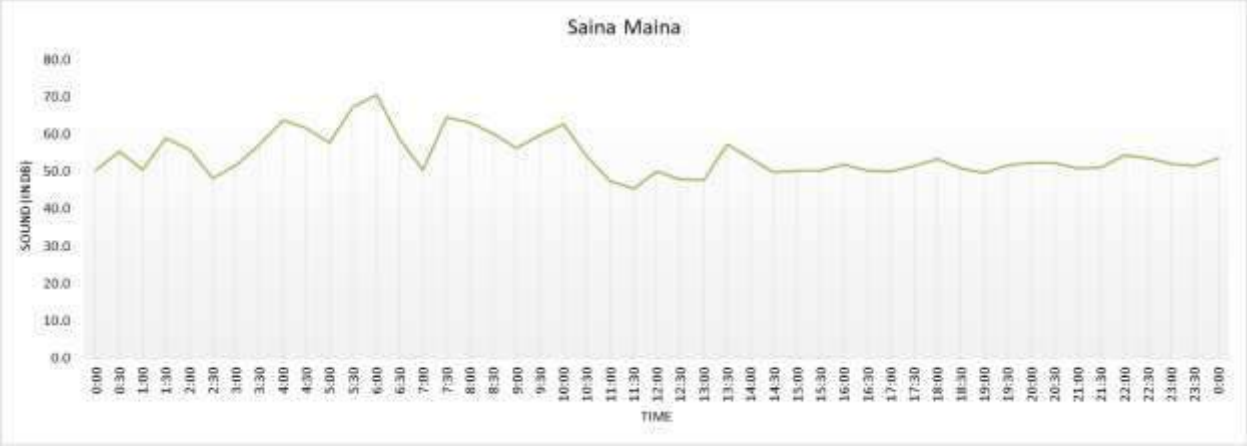


Figure 120: Noise level at Tinau Bridge[37]

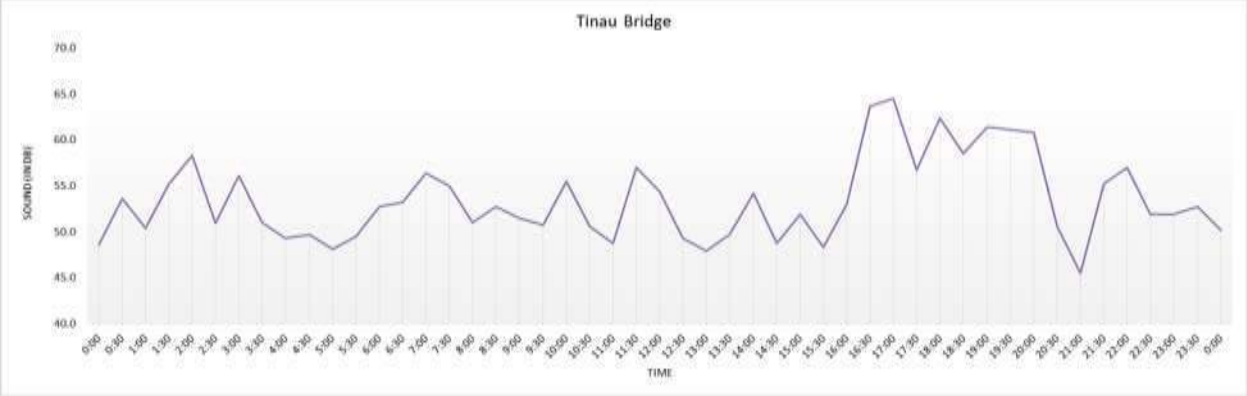


Figure 121: Noise level at Bhaluwang[38]

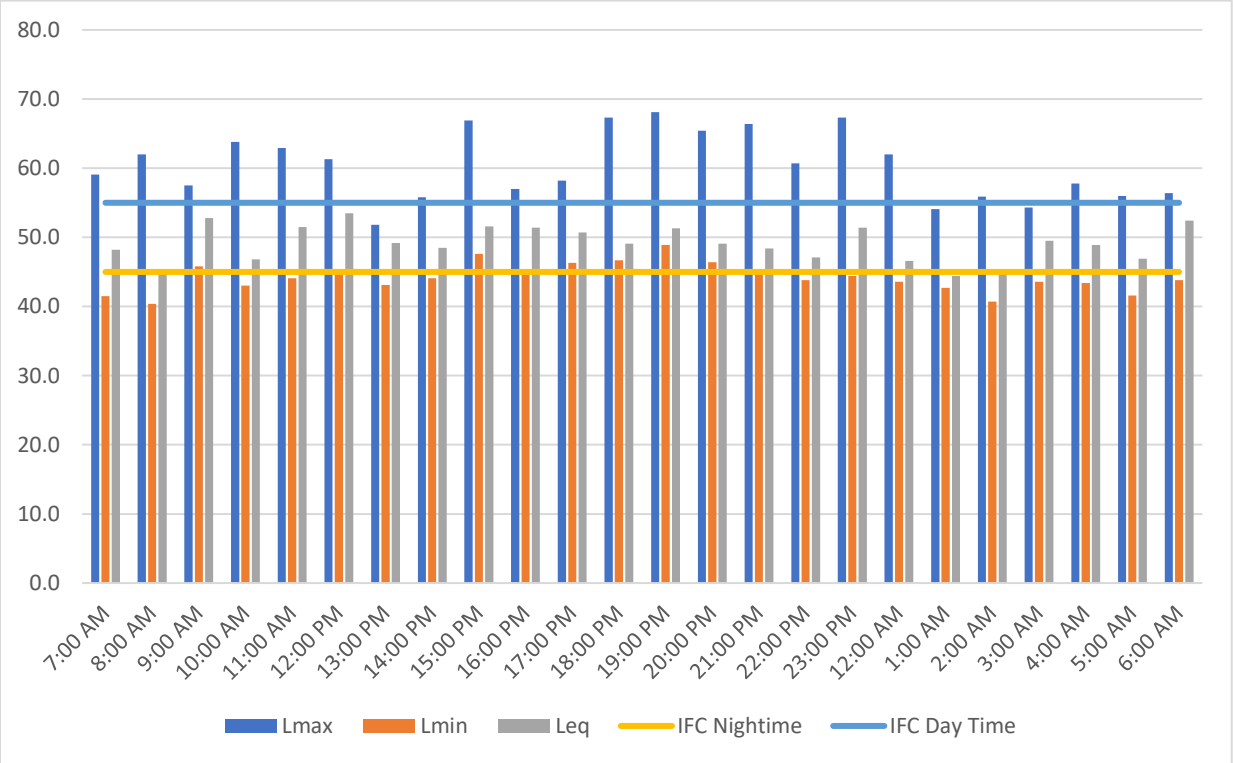
[36] NBLTL, IEE
[37] NBLTL, IEE
[38] NBLT, IEE

Table 95: Existing noise level of the project area [dBA][39]

Station	Max	Min	Avg
Butwal	75	55	65
Tinau Bridge	65	45	55
Sainamaina	70	40	55
Gorusinghe	90	50	70
Bhaluwang	65	45	55

483. Additional noise monitoring has been completed to supplement the data collected in the IEE. The following graphs present the results from eight sites shown in Figure 33. The sites selected were close to residential receptors rather than in forest areas. The results show a fairly constant level of noise throughout the daytime and nighttime periods with Leq levels generally elevated above IFC nightime guideline values but within daytime guidance values.

Table 96: Rupandehi District, Devdaha Municipality Ward No. 6, (Jyotinagar)



[39] NBLTL, IEE

Table 97: Rupandehi District, Devdaha Municipality Ward No. 10, (Charange Tole)

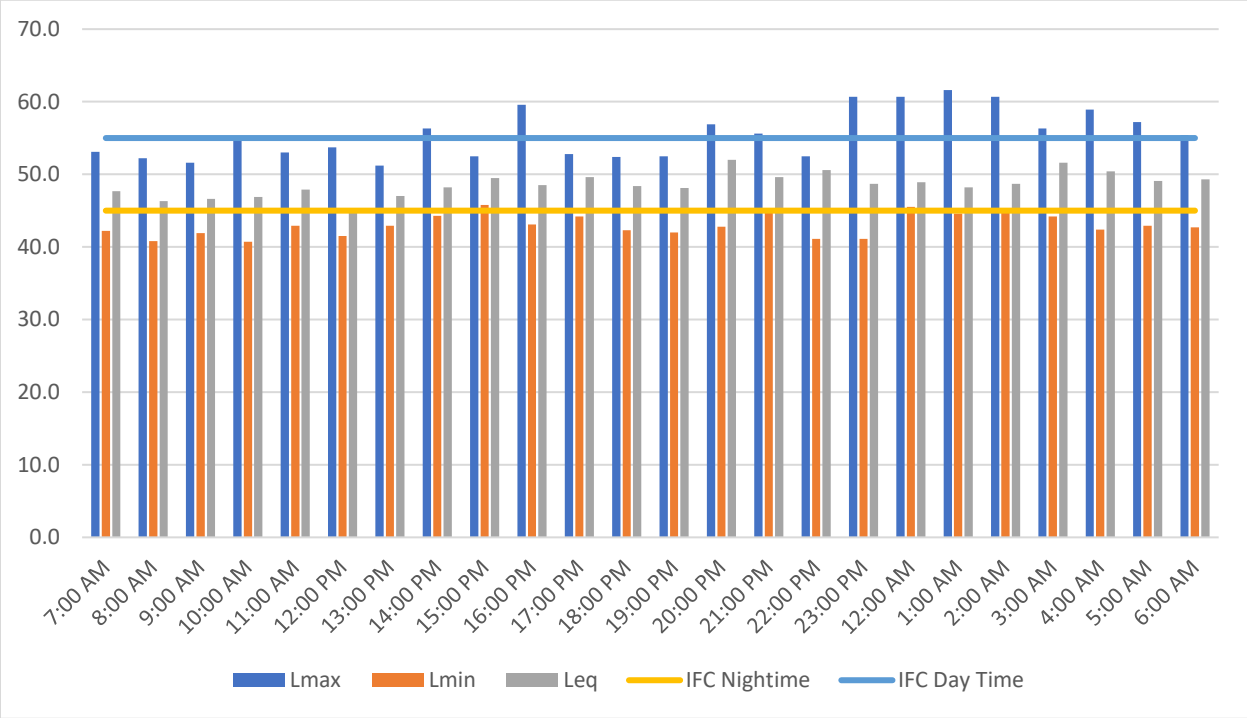


Table 98: Kapilvastu District, Butwal Sub-Metropolitan City, Ward No. 3

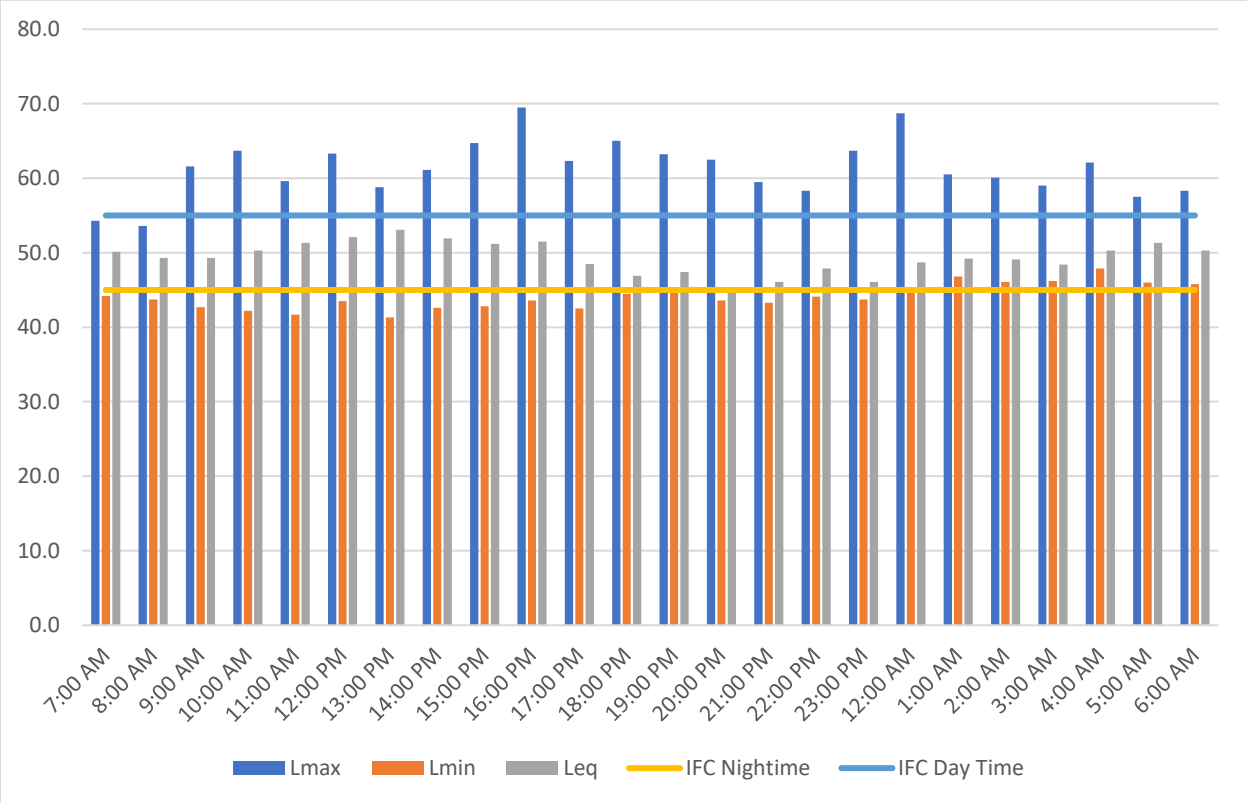


Table 99: Kapilvastu District, Banganga Municipality Ward No. 7, (Motipur Danda)

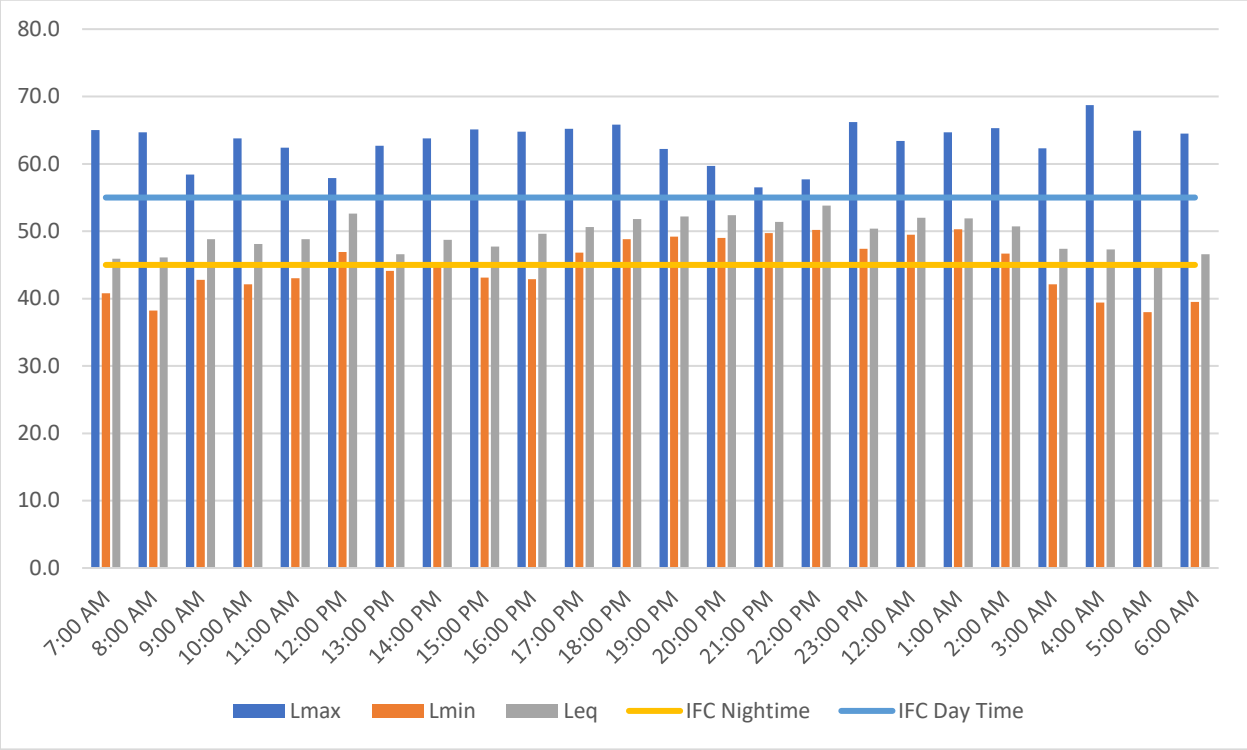


Table 100: Kapivastu District, Shivaraj Municipality Ward No. 1, (Bankas Basa)

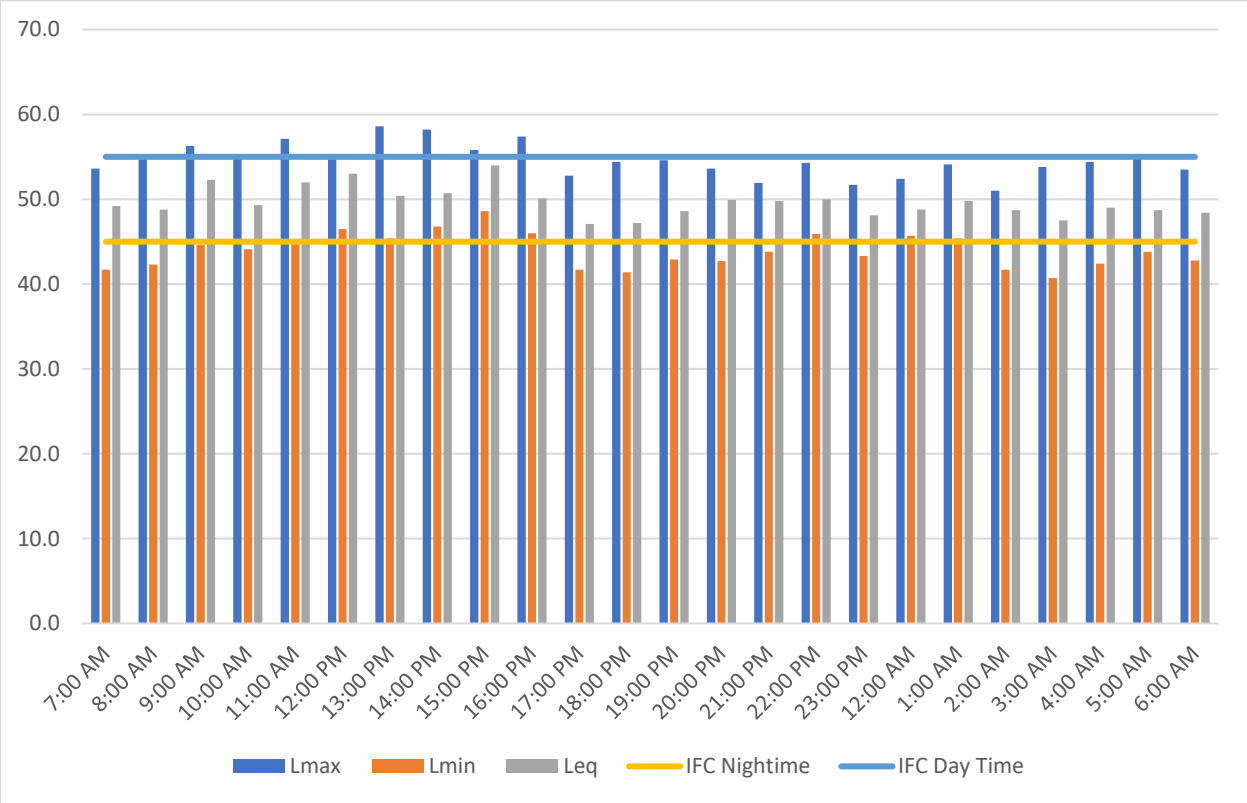


Table 101: Kapivastu District, Shivaraj Municipality Ward No. 9, (4 Number Dobato)

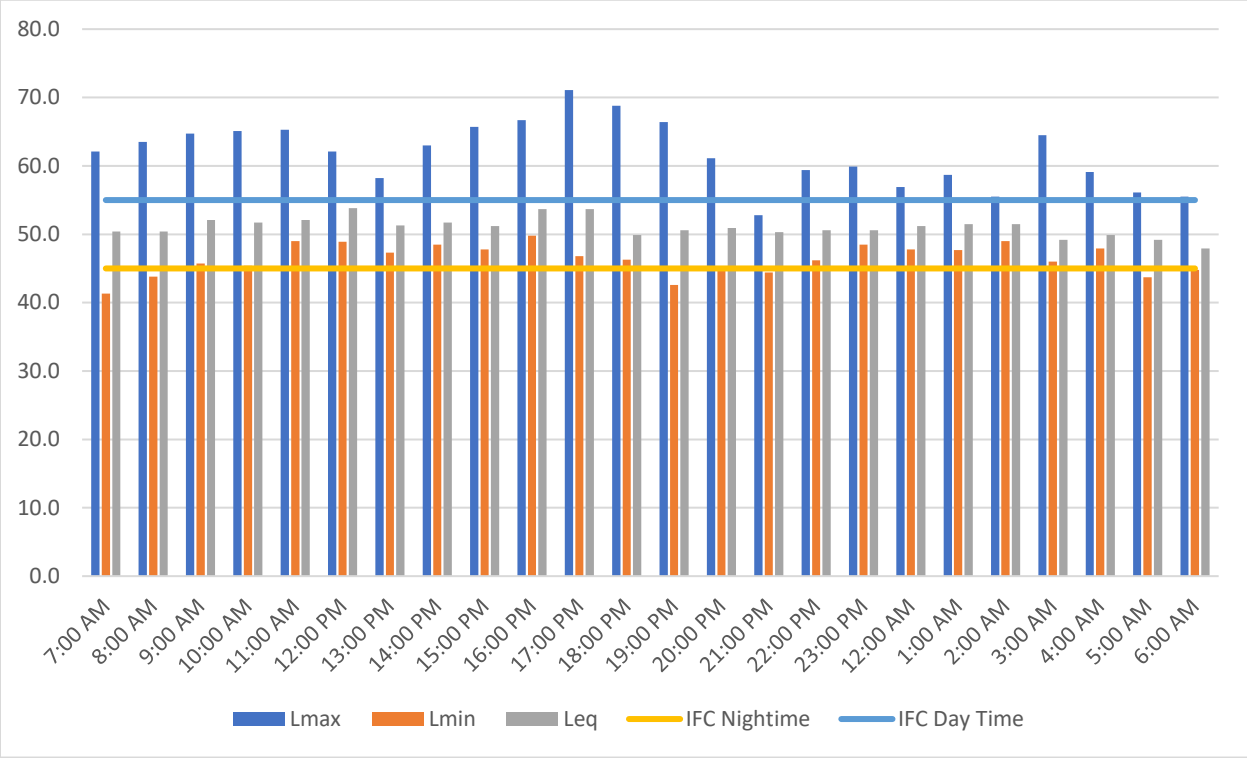


Table 102: Dang District, Rapti Municipality Ward No. 5, (Singhe)

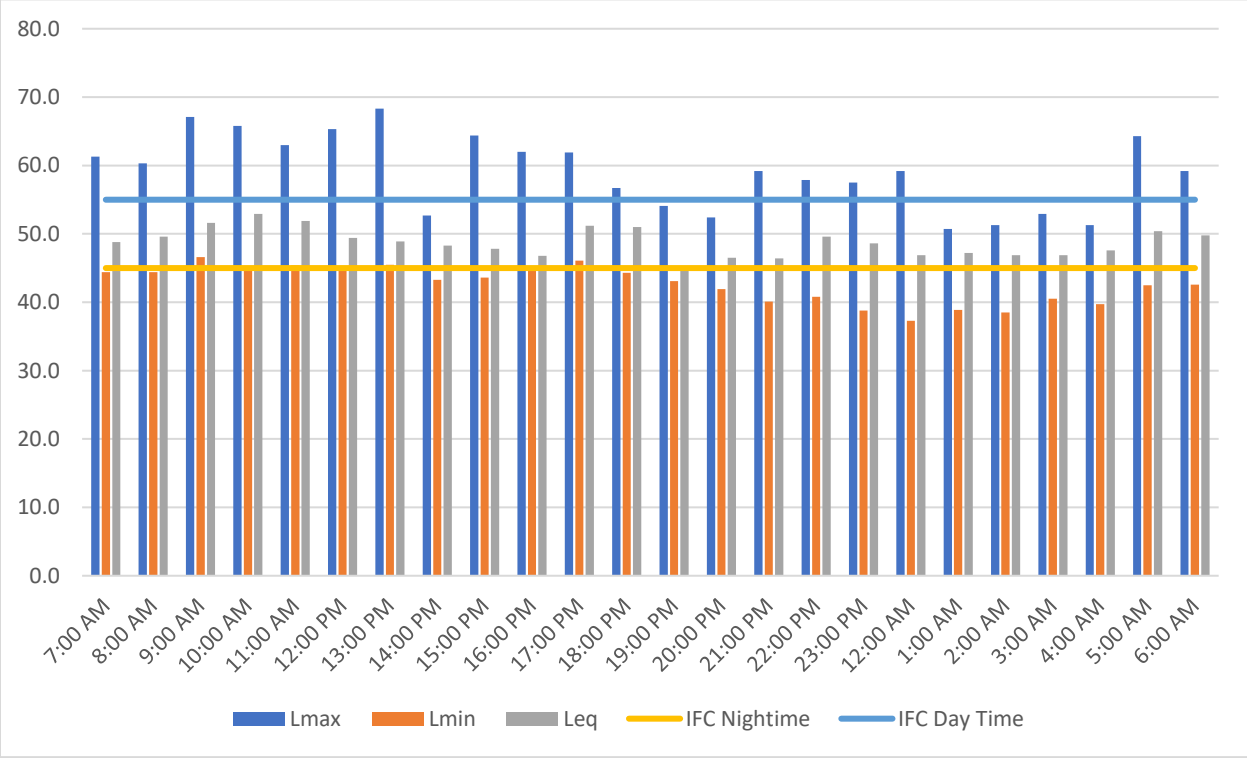
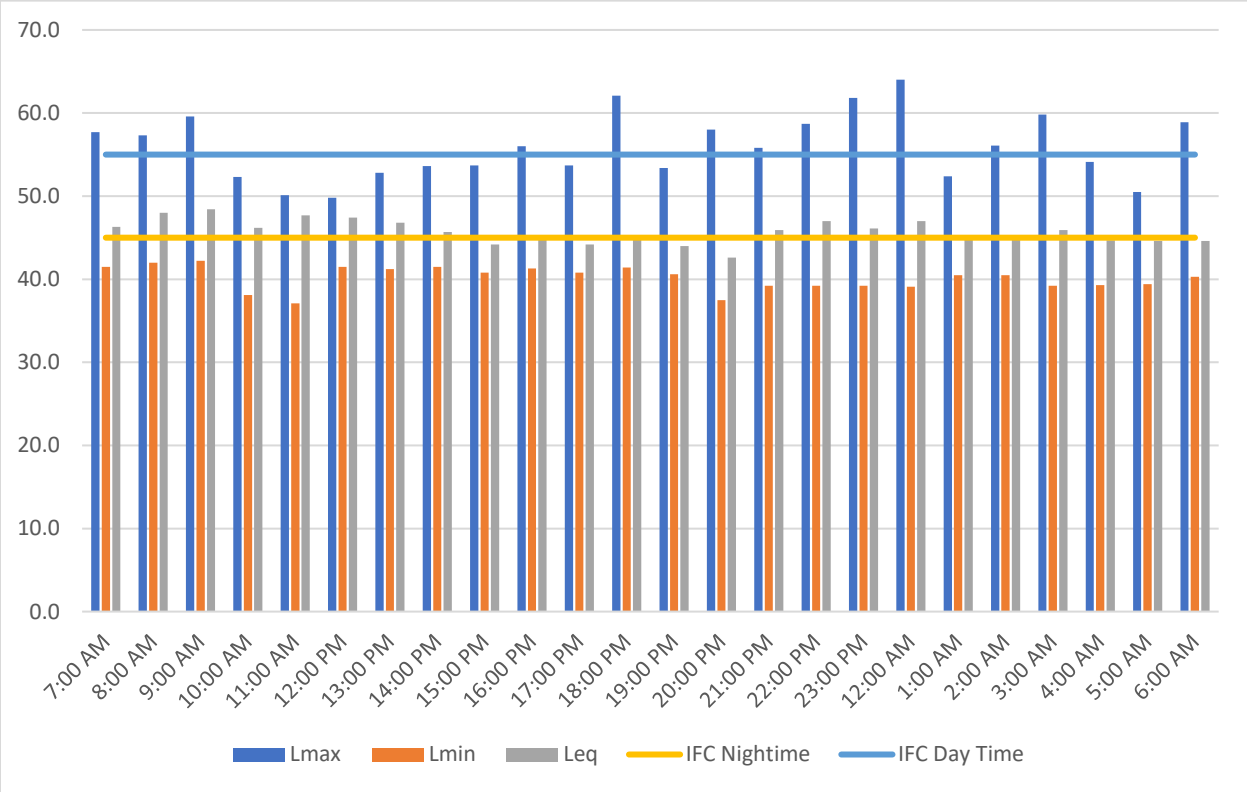


Table 103: Dang District, Lamahi Municipality Ward No. 9, (Lauri, Rihar)



VII. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

7.1 Preamble

484. This portion of the report identifies the environmental and social impacts of the Project and proposes mitigation measures to eliminate the impacts, or where this is not possible, reduce their significance.

7.2 Physical Resources

7.2.1 Air Quality and Greenhouse Gases

485. This section discusses emissions of atmospheric pollutants and greenhouse gases during construction and operation of the Project and associated mitigation measures to be adopted.

Potential Impacts

Construction Phase

486. Release of Exhaust Gases - During construction, the release of combustion gases will mostly be from vehicles and potentially from mobile sources such as mobile generators. These may locally increase concentrations of atmospheric pollutants (NO_X and SO_2) to a limited extent and over a short time period. Most of NBTL traverses forest areas and there are few residential receptors that would be significantly impacted by exhaust gases.

487. Dust - Dust impacts may impact upon the few receptors close to tower excavation sites. Impacts are only anticipated up to 150m from the construction site with impact being greatest immediately adjacent and diminishing with distance. In the absence of mitigation to control air pollution, short term, localized exceedance of national air quality standards, especially for particulate matter, may occur although impacts are readily mitigated and reversible in short term.

488. Dust impacts are likely to be of higher significance on haul routes which are generally unmade dirt tracks, or poorly maintained asphalt roads. Traffic moving to and from tower sites is not anticipated to be high volume, with periodic deliveries of equipment and manpower to site. This may however involve large trucks which can generate plumes of dust as they move along access roads.

489. Excavation works around Lamahi SS will generate potentially highly significant dust impacts to the residential properties close to the SS and neighboring cow sanctuary and local cultural heritage site. Land leveling will be required across the site which comprises loose loamy soils. Approximately 16 properties have been identified within a 350m boundary of the SS, the closest of which is 90 m west.

490. To supplement the current baseline data and to provide a basis for monitoring the contractor will undertake air quality monitoring per the EMoP to confirm current background levels in the subproject area prior to the commencement of any activity on-site. Further on-going air quality monitoring will be completed at the baseline locations throughout construction and at areas where any complaints from residents are received.

Operational Phase

491. The air quality impact of the operational phase will be minimal.

492. In relation to climate change, SF_6 is a non-toxic greenhouse gas used as a dielectric in gas insulated substations (GIS) as well as switch gear and other electrical equipment. 1kg has a global warming potential of 22,800 carbon dioxide equivalent (CO_2e) i.e., equivalent to an average car covering 160,000 km. Due to high global warming potential, SF_6 contributes to climate change if it is released into the atmosphere during operation, maintenance or during end of-life disposal. The SF_6 contained in GIS and switchgear equipment varies greatly according to type and manufacturer.

493. Major leak of SF_6 from project-installed equipment is the worst-case scenario but could easily occur during operation if equipment is not well maintained, or at end of life if the equipment is not appropriately disposed. Climate change is a global concern, however, the impact of a worst-case SF_6 release from the project will be negligible in percentage terms compared to the 36 billion annual global CO_2e emissions.

Impact summary and assessment of significance

494. **Error! Reference source not found.** The following table provides an assessment of the significance of potential air quality impacts before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 104: AQ Impact Significance

Component	Potential Impact	Project Phase	Magnitude	Extent	Duration	Significance
All	Dust	C	M	L	ST	Moderate
All	Exhaust Gas	C	L	L	ST	Low
SS	SF6	O	L	L	LT	Moderate

Air Quality Mitigation and Management Measures

Design Phase

495. Although no highly significant impacts relating to climate change from leaks of SF_6 are anticipated it is still prudent to manage SF_6 at the SS according to best practice as follows:

- If no alternative the use of SF_6 in gas insulated equipment must be minimized as part of design requirements.
- Design of any gas insulated equipment will comply with international norms and standards for handling, storage, and management of SF_6.

- Equipment to be hermetically pressure sealed "sealed for life" units and be tested and guaranteed by the supplier at less than 0.1% leakage rate.
- Installation designed and operated so that any leakage will trigger an alarm at the nearest concerned staffed substation requiring O&M staff to rectify the situation immediately.
- Provide SF6 leakage detector at the SS.
- SF6 in fire extinguishers provided at substations to be avoided.

Pre-construction Phase

496. During the pre-construction phase EPC Contractors, as part of their SEMP, will be responsible for the preparation and implementation of a Pollution Prevention Plan covering dust and emissions to air management.

497. An Emergency Response Plan comprising specific requirements to manage SF_6 will be prepared and implemented to deal with event of an accidental leak.

Construction Phase

498. Siting of Facilities and Equipment - Stationary emission sources (e.g., portable diesel generators, compressors, etc.) shall be positioned as far as is practical from sensitive receptors.

499. Release of Exhaust Gases and Fugitive Emissions

- Equipment and vehicles will be regularly maintained in accordance with the manufacturer's recommendations to maximize fuel efficiency and help minimize emissions.
- Preferentially the Project will use fuel that has low sulphur content of 0.1%, where practical and available within country.
- Construction equipment and vehicles will meet national emissions standards. Belching of black smoke is prohibited.
- Limit engine idling to maximum 5 minutes.
- The burning of wastes generated by project-related activities is strictly prohibited.
- Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery-powered equipment where practicable

500. Dust - Measures that will be adopted to help prevent dust problems from occurring include:

- Ensure an adequate supply of bowsers and carry out watering for dust control at least once a day near residential areas: in dry weather with temperatures of over 25°, or in windy weather. Avoid overwatering as this may make the surrounding muddy.
- Vehicle movements will be restricted to defined access routes and demarcated working areas (unless in the event of an emergency).
- A strict Project speed limit of 30km/hr will be enforced for Project vehicles using unmade tracks.

- Excavated materials will be stockpiled where practical away from sensitive receptors, such as homes, schools, and health facilities. Where this is not possible, ensure regular watering of stockpiles to prevent dust impacts.
- Earthwork operation will be suspended when the wind speed exceeds 20 km/h in areas within 500 m of any community.
- Vehicles carrying fine aggregate materials will be sheeted to help prevent dust blow and spillages.
- Only use cutting, grinding, or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g., suitable local exhaust ventilation systems.
- Provide workers with N95 dust masks to be worn when ambient conditions are dusty or when dust generating activities take place.

Operational Phase

501. On disposal at end-of-life NEA must ensure SF_6 is first removed in accordance with International Electrotechnical Commission (IEC) standard 61634 to a very low pressure so losses of SF6 are less than 0.5% at end of life and then reused, recycled, or destroyed in a high-temperature incinerator. NEA will need to define a safe SF6 retrieval arrangement, with appropriate handling, storage, disposal process for end of life equipment in accordance with international good practice.

Residual Impacts

Table 105: Project Air Quality Residual Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	Release of exhaust gases	Low	Generic mitigation measures will ensure residual impacts will not be significant.	Not significant
C	Dust	Moderate	Generic mitigation measures will ensure residual impacts will be reduced to low significance.	Low
O	SF6	Moderate	Application of measures to manage SF6 at the SS should help ensure there are no significant residual impacts.	Not significant

7.2.2 Soils & Geology

Potential Impacts

Pre-construction / Construction Phase

502. Soil Properties and Compaction - Soil compaction may occur around access roads and tower pad sites. Areas beneath lines are not anticipated to be disturbed as drones will be employed to during stringing.

503. Soil Erosion and Soil Loss - Erosion is a natural process by which wind and rain wear away soils that have poor cohesion or are steeply sloping. Where the land surface is disturbed and when vegetation and topsoil are removed, erosion rates increase. After reinstatement of topsoil temporarily removed from the worksites during construction or at the temporary storage areas, the soil is less

cohesive and is much more easily erodible in wet weather. As noted below, the Chure area is specifically at risk of increased erosion.

504. Soil Contamination During Construction - The principal potential contaminants associated with the construction activities are the same as those listed below for hydrology. The soil can also be contaminated if substances from hazardous waste storage leach into the ground or if large quantities of raw sewage are discharged onto the ground. This can occur at both work sites and camp sites.

505. Aggregate Requirements - Any aggregate required for construction of tower foundations (e.g. fill material beneath tower pads) or for substation works will be obtained from state licensed quarries and/or borrow pits. Extraction and use of aggregates constitute depletion of non-renewable natural resources. If borrow pits or quarries are poorly sited, extraction can have adverse impacts on ecology, water resources, cultural heritage and communities.

506. Spoil Disposal - Excavated material from tower footings will be backfilled into the excavated area and compacted. Any excess spoil material will be spread around the base of the tower on GoN land. Spoil disposal from the SS will be managed according to the section below relating to Waste Management.

Operational Phase

Impact summary and assessment of significance

507. Table 78 provides an assessment of the significance of potential impacts to soil before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 106: Potential Impacts to Soils

Component	Potential Impact	Project Phase	Magnitude	Extent	Duration	Significance
NBTL	Soil Compaction	C	L	SS	ST	Low
NBTL	Soil Erosion	C/O	H	SS	LT	High
All	Soil contamination	C	L	L	ST	Low
All	Aggregate requirements	C	M	L	ST	Moderate
SS	Spills and leaks at substation	O	L	L	LT	Moderate

Mitigation and Management Measures

Design Phase

508. To manage leaks from oil containing equipment substations designs will include at minimum 110% impermeable bunds to storage areas used for oils etc.

- An oil soak pit shall be designed and provided below each oil filled transformer / reactor to accommodate at least 150% of total quantity of oil contained in the transformer / reactor with minimum 300 mm thick layer of gravels / pebbles of approximately 40 mm size (spread over a steel iron grating / trans rack) providing free space below the grating.

- Every soak pit below a transformer or reactor shall be designed to contain oil dropping from any part of the transformer or reactor.

- The common remote oil collecting pit and soak pit shall be provided with automatic pumping facility, to always keep the pit empty and available for an emergency.

- The disposal of transformer oil shall be carried out in an environmentally friendly manner.

509. A 110% bunded, secure storage area will also be provided at SS sites for oil.

510. NBTL EPC Contractor shall identify presence of any unstable land and where towers are not on flat land and conduct geotechnical/slope stability analysis with slopes to be graded with drainage installed to minimize landslide risk. Ensure resulting slope design/topography does not exacerbate surface erosion and/or trigger a landslide; all disturbed areas are to be revegetated. Bioengineering methods can be considered for slope protection.

Pre-construction

511. EPC Contractors for all components will be responsible for the preparation and implementation of a Pollution Prevention Plan covering and environmentally sound and safe storage, use, and disposal of all fuels, chemicals and oils used on site and an emergency preparedness and response plan in the event of any leaks or spills (e.g., of oil, etc.). They will also prepare and implement a Reinstatement Plan to cover all disturbed work zones beyond the boundary of sub-activity sites. Both plans will form part of CSEMPs.

Construction

512. During the construction phase all soil contamination will be managed in accordance with the Pollution Prevention Plan.

513. To manage topsoil and prevent soil erosion and pollution from hazardous materials a range of international good practice measures will be applied to all project components. These measures are outlined in detail in Appendix A. Stability of slopes over 30% shall be checked and approved by the PSC prior to selection of foundation to be used.

514. Any aggregate required for construction of tower foundations (e.g. fill material beneath tower pads) or for substation works will be obtained from licensed quarries and/or borrow pits.

515. As part of the overall management process EPC Contractors for all components shall conduct bi-monthly training of workers on pollution prevention control including good housekeeping and how to clean up oil/fuel/chemical spills and dispose of contaminated sorbent material which would be

treated as a hazardous waste. This will include emergency preparedness and response procedures (drills) in case of spill. Training for subcontractors before commencement of works will also be completed.

Residual Impacts

Table 107: Soils Residual Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	Soil Compaction	Low	Soil compaction and soil erosion is not likely to result in significant impacts during the construction phase. Implementation of the proposed mitigation measures will further limit the potential for impacts to occur.	Not significant
C	Soil Erosion	Low		Not significant
C	Soil contamination	Medium	Mitigation will ensure that any residual impacts are of low significance.	Low
C	Aggregate requirements	Low	No residual impacts are anticipated if licensed existing sources are used.	Not significant
O	Spills and leaks at substations	High	Construction of containment measures according to GIIP will ensure that leaks and spills at substations do not result in highly significant impacts.	Low

7.2.3 Hydrology, Water Resources and Water Quality

516. This section discusses potential impacts on hydrology, water resources and water quality during construction and operation of the Project and associated mitigation measures to be adopted.

Potential Impacts

Pre-construction / Construction Phase

517. The Project will involve the use or generation of some or all the following materials that have the potential to contaminate surface waters:

- Fuels and lubricating oils.
- Paints and solvents.
- Leachate from hazardous waste storage areas at camp sites and work zones.
- Raw sewage from camp sites.

518. The alignment of NBTL intersects various rivers, primarily seasonal ones such as Khahare, which become active during the monsoon season to channel the rainfall. Several major rivers along the TL alignment include:

- Tinau River at Butwal
- Banganga River at Banganga
- West Rapti River at Bhaluwang
- Arjun Khola at Lamahi

519. However, this is not considered a significant issue in terms of hydrology as the lines are designed to cross over the rivers and streams with no impacts to these areas. No towers are planned to be constructed in rivers.

520. The possibility of minor groundwater contamination also exists from any spills or leaks of hazardous liquids at work sites, although in generally the use of hazardous liquids in the NBTL work zones long the alignment will be fairly limited.

521. Although large volumes of water are not anticipated to be required at each worksite, there will be the need for technical and drinking water supplies during the construction phase. For the SS a new borewell will be provided. The water supply for construction workers is expected to be obtained from local resources by the contractors. While there should be no significant impact during the wet season, it is important to note that Nepal experiences water stress during the dry season. Consequently, the use of water by the EPC Contractors, although relatively minor, may create conflicts with local community users who also rely on limited water resources.

522. Extreme flood events associated with climate change could impact upon project infrastructure. This issue is addressed through climate change adaptation measures to be included in the detailed design and below under geohazards.

523. Leaks of oil from substation equipment and stores could impact upon groundwater, but the requirements outlined above under Soils will ensure that leaks and spills are managed in accordance with national guidelines and best practice.

524. It is important to note that Polychlorinated biphenyls (PCBs) will not be used in the new substation transformers or other equipment related to the project. Therefore, the risk of PCB contamination is not within the scope of this project. However, special attention will be given to handling old equipment, particularly when it comes to transformer oil, unless there is documentary evidence ruling out the presence of PCBs.

525. Adequate drainage needs to be provided at new SS to manage site run-off during the operational phase. An excavated area to the west of the SS will be retained as a water resource for cattle.

Impact summary and assessment of significance

526. Table 108 provides an assessment of the significance of potential impacts to hydrology, water resources and water quality before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 108: Potential Impacts to Hydrology, Water Resources and Water Quality

Component	Potential Impact	Project Phase	Magnitude	Extent	Duration	Significance
All	Contamination of surface water	C	L	L	ST	Low
SS	Water use	O	L	L	LT	Moderate
NBTL	Damage to water supply	C	L	L	ST	Low
All	Contamination of groundwater resources	C/O	L	L	LT	Moderate

Mitigation and Management Measures

Design Phase

527. At the SS all new transformers; oil and waste storage areas; and septic tanks/soak aways shall be located at least 50m any borewells to reduce pollution risk. If closer proximity is required due to site layout further assessment will be carried out to demonstrate using a source-pathway-receptor model there will be no adverse impact on aquatic ecology or human health. Wastewater will be connected to existing sewerage system or septic tank with soak away so no untreated wastewater will be disposed of to surface water or ground in operation, septic tank/soakaway effluent to meet national general wastewater standards.

528. During the design phase the EPC Contractor will identify all water supply systems and water pumps and ensure that alignments avoid any interference with these areas. However, it is possible that temporary disruptions could occur.

529. Regarding drainage, adequate drainage design will be provided at the SS to manage runoff during operation.

Pre-construction Phase

530. At this stage the EPC Contractors for all components will prepare and implement their Pollution Prevention Plan covering the protection of water resources and environmentally sound and safe storage, use, and disposal of all fuels, chemicals and oils used on site and an emergency preparedness and response plan in the event of any leaks or spills (e.g., of oil, etc.) or an incident such as flood.

531. For surface waterbodies or groundwater sources within 50m of any tower site baseline water quality sampling will be required (per EMoP) to confirm their current water quality status at least one week prior to the commencement of any actively onsite. Sites to be confirmed by the EPC Contractor as part of this activity. Any drilling or excavation works within 50m of boreholes and wells for any tower and the SS will require pre-construction and post construction water quality monitoring against national drinking water standards to ensure no contamination of the local community supply. If any water pumps and water supply networks are damaged during works the contractor must provide the

affected users with an adequate, alternative drinking water supply meeting national standards whilst immediately repairing the damage caused.

532. Permissions for any new borewell installation at the SS substation shall be obtained together with agreement of local communities before drilling and abstraction. A water meter will be provided on the borewell for monitoring of water abstracted.

Construction Phase

533. To manage potential impacts to hydrological resources during construction of all components a range of good practice measures will be applied to all project components. These measures are outlined in detail in Appendix A.

Residual Impacts

Table 109: Residual Impacts – Hydrology, Water Resources and Water Quality

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	Contamination of surface water	Low	The mitigation measures outlined above will ensure that residual impacts are not significant.	Not significant
O	Water use	Moderate	The mitigation measures outlined above will ensure that residual impacts are not significant.	Not significant
C	Contamination of groundwater	Low	The mitigation measures outlined above will ensure that residual impacts are not significant.	Not significant
C/O	Disruption of water supply	Moderate	Temporary disruptions may still occur. Residual impacts will be low as impacts will be short term.	Low

7.2.4 Geohazards

534. This section discusses potential impacts geohazards may have on the Project during the operational phase and associated mitigation measures to be adopted.

Potential Impacts

Operational Phase

535. Floods – Flood hazard mapping completed for the Project suggests that flooding is only likely to be a high risk hazard close to major rivers along the NBTL route. Flood risk is considered low at the SS. Due to the small footprint and scattered locations of the tower foundations across the landscape, the adverse impact on drainage hydrology and flood risk caused by the tower bases is expected to be minor. There is a possibility of erosion or changes in flood flows, primarily associated with the presence of river training works if the structures are situated too close to the riverbank. This risk is more significant when the minimum distance between a tower footing and the riverbank is less than 100 meters.

536. Seismic Events - Southern Nepal generally exhibits lower seismic hazard levels than the rest of the country. However, it's important to note that this lower hazard level is not universally applicable to all locations within the project area.

537. Landslides - The construction of the towers requires undertaking of earthwork and vegetation clearance. These activities are expected to destabilize the land and exacerbate soil erosion. Most of the TL passes through the Siwalik range, which poses specific risks and challenges. Geologically, the Siwalik range is fragile and susceptible to landslides, rockfalls, and slope instability. Additionally, the delicate nature of soil makes it susceptible to erosion as well. Construction activities within the Siwalik range can accelerate slope instability and erosion. Specific areas of concern mapped by the EIA include slopes around New Butwal and Shivapur forest

Impact summary and assessment of significance

538. Table 110 provides an assessment of the significance of potential geohazards before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 110: Potential Geohazard Impacts

Component	Potential Impact	Project Phase	Magnitude	Extent	Duration	Significance
All	Floods	O	M	SS	LT	Moderate
All	Seismic Events	O	M	SS	LT	Moderate
NBTL	Landslides	O	H	SS	LT	High

Mitigation and Management Measures

Design Phase

539. Seismic Events - In the first instance all designs will incorporate specific measures, as required by national design and construction codes, to mitigate the risk of damage from seismic events, and other natural hazards including flooding and landslides. All structural designs will be checked for building and seismic safety by an independent expert, separate to the design team, to confirm national and international good practice standards are met.

540. Landslides - During the construction phase, the following measures are proposed to mitigate risks and address the challenges associated with the fragile geology of the Chure range.

- Thorough site evaluation of the areas prone to landslides and existing landslides. Avoidance of existing landslides and landslide-prone areas for the tower installation.

- Thorough examination of the stability of tower locations before site preparation. If a tower must be in an unstable area, appropriate foundation design techniques will be employed.

- Implementation of re-vegetation and slope maintenance practices in disturbed areas to prevent erosion.

- Application of proper landscaping techniques that combine bioengineering principles with civic structures at the tower sites.

- Implementation of erosion prevention and minimization measures.

- Provision of temporary access, diversions, and signboards for pedestrians.

- Exposed soils will be stabilized and vegetated to prevent further erosions.

541. Floods - Although no major risks have been identified, for the SS the EPC Contractors design team will conduct flood and drainage risk assessment and incorporate effective drainage design (allowing for climate change) to prevent possible flooding or waterlogging during the wet season, whilst ensuring that surface runoff from the project site is no more than the greenfield runoff rate. Further, the substation or switchyard shall be constructed above the highest flood level and, wherever required, flood protection walls shall also be provided.

542. The final surface level of tower sites shall be at least 0.5 m above the existing ground level and highest flood level and shall be constructed in such a way as to be adequately drained to prevent washouts and flooding impacts to adjacent areas. The surface level shall also consider the findings of the climate change assessment prepared by ADB (final version in progress).

543. For non-navigable rivers, the clearance required for the crossing will be calculated based on the highest flood level (HFL). This approach takes into consideration the potential rise in water levels during flood events and ensures that the power lines remain at a safe distance above the water surface.

Construction Phase

544. Construction activities will be undertaken within a 100 m range on either side of river crossings and in floodplains during the dry season to avoid the flood risks that could lead to accidents or water contamination.

Residual Impacts

Table 111: Residual Impacts - Geohazards

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
O	Floods	Medium	Ensuring designs account for potential flood risks will help reduce potential impacts, but given the uncertainties associated with climate change impacts in foothill areas cannot be ruled out.	Low
O	Seismic Events	Medium	None identified, as long as earthquake loading, and national design standards are considered.	Not significant

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
O	Landslides	Medium	Ensuring designs account for potential landslide risks will help reduce potential impacts, but given the uncertainties associated with climate change impacts in foothill areas cannot be rules out.	Low

7.3 Biodiversity

7.3.1 Flora and Fauna

545. This section discusses potential impacts to flora and during construction and operation of the Project and associated mitigation measures to be adopted.

Potential Impacts

Construction Phase

546. Trees Cutting – requirements for tree cutting have been significantly reduced within the RoW (RoW is 46m) through increasing the height of towers in forested areas. Within this alignment, the land composition is as follows: the community forest covers approx. 92% of the forested land, the collaborative forest covers 2% and the National Forest covers 6%. A comprehensive analysis of the land use within the NBTL RoW revealed that nearly 97% of the area within the RoW, totaling 708.22 ha out of 738.44 ha, consists of various types of forested land. Within this area, approximately 700 ha possesses a substantial population of standing trees.

547. Increasing tower height to 90 m will only necessitate the removal or trimming of trees that exceeds 20 m in height. A comprehensive assessment of the NBTL corridor's RoW revealed that approximately 20% of the trees surpass the 20 m mark. Consequently, a total of 35,310 trees in the RoW will need to be addressed to accommodate the tower height increment while adhering to the regulatory guidelines.

548. Furthermore, the construction of towers including stringing will require removal of additional trees. Typically, the conventional stringing approach would have entailed the complete removal of vegetation along the RoW. However, this project proposes the utilization of drone technology for the stringing operation, significantly reducing the extent of vegetation removal. Specifically, vegetation will only need to be cleared along a 200 m stretch of the RoW at every 4 km of the NBTL alignment. Considering the total alignment length of 160 km, a total of 40 such clearance will be required. This amounts to a cumulative removal of vegetation spanning 200 m in length and 46 m of RoW width across the 40 sites. In terms of area, this will sum up to 36.8 ha. Given the tree density in the project area is 255, it can be estimated that approximately 9,000 trees will need to be removed to accommodate tower construction and stringing. The distribution of tree removal in the project district is presented below:

Figure 122: Expected forest area loss and tree removal

District		Forest area required for the project	Trees removal

	No. of tower	Towers (Permanent)	Construction area (Temporary)	Substation (Permanent)	
Nawalparasi - West	31	1.41	2	0	4,000
Rupandehi	130	5.90	10	0	12,900
Kapilvastu	140	6.35	11	0	15,000
Arghakhanchi	7	0.32	1	0	1,200
Dang	133	6.03	10	11	13,000
Total	441	20	34	11	46,100

549. Considering the removal of tree above 20 m along the RoW, tree removal for construction of towers and space for construction area, as well as the removal of trees in the substation sites, the total number of trees expected to be removed will amount to about 46,100.

550. The impact will be direct in nature, high in magnitude, site specific in extent and long term in duration.

551. Forest fragmentation, alteration, and reduction of ecosystem functions due to shrinkage of forest and vegetated area - The width of RoW will encompass a total width of 46 m. Clearing the RoW, as is typically done in other transmission line projects, may result in forest fragmentation, which can lead to disruption in the interconnectedness and continuity of the forest ecosystem. It can hinder the effective delivery of vital ecological services provided by the forests. The study conducted revealed that the local communities extensively rely on forest products for medicinal, religious, economic, food, and agricultural purposes. It was observed that the forests along the entire length of the TL are managed by local communities in the form of community forests and collaborative forests. The RoW passes through 71 community forests and 5 collaborative forests. Furthermore, the fragmented forests restrict the movement of faunal species, Wildlife and animals dependent on the forests for their habitat, feeding grounds, and migration routes encounter barriers and limitations due to the fragmented landscape. This can have adverse effects on their population dynamics.

552. Consequently, the fragmentation of the forest is anticipated to have a notable impact on both the forest ecosystem and the local communities dependent on it. However, in this NBTL project, the removal of trees up to a height of 20 m will be mitigated by raising the height of the NBTL. This measure aims to preserve the ecological services provide by these forests to a considerable extent. Nonetheless, the construction works, will still disturb the forest. As a result, the expected impact is expected to be of low magnitude, regional in extent, and have a short-term duration.

Table 112: Types of forest management in the RoW (Source: IEE Study)

#	Forest	No. of forests	Coverage (in %)
1	Community Forest	71	92
2	National Forest	4	6
3	Collaborative Forest	5	2
	Total	81	100

553. Impacts to Reptiles of Concern – Information gathered during reptile surveys points to excessive killing of turtles for consumption, constant forest fires harming turtles and tortoise species and their habitats, and a lack of awareness among people, leading to a very low number of turtle and tortoise species. The impact of the transmission line on the population dynamics of these species is not significant, though precautions should still be taken when constructing it.

554. Loss of biodiversity and ground vegetation - The project area comprises a vast forested environment that harbors a diverse range of plant species. The removal of ground vegetation poses a risk to their crucial roles in soil stabilization, nutrient cycling, and as habitats for various organisms. Additionally, the removal of ground vegetation would result in the loss of valuable non-timber forest products (NTFPs). These NTFPs include plant species of medicinal, aromatic, ornamental, fiber-bearing, religious, ethno-botanical, and ecosystem value. The loss of NTFPs not only impacts the livelihoods of local communities but also disrupts traditional knowledge and sustainable practices associated with their use. Furthermore, the clearance of vegetation would have a negative impact on ethno-botanically important plants and associated practices. These plants hold significant cultural and traditional value for local communities, who have long relied on them for purposes such as medicine and religious rituals. The loss of these plants disrupts cultural heritage and traditional practices linked to their utilization.

555. However, it should be noted that in this transmission line project, the ground vegetation within the right-of-way (RoW) will not be removed except around tower bases and the SS. Nevertheless, construction activities, including stringing, may still disturb the forested areas, necessitating the removal of vegetation from tower sites and substation sites. As a result, the anticipated impact is expected to be of low magnitude, site-specific in extent, and have a long-term duration. Efforts should be made to mitigate the disturbance caused by construction activities and protect the valuable plant species and cultural practices associated with the project area.

556. Loss of Wildlife Habitat - Clearance of the trees and vegetation in the RoW of NBTL, which is 160 km long between New Butwal to Lamahi, 97% of which passes through the forested areas, is expected to disrupt, and fragment wildlife habitat. The connectivity of the habitat between Siwalik and Terai Forest will be disrupted resulting in:

- Habitat loss and fragmentation – forest fragment reduce the overall size of habitat patches and create barriers that restrict the movement of wildlife. As a result, many species, particularly those with large home ranges or specific habitat requirements, may lose their suitable habitat or become confined to smaller fragmented areas.

- Disruption of animal movement – fragmentation can disrupt the natural movements and dispersal patterns of wildlife. Animals may face challenges in accessing essential resources like food, water, and mates. This can negatively impact their survival, reproductive success, and genetic diversity.

- Increased human-wildlife conflict – Fragmentation can bring wildlife in closer proximity to human settlements, increasing the chances of conflicts. As animals navigate through fragmented landscapes, they may encounter cultivated field, livestock, or human settlements, leading to conflicts over resources or safety concerns. Incidences of snake bites, crop raiding by monkeys, porcupines, etc. can increase.

- Altered species compositions – forest fragmentation can result in changes to the composition of wildlife species in the fragmented areas. Some species like leopard (Panthera pardus) may thrive in the edge habitats created by fragmentation, while others, especially those requiring larger continuous habitats, may decline or disappear from the area.

- Reduced biodiversity – Fragmentation can lead to a decline in overall biodiversity by reducing the range of habitats available and limiting the connectivity between different habitats. This can negatively impact the abundance and diversity of species, including rare or specialized species.

557. Considering the potential impact of this activity, the magnitude is expected to be moderate. Because the impact will occur throughout the transmission line corridor, the extent will be regional rather than site-specific. Additionally, the duration of this impact is expected to be long-term, as the trimming will be an ongoing requirement for maintaining the necessary clearance.

558. Pressure on forest and non-forest products - The community forests, collaborative forests, and national forests existing in the project area are of considerable size, capable of meeting the demand for forest resources like firewood and timber, even after the loss of trees due to this project. However, during the site clearance for construction, there is a potential risk of encroachment by construction workers, local communities, and individuals from surrounding areas on the forested areas. In such circumstances, opportunistic individuals may exploit the situation by illegally felling trees beyond the designated ones or increasing the number of trees being cut down to maximize their profits. Additionally, some people may take advantage of the clearance activities to enter the forest and harvest other forest products.

559. There is a potential risk of poaching by the labor force, which could have short-term localized impacts. Local hunters and the workforce may be enticed to hunt birds and other wildlife species, leading to adverse effects on the wildlife population, particularly exacerbated by the easier access facilitated by the clearance of the right-of-way (RoW).

560. Considering the significance of the area in terms of critical habitat, these impacts can have significant consequences. However, it is important to note that this project aims to maintain the forest vegetation within the RoW, thereby reducing the number of trees that need to be removed. Nonetheless, disturbances are still expected during the construction period, which may contribute to these impacts. Therefore, the overall impact is anticipated to be of moderate magnitude, localized in extent, and short-term in duration.

561. Loss of rare, endangered, and threatened plant species of conservation significance - The project area, encompassing the NBTL corridor, tower placement sites, and substation, predominantly consists of forested lands that play a vital role as habitats for diverse array of floral and faunal species. These habitat support plant species of various conservation statuses, including rare, endangered, vulnerable, and protected species. Among them, the prominent tree species observed within the project area is discussed below:

562. Sal (Shorea robusta), trees exhibit a high population in the project area. It is a large, evergreen, or semi-deciduous tree that can grow up to 30 – 35 m in height. The Section 5.2.1 and its subsequent subsection has elaborated on the importance of Sal in the project area. Almost 90% of the tree vegetation that will be affected by the project consists of Sal. It is included in the list of protected species. The Forest Act categorized Sal Forest as protected forests, and special provisions are in place

to regulate their utilization, harvest, and trade. The Act prohibits unauthorized cutting, removal, or transport of the Sal trees without necessary permits. The IUCN Red List of Threatened Species has, however, listed it as Least Concern because of recent improvement on its population and distribution.

563. Vijay Sal (Pterocarpus marsupium) is reported from the project area, however, in a small number. It is a deciduous tree species native to Nepal and other parts of South Asia. It is a medium to large-sized tree that can reach height of up to 25- 30 m. It is highly valued for its timber and has significant cultural, economic, and ecological importance in the region. The Forest Act 2019 recognizes the importance of conserving Vijay Sal to ensure their sustainable use and protection. The act prohibits the unauthorized felling, transportation, possession, or sale without permits. Furthermore, it is listed as Near Threatened (NT) on the IUCN Red List of Threatened Species due to habitat loss and overexploitation.

564. Sati Sal (Dalbergia latifolia) is reported from the project area, however, in a small number. It is species native to the South Asia. Sati Sal is a large, deciduous tree that can reach heights of up to 30 m. The wood of Sati Dal is highly valued for its strength, durability, and attractive grain patterns. Its timber is often referred to as "Rosewood". The main threat to its survival is habitat loss and illegal logging and it is listed as Vulnerable (VU) on the IUCN Red List of Threatened Species.

565. Based on plot studies conducted, it has been determined that the project may result in the potential loss of a large number of Sal trees. It is worth noting that these species have a significant presence on nearby hill slopes. As part of the project's efforts to minimize tree clearance, the removal of these trees will be significantly reduced. However, considering that these trees can grow above 30 meters in height, many of the trees will require trimming to maintain a vertical clearance between the power lines and the tree canopy.

566. The impact will be direct in nature, moderate in magnitude, site specific in extent and long term in duration.

567. Forest Fires - The presence of construction workers in temporary work camps can potentially increase the risk of fire hazards in the local forest. Improper handling of fuel, oil, or cooking fuel could lead to such incidents. The fires started by construction workers have the potential to cause significant indirect impacts on all Critical Habitat-qualifying species and sites.

568. Wildlife disturbance due to construction activities - The construction activities and influx of outsiders can disturb physical habitats, feeding habits, reproductive behaviors, and movement of wild animals and birds, potentially altering the diversity of ecosystems and natural communities of plants and animals. Protected plant and animal species are particularly vulnerable to such adverse impacts.

569. The various construction activities, such as site clearance, foundation excavation, vehicle movement, material transportation, and related actions, can disturb the normal movements and activities of wildlife in the surrounding areas. Birds may experience temporary disruptions to their usual routes due to construction activities. The presence of electric lights and human presence can also impact the grazing behavior of wild animals in the vicinity. Smaller and less mobile species like frogs, lizards, and small mammals (rats) may be affected by the clearing, excavation, grading, and filling activities.

570. The general disturbance caused by construction noise, bright lighting from the movement of heavy vehicles throughout the day and night, and other daily activities of project personnel can impact

herpetofauna and mammals. The movement and activities of laborers may disrupt the natural free movement of these fauna. While these project activities will have some adverse impacts on local wildlife, the magnitude of the impact is expected to be low, limited in extent and of short duration.

571. Spread of non-native or invasive species - Spread of non-native or invasive species will reduce the ecological value of an area.

572. Poaching and deliberate killing of animals - During the construction phase, there is a potential increase in the trapping and hunting of birds, such as Red Jungle Fowl and Peafowl, by both the workforce involved in the project and the local communities. The accessibility to bird habitats and the demand for bird products may rise during this period. However, we anticipate that the impact of this activity will be of medium magnitude, limited to the local area, and temporary, occurring only throughout the construction period. It is important to recognize the potential negative consequences of increased trapping and hunting, as it can disrupt the local bird populations and have ecological implications. The impact is expected to be of low magnitude, local and short-term in nature.

Operational Phase

573. Impact on the surrounding forest area due to increased access to the surrounding forest - During the operation phase, the construction of trails and roads for maintenance purposes, specifically for the tower and TL conductors, may inadvertently provide access to unauthorized individual engaged in activities such as illegal timber and firewood collection, as well as hunting and poaching. This increased accessibility can have various impacts on the surrounding forest area:

- Forest degradation – the easier access to the forest can lead to increased human activities such as illegal logging, gathering of firewood, and extraction NTFPs. The forests in the area are already under such pressure and can further escalate degradation of the forest ecosystem.

- Forest encroachment – with improved access, there is a risk of increased encroachment into the forest area by locals. Unauthorized expansion of agricultural land, settlement, or other human activities into the forest can lead to habitat fragmentation and loss, affecting the overall integrity and biodiversity of the forest ecosystem.

- Hunting and poaching – Easier access may facilitate hunting and poaching activities in the forest. Increased human presence and disturbance can disrupt wildlife populations, leasing to declines in certain species, particularly the vulnerable ones.

- Ecological impact: changes in vegetation composition, alteration of natural regeneration processes, and disturbance of sensitive habitats can affect the overall ecological dynamics of the forests.

574. The impact of these activities will be indirect in nature, as they indirectly affect the forest ecosystem. The magnitude of the impact is considered moderate, the extent of the impact will be localized to the specific areas affected by these unauthorized activities. Furthermore, the duration of the impact is expected to be long-term, as the consequences on the forest ecosystem may persist over an extended period.

575. Accidents and risk of electrocution of wildlife - During the operation, transmission towers may attract populations of climbers like Langur (*Semnopithecus entellus*), Rato Bandar (*Macaca mulatta*),

squirrels, lizards, arboreal snakes. These animals face a potential danger of electrocution. Arboreal mammals, including monkeys, are likely to use towers primarily as an escape from predators, chasing prey, or out of curiosity. While vegetation clearance distances around the base of towers and along spans will prevent monkeys from accessing the towers or lines, there is still a remote chance due to inquisitive nature of monkeys. To mitigate this risk, anti-climbing devices will be installed on the towers to prevent the monkeys and other arboreal mammals from climbing them.

576. In addition to the risks for climbers, the NBTL conductors may also impede the mobility of flying mammals such as flying squirrels and bats, and flying fox, to some extent. These small mammals may not notice the wire, especially during periods of low visibility caused by bad weather, foggy conditions, or nighttime. Collisions with the NBTL during such times can result in injuries, which can be fatal. It is worth noting that the NBTL alignment does not pass through areas with high concentration of these wild animals. As a result, these impacts are expected to be of low magnitude, specific to the site, however, will be there for long term.

Impact summary and assessment of significance

577. The following table provides an assessment of the significance of potential air quality impacts before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 113: Impact Significance

Component	Potential Impact	Project Phase	Magnitude	Extent	Duration	Significance
Forest	Trees Cutting	C	H	SS	ST	High
	Pressure on forest and non-forest products	C	M	L	ST	Moderate
	Forest Fires	C	M	L	ST	Moderate
	Impact on the surrounding forest area due to increased access to the surrounding forest	O	H	L	LT	High
Flora	Loss of biodiversity and ground vegetation	C	M	SS	ST	Low
	Loss of rare, endangered, and threatened plant species of conservation significance	C	H	SS	LT	High
	Spread of non-native or invasive species	C	M	L	ST	Moderate
Fauna	Reptiles of Concern	C	H	SS	ST	High

Component	Potential Impact	Project Phase	Magnitude	Extent	Duration	Significance
	Loss of Wildlife Habitat	C	H	SS	LT	High
	Wildlife disturbance due to construction activities	C	M	L	ST	Moderate
	Poaching and deliberate killing of animals	C	M	L	ST	Moderate
	Accidents and risk of electrocution of wildlife	O	L	SS	LT	Low

Mitigation and Management Measures

Construction Phase

Tortoise and Turtles

578. The following measures are recommended during the construction phase:

- Unfavorable construction period: The pre-monsoon and post-monsoon seasons are not ideal for construction work. If construction continues during these times, the increased presence of workers and villagers in the area will raise the likelihood of encounters with turtles and tortoises.

- Continuous habitat monitoring: Regular monitoring of the habitat must be conducted throughout the construction period.

- Worker training and awareness campaign: Educate workers on the importance of turtle and tortoise species. If construction occurs during the proposed season, species safety protocols must be followed to protect their habitat. Additionally, pollution, hunting, and fishing in the river system and adjacent areas are strictly prohibited.

- Community education and engagement: Conduct awareness campaigns for local residents to highlight the ecological importance of turtles and tortoises and the impact of forest fires on their habitat.

Minimize loss of habitat and biodiversity

579. Tree Cutting - Prior to commencing any works in , NEA will ensure that the necessary forest clearance permission is obtained.

580. During the implementation of the project, any clearing of forest vegetation will strictly adhere to the requirements specified for the TL or RoW. Before any trees are felled, a thorough marking and documentation process will take place. This involves conducting a joint inspection, which includes

representatives from the forest authority, community forest, leasehold forestry, and relevant stakeholders.

581. The purpose of the joint inspection is to identify and document the specific trees that need to be cleared to make way for the TL. This collaborative approach ensures transparency and accountability in the process, as all parties involved can verify and agree upon the trees that will be affected.

582. The ecological importance of the forest to be cleared will be assessed prior to clearance, verification of the number of trees to be cleared, and documentation fauna of the study area. If tall trees that hold value for vultures, high-quality forest habitat with a density of over 200 trees/ha, or other significant natural habitats are identified as being impacted, the contractor will actively seek ways to minimize tree and habitat loss through design reconsiderations. This may involve exploring options such as realignment of the route or implementing alternative construction methods that reduce the impact on the identified areas of importance.

583. It is important to note that the proponent of the project will be responsible for the remuneration of both government authority and the community during the inspection. This includes covering the costs associated with the felling of the marked trees as well as managing the stockpile of the cleared trees.

584. By following these procedures, the project ensures that the clearing of forest is carried out in a controlled and responsible manner.

585. This project has considered increasing the height of the towers to avoid removal of trees up to a height of 20 m. This measure aims to preserve the ecological services provide by these forests to a considerable extent.

586. Cutting of trees in the RoW, outside the tower footprints, will therefore be minimum and only permitted when necessary for the installation and stringing of conductors, ensuring compliance with safety clearance requirements outlines in the Electricity Rules and managing the risk of forest fires. Whenever possible, trees within the RoW that can survive the construction activities will be pruned rather than cut, allowing them to potentially regrow and reestablish more rapidly after the works are completed.

587. Selective felling of trees will be conducted in a meticulous manner, with careful identification and confirmation of the target trees. The species and location of the trees will be verified, and they will be conducted, marked, and harvested manually using suitable forestry techniques. This approach aims to minimize the impacts on the surrounding vegetation and reduce habitat fragmentation.

588. The process of tree felling will involve collaboration with the local Divisional Forest Office, Community Forest User Groups, and Leasehold Forest Groups, ensuring their involvement and expertise in the process.

589. The specific details of the tree felling activity, including the identified trees and the methods employed, will be documented, and reported in periodic monitoring reports, demonstrating transparency and accountability in the project's implementation.

590. The project will pay special attention to the preservation of important tree species as designated by the DFO. These identified tree species will be marked separately and safeguarded during the

construction phase. This protective measure aims to ensure the retention and conservation of significant tree species, contributing to the maintenance of biodiversity and ecological balance in the project area.

591. The recovered felled trees and NTFP will be handed over to the CFUGs in compliance with national legislations.

592. The project will maintain a clear demarcation of the working area and strictly avoid encroachment beyond the agreed corridor of impact. This measure will ensure that the project activities are confined within the designated boundaries, minimizing any potential adverse effects on surrounding areas.

593. Project will not construction of access roads, rather it will use existing roads and tracks for transporting tower materials and machinery. In locations where access is restricted, manual labor and Heli-lifting will be employed for the transportation and installation. Stringing will be done using the heavy-duty drone technology. This will ensure minimal disruption to the natural environment while fulfilling the project's operational requirements.

594. The use of herbicides, pesticides, or burning to control vegetation or manage vegetation waste within substations and along the RoW will be strictly prohibited. This safeguard prevents the potential adverse impacts of chemical substances and supports environmentally friendly practices.

595. Regular tree trimming will be conducted for trees within the RoW that exceed a height of 15 m. This trimming activity will be performed at least once every 10 years considering the growth rate of 2 cm a year of the tree in average.

596. Compensation to lost - The acquisition of forest land for the TL RoW, tower foundations, and substations will be carried out in accordance with the Forest Act 2076/Regulations 2079 and Standards and Work Procedures for Utilization of National s for Projects of National Priority, 2076.

597. In compliance with these procedures, the project will allocate an equivalent amount of land to the Government of Nepal wherever / whenever feasible. Alternatively, the project will compensate the GoN monetarily based on the specific rates for different land types outlines in Schedule 1, as stipulated in Section 10 of the Standards and Works Procedures for the Utilization of National Forest Areas for Projects of National Priority 2076.

598. The RoW for the TL covers a substantial land area, stretching 160 km in length and 46 m in width. A comprehensive evaluation of land use within this RoW demonstrated that nearly 96% of the RoW area, which amounts to 708.22 ha out 738.44, consists primarily of forested land.

599. By employing an innovative strategy to circumvent vegetation clearance within the RoW, the main and permanent impact on forests will be concentrated around tower sites and substations. To effectively address this, it is proposed that the ownership of forests within the RoW remains under the jurisdiction of GoN.

600. NEA will have to, however, undertake routine trimming and maintenance of tree height within a collaborative framework, ensuring seamless coordination with the respective Divisional Forest Office (DFO) and Sub-Divisional Forest Office (S-DFO), as well as the respective CFUGs, Leasehold Forest User Groups, and Collaborative Forest Groups.

601. As per the existing regulations, the GoN will be compensated with the replacement cost for acquisition of the forested land in the RoW, tower sites and substations, which amounts to 724.89 ha in total.

602. The GoN has given priority to developing the transmission line. As a result, they are currently exploring ways to optimize compensation for the loss of forest land. If the new provisions regarding forest land acquisition come into effect, the compensations will be adjusted according to these updated regulations.

603. The process of selling forest products obtained from the cleared forest site - The project will undertake the clearance of the forest and stockpile the materials as per the guideline provided in the Forest Products Collection, Sale, and Distribution Directives 2075. Subsequently, the materials will be handed over to the respective owners.

604. The forest will be cleared only after the joint inspection and documentation of the trees to be felled involving the forest authority. The proponent will bear the expenses associated with the government and community authority's participation in the inspection, including the costs related to tree felling and management of stockpile.

605. Compensatory plantation for the removed trees - To address the unavoidable loss of forest due to the project, it is essential to implement compensatory measures such as plantation activities. These efforts should be carried out simultaneously with conservation practices in the remaining forest areas. NEA and contractor will collaborate to prepare a reforestation plan, with the objective to achieve "no net loss of biodiversity".

606. According to the Forest Regulations 2079, compensatory plantations are mandatory, which shall be carried out with a ratio of 1:10 *i.e.,* for each felled tree 10 saplings shall be planted. The Forest Regulations 2079 also specifies that the trees within the protected areas and the protected species shall be compensated at the ratio of 1:25.

607. The reforestation will aim at plantation of a standard of 1600 seedlings per ha. However, adjustments to this ratio may be made based on recommendations from the DFO and user groups, considering local site conditions or specific requirements. The selection of plantation sites will be conducted in consultation with the respective DFO and user groups. Preference will be given to the sites that have a similar climate range and soil types as the deforested areas, while also considering proximity to existing forest areas to extend the range of species habitats. The species composition of the reforested areas will consist of locally native species, mirroring the composition of the corresponding deforested sections under the project. Preferences of the user groups will also be considered in selection of the species. Additionally, emphasis will be placed on selecting species that contribute to the habitat for fauna, particularly trees that provide suitable habitat for vultures and other wildlife.

608. The proponent will bear all the expenses related to the cutting, stockpiling, and transportation of the trees.

609. Establishment of nursery - The establishment of the tree nursery will commence upon the effectiveness of the loan, providing sufficient time for seedling growth, planting, and management over a period of 5 years. This timeline will allow for the necessary preparations and ensures the availability of healthy and well-developed seedlings for the restoration efforts.

610. However, if it is determined that purchasing seedlings from existing nurseries is a viable option for the entire project, this alternative approach may be adopted. If the decision is made to establish a nursery, the selection of nursery sites will be done in consultation with the respective DFO and affected User Groups to facilitate the establishment of micro-nurseries. Additionally, NEA will procure improved seeds and offer the necessary technical support for the setup and operation of the nurseries. This collaborative approach will ensure that the nursery sites are chosen strategically, considering local expertise and the involvement of relevant stakeholders, while also providing the essential resources and guidance for successful nursery management.

611. Coordination with Stakeholders - The implementation of compensatory plantation activities will be conducted in close coordination with the Divisional Forest Office (DFO). Moreover, the involvement of affected Community Forest User Groups and Leasehold Forest User Groups will be ensured to facilitate the process.

612. Caring of the plantation sites - The project proponent will assume responsibility for the management and protection of the plantation sites for a minimum period of 5 years. During this time, various measures will be implemented to enhance the survival rate of the saplings. These measures include erecting fences to protect the planted areas, regularly providing water to the plants, offering necessary care, and monitoring their progress.

613. After the 5 years period, NEA will hand over the management of the plantation areas to the relevant DFO and User Groups. Prior to the handover *i.e.,* for the 5 years, NEA will be accountable for ensuring the well-being and development of the reforestation areas. Alternatively, NEA may opt to delegate the management of the plantation areas to the local DFO or User Groups, with continued support from the project for designated period of 5 years.

614. The project will maintain regular monitoring of the reforestation sites, and this monitoring will be included in the semi-annual safeguards monitoring reports. This will ensure that the progress and condition of the reforested areas are regularly assessed and reported on. In the event of any loss of trees and saplings, immediate action will be taken to replace them with new saplings. This proactive approach will ensure that the reforestation efforts remain consistent and that any gaps in tree coverage are promptly addressed to maintain the intended objectives of the project.

615. Tree trimming - Maintenance activities, including tree trimming in the RoW, will be performed manually using human labor, and handheld equipment. The selection of trees to be trimmed will be done in the presence and with the approval of the concerned DFO and User Groups representative. This collaboration will ensure that the necessary vegetation management is conducted with careful consideration for the forest conservation.Tree trimming in the RoW will be scheduled outside of the bird breeding season, particularly considering the vultures' breeding season from January to March. In these areas, trimming of tree will be carried out in the presence of and under the supervision of ecologists, ensuring that the activities are conducted with sensitivity to the ecologic al needs and breeding cycles of the local bird species.

616. Estimates of the compensatory plantation - In accordance with the regulatory procedures, the project will adhere to the Standards and Work Procedures Regarding the Use of National Forest Areas for Project of National Priority 2076, Forest Act 2076, and Forest Regulations 2079 to appropriately compensate for the acquired forest land and the trees felled from community forests.

Table 114: Compensatory plantation and afforestation cost

Particulars	Rate	Total Cost [NPR]	Remarks
Total tree to be lost from forested area	46,100 trees will be felled		Tree loss estimation - tower installation, construction activities, and tensioner/puller placement at every 4 km of TL route which occupies at least 150 m in length and 46 m width with a tree density of 255 based on the baseline data.
No. of trees for compensatory plantation, at 1:10 ratio	461,000 seedlings to be planted		
Cost analysis of compensation plantation consisting of seedlings, transportation, land preparation	NPR 300 per sapling	138,300,000.00	NPR 300 X 461,000 seedling
Compensation cost for the 724.89 ha of permanently acquired forests	NPR 16,53,750/ ha	1,198,786,838	The rate of high-quality forest of Terai, Chure, and inner Madhesh is NPR 16,53,750 per ha in accordance with the Schedule 1 of the Standards and Works Procedures for the Utilization of National Forest Areas for Projects of National Priority 2076.
Afforestation Tree Count for 775.69 ha of permanently acquired land	1,159,824 seedlings		The replacement site will have a plantation rate of 1600 seedlings per ha, covering 724.89 ha of permanently acquired forest area.
Cost for afforestation plantation (including seedling cost and transportation, land preparation, etc.) in the replacement forest	NPR 300 per sapling	347,947,200	NPR 300 X 1,159,824 seedlings
Caring of saplings for 5 years (including caring, weeding, watering, watching, etc.)	NPR 150 per sapling	243,123,600	NPR 150 X (461,000 + 1,159,824) seedlings =
Felling of trees including transportation.	@ NPR 5000	230,500,000.00	NPR 5000 X 46,100 trees
Total cost (NPR)		2,159,817,462	
Total cost (USD)	(USD 1= NRs 130.97)	16,490,933	

617. The estimated compensation cost has been calculated according to the existing provisions as mentioned above. As the GoN is contemplating ways to optimize the cost of compensation related to forest resources, it is possible that these costs will need to be adjusted in accordance with the updated regulations.

Conservation initiatives and minimization of forest fragmentation

618. The removal of trees and vegetation will have adverse effects on the ecological functions, habitat integrity, and biodiversity of the forest, leading to a quantitative degradation of the ecosystem. Thus, the following measures will be carried out to prevent and/or minimize such forest degradation.

619. Maintain tree and vegetation within RoW - The installation of towers and substation will necessitate the clearance of forests at the designated sites. However, in the case of the transmission line, there is a possibility of preserving trees and vegetation to a certain extent. As per the Electricity Regulations, there are specific requirements to maintain vertical clearance between the conductor and tree canopies, which is recommended to be about 7 m, and additionally horizontal clearance of about 6 m for 400 kV line. These regulations allow for the preservation of trees within the RoW and the maintenance of ground vegetation beneath the wires.

620. Consequently, the project will take measures to maintain the ground vegetation beneath the wires and preserve trees located beyond the specified horizontal clearance limits. This approach will minimize forest fragmentation and ensure that vegetation and trees can be conserved with the RoW. Be adhering to these guidelines, the project can strike a balance between infrastructure development and environmental preservation, reducing the impact on the forest ecosystem.

621. Strictly prohibit cutting/ trimming of trees outside RoW - During the process of clearing, special attention will be given to ensure that tree outside of RoW are not cut and/or trimmed. Clear instructions will be provided to the contractor to exercise vigilance and avoid unnecessary tree removal. Additionally, the contractor will be directed to take care of the ground vegetation to maintain the biodiversity of smaller life-forms.

622. Conservation of surrounding forests - The project acknowledged the importance of conserving the surrounding forest areas, particularly thinly populated sites. Priority will be given to expanding forest growth and promoting the conservation of these areas. By emphasizing the preservation of trees, vegetation, and biodiversity, the project aims to strike a balance between infrastructure development and ecological sustainability.

Provision of alternatives to firewood and timber

623. The collection of firewood, timber, and illegal gathering of NTFP by the construction workers in the surrounding areas can significantly contribute to forest degradation. To prevent such activities, the following actions are proposed:

624. Alternative sources of energy available - The contractor will be responsible for providing suitable workers accommodation that meets the standards, including cooling and heating facilities and proper meal arrangements. This initiative aims to discourage workers from engaging in activities that are prohibited, such as unauthorized collection of firewood.

625. To further support this effort, the contractor will ensure the availability of alternative fuel sources, such as kerosene or LPG, which will be stored safely. These alternative fuel sources will be provided for common kitchens and heating purposes in the worker accommodation. By offering alternative fuel options, the reliance on fuelwood will be minimized, reducing the demand for firewood, and promoting sustainable practices.

626. By implementing these measures, the project aims to create an environment where workers have access to suitable accommodation and alternative fuel sources, discouraging them from engaging in activities that contribute to forest degradation. This approach supports the preservation of the forest ecosystem and encourage sustainable practices.

627. Awareness programs – Forest and Wildlife Conservation - Comprehensive awareness programs will be conducted for the working personnel to educate them about the importance of the forest environment and the significance of maintaining a health ecosystem. These programs will emphasize the need to minimize the use of firewood, timber, and other forest products through sustainable practices.

Table 115: Proposed awareness program – Forest and Wildlife Conservation

Nature of awareness program	Target group	Duration of training	Cost	No. of trainings	Remarks
Forest and Wildlife Conservation	Construction workforce, project staff, CFUG	One week	NPR 600,000/ District Total 24,00,000 for 5 years USD 20,000	Twice a year	The cost includes patrolling the project site for checking illegal hunting and poaching

628. Enforcement of rules and regulations - Strong rules and regulations will be enforced, particularly for the construction workforce. Strict measures will be implemented to deter and penalize individuals who violate these rules. The contractual agreements with the workforce and staff members will include clauses specifying the consequences of rule violations, including potential job dismissal.

629. Workers will be strictly prohibited from entering forest areas outside of their designated working hours unless they are locals. This measure aims at minimizing human disturbance and protect the integrity of these areas.

630. Construction workers will be strictly prohibited from cutting fuelwood or timber. This regulation aims to prevent unauthorized logging and depletion of forests.

631. The purchase, sale, and use of firewood, timber, and NTFP by construction workers will be strictly prohibited. Additionally, activities such as hunting and poaching will also be strictly prohibited. These measures aim to prevent the illegal exploitation of forest resources.

Protection species of conservation significance

632. According to the Forest Rules, compensatory plantations are mandatory for every felled tree in specific rations. For common trees, the ratio is 1:10, while for the protected species, ratio is 1:25. In addition to these compensatory plantations, the project can also contribute to the conservation of protected species like Sal, Satisal, and Bijay Sal in forests of the project districts in collaboration with the community forest, collaborative forests, and Divisional Forest Office. The cost for the compensatory plantation of protected species is included in the previous section.

633. Germinating Sal tree seeds in nursery can be challenging due to their recalcitrant nature (Sinha & Pandey, 2020). This means that they have a very short period of viability and must be germinated quickly after harvesting. As a result, Sal tree seedlings are typically not developed in nursery. However, nursery development is feasible for seedlings of Vijay Sal and Sati Sal. There are several other hardwood species that can be planted as substitutes to Sal. These include teak, mahua, Sheesha, and rosewood. These species have relatively similar growth rates and timbers qualities to Sal, and they can be more easily germinated in the nursery.

634. Moreover, the project takes into consideration the conservation of ground flora, including shrub and herb species of conservation significance, such as orchids. To ensure their survival and multiplication in their natural habitats, a translocation program is recommended. These species will be relocated to suitable habitat conditions in nearby areas part of ex-situ conservation efforts (Rajbhandari, 2014). Examples of suitable locations for translocation include nearby botanical gardens like Dhakeri Botanical Garden in Banke and Banke and Bardia National Parks. These protected areas provide appropriate facilities and resources for effective ex-situ conservation practices. About USD 20,000 will be allocated for translocation and ex-situ conservation of orchids and other ground vegetation.

635. By following these guidelines and initiatives, the project aims to mitigation the impact of tree felling, promote biodiversity conservation, and contribute to the sustainable management of forest resources.

Safety from forest fires

636. Forest fires pose a significant threat to the Terai forests, with both natural and deliberate causes contributing to their occurrence (Kunwar, 2006) (Parajuli, Manzoor, & Lukac, 2023). The implementation of TL may increase the incidences of forest fires in the area. To mitigate this risk and protect the forests, the following measures will be implemented.

637. Firebreaks and clearing - Creating firebreaks by clearing vegetation in strategic locations will help prevent the spread of fires. These areas will be carefully selected and maintained to effectively contain and control potential fire incidents. In collaboration with the DFO and user groups, these fire break lines will be constructed, for which a budget of USD 20,000 will be allocated.

638. Early detection and rapid response - Establishing a robust early detection system will be crucial in identifying and prompt response. The project will collaborate with the initiatives of ICIMOD and Department of Forest Research and Survey on forest fire detection and monitoring system to be implemented in the project districts. The project will support respective DFO and User groups in strengthening their capabilities in fighting forest fire. A budget of USD 30,000 will allocated for this purpose.

639. Public awareness and education - A comprehensive awareness programs will be implemented to educate not only the workforce but also local about the severe consequences and unpredictable losses associated with forest and vegetation degradation. The contractor will be responsible for installing informative signages throughout the project area, emphasizing preventing forest fires. Additionally, in collaboration with the DFO, the project will organize training workshops to enhance awareness among the workforce and local communities.

640. The annual training program of 3 -5 days in each district, in close coordination with DFO, will be carried out. A budget of USD 12,000 will be allocated for this purpose.

641. By implementing these initiatives, the project aims to foster a culture of environmental responsibility and enhance the understanding of the local population regarding the crucial role forests play in sustaining ecological balance and livelihoods.

Wildlife Environment

642. The cost effective and pragmatic mitigation and enhancement measures are suggested in this section to curtail potential adverse impacts and enhance beneficial impacts identified during the study. Mammalian fauna will be more vulnerable during both phases of the project implementation, particularly, from habitat loss, poaching and project related disturbances. Under ADB Loan SASEC Road Improvement Project from Narayanghad to Butwal several animal passages have been designed along the East West Highway. There are altogether 12 such passages designed from Sambar, Jackal, Wild boar, Leopard, Spotted Deer to Blue Bull. The alignment of the project TL between Butwal to New Butwal SS falls north of these passages. They are approximately 378m to 3.5km south the power line. Moreover, there are certain section of the alignment that traverses along potential wildlife corridors between AP 51 to AP 55 (2.7km at Shivraj Municipality of Kapibastu District) of which (39% is within 100m, 24% between 100-200m and 10% beyond 500m from East West Highway), AP 23B to 24A of Sainamaina Municipality and AP12 to AP12G of Butwal Sub Metropolitan City (although here the alignment in forest is very close within 30 to 500m from highway and urban area). Likewise, 2km from AP 28 to AP 29 of the alignment traverses forest categorized with high biodiversity areas (40% in Sainamaina Municipality of Rupadehi district and 60% in Banganga Municipality of Kapilbastu District). It is obvious that overall protection of the local herpetofauna and mammals is crucial to maintain the natural environmental balance of the area. To maintain the same following mitigation measures are suggested.

643. The following mitigation will be adopted:

- Detailed design will have minimum height from ground level 6.1 m sufficient for safe passage fauna (*i.e*., the lowest point of a conductor between two adjacent towers to be above 6.1m from the ground)

- Detailed design to include fitting of transmission towers in forest areas and within 500m radius of them with anti-climbing devices for primates (langur)

- Emergency fauna rescue and handling procedure, including contacts of protected area management, nearest veterinary *etc*.

- Trees are to be cleared during non-breeding season - vultures breeding season (Jan March), if this not possible due to weather restrictions on access, trees cleared during breeding season to be

checked by ecologist for nests prior to clearance, if present harvesting to be postponed until the young have fledged.

- It will be ensured that no workers are carrying local hunting equipment such as catapult while entering into the forest.

- Prior to excavation for tower foundation, the area will be checked by ecologists for any signs of burrows *etc*. If determined to be occupied, only manual digging under the supervision of the ecologists will be permitted.

- Excavated pits will be robustly fenced or covered to prevent fauna accidentally falling in, further an escape ramp will be provided to allow their escape – particularly in protected and forest areas.

- Keep written record, supported by photographs, of any animal casualties, including a cause of death if known.

- In wet conditions, minimize use of heavy machinery and consider temporary installation of removable steel plates to protect soil and its vegetation cover.

644. Regular visual and technical inspection of condition and maintenance as required to be carried out by NEA quarterly for transmission lines and distribution lines to check: minimum vertical clearance (6.1m) and the anti-climbing devices are maintained *etc*.

645. During inspections of power lines count fauna carcasses encountered, if any, record species and assess cause of death (e.g., electrocution/collision).

Conservation of wildlife habitat

646. To minimize the negative impacts on local wildlife habitat, specific measures should be implemented during the tree felling.

647. Restriction of tree felling - The project aims to restrict tree felling along the RoW to maintain the trees and vegetation while ensuring the necessary vertical and horizontal clearance between the top of the tree canopy and conductor. To achieve this, the height of the towers has been increased. Instead, the focus is on lopping and topping of high-growing or potentially high-growing trees and poles. By removing specific parts of the trees while preserving the main structure, the project aims to avoid complete tree removal and maintain habitat continuity.

648. This approach is beneficial in preventing forest fragmentation, as it allows for the retention of tree habitats that are essential for local wildlife.

649. Manual clearing of the trees and excavation **-** Clearing of trees should be done manually, using methods that cause minimal disturbance to the surrounding vegetation. The study carried out by Spicer, Mellor, & Carson (2020) have highlighted importance of ground vegetation – herbs and shrubs, playing a crucial role in maintaining biodiversity. These vegetations provide food sources, nesting sites, and cover for various wildlife species. Therefore, it is essential to preserve the herbs and shrub in the RoW.

650. Additionally, before excavation begins for the tower foundation, thorough inspections will be conducted by ecologists to identify any signs of burrows or habitats for burrowing animals. If occupied burrows are found, only manual digging, under the supervision of the ecologist, will be permitted to ensure the safety and protection of burrowing animals.

651. Excavated pits will be securely fenced or covered to prevent accidental falling of fauna. Additionally, an escape ramp will be installed to facilitate the safe exist of animals.

652. Local workforce preference **-** To mitigate the impact on natural resources and foster community involvement, the project will prioritize hiring local individuals from the surrounding area for unskilled jobs. This approach not only reduces the overexploitation of natural resources but also ensure economic benefits for the local community.

653. Strict instructions and penalties **-** The workforce engaged in the project will receive regular instructions and included in awareness program "***Forest and Wildlife Conservation***" emphasizing the significance of minimizing damage to local wildlife habitat. Strict penalties will be imposed on individuals found engaged in activities that harm these habitats, serving as a strong deterrent and promoting responsible behaviors. The cost for this program is mentioned in forestry section.

Prohibit illegal hunting and poaching

654. Wildlife poaching and illegal hunting poses a potential threat once the project begins its activities driven by the demand for meat and trophies. Local game hunters may also engage in and encourage illegal activities among the workforces. Given that the project area is home to endangered wildlife species, it has qualified as a critical habitat based on the IFC PS6 on Biodiversity Conservation and Sustainable Management of Living Resources and ADB SPS 2009. This designation emphasizes the need for the project to exercise extra caution and responsibility in addressing this issue.

655. Enforcement of existing legislation on wildlife conservation **-** To prevent wildlife poaching, it is crucial to enforce existing laws and regulations in the project area. Some of the important legislations that are relevant are to wildlife conservation are reviewed in chapter 4. In Nepal, the primary wildlife conservation regulation is the National Parks and Wildlife Conservation Act, which prohibits hunting, poaching, and the trade in endangered species. The act also specifies the punishments for violating its provisions, which include fines, imprisonment, or both. Furthermore, Nepal has ratified CITES, which has been proved as an important instrument in regulating the trade in endangered species.

656. Collaboration with line agencies **-** The project will collaborate with relevant lines agencies and communities to ensure the enforcement of these measures. Some of the relevant agencies are Divisional and Sub-Divisional Forest Offices of the project districts, User groups of affected community forests and collaborative forests at the project site. Furthermore, coordination with Department of National Parks and Wildlife Reserve and Department of Forests and Soil Conservation will also be coordinate in this regard.

657. Anti-poaching clause in contracts **-** The contractual agreements with contractors, sub-contractors, and project employees will also include an ***anti-poaching*** clause, with legal implications for non-compliance. This contractual provision acts as a deterrent and reinforces the project's commitment to wildlife protection.

658. Awareness raising – Forest and Wildlife Conservation - Creating conservation awareness among the local community, laborer, and contractors, and project staff is essential, which will be ensured by participating them in the "***Forest and Wildlife Conservation***" awareness program. The training manuals should be developed that incorporates existing wildlife rules and regulations, importance of biodiversity conservation, threats to local herpetofauna and mammals, forest fire control, and the responsibility of project implementing agencies, institutes, and individuals. Additionally, the project will also prepared posters, pamphlets, and signboards in Nepali to effectively communicate and generate conservation awareness.

Minimize disturbance to wildlife

659. Labor-based construction methods are generally considered to have fewer negative impacts on wildlife compared to the use of heavy machinery. However, it is acknowledged that certain construction activities may require the use of heavy machinery. In such cases, it is crucial to implement proper management practices and take necessary precautions.

660. Management of noise and vibration - By implementing effective management practices, such as establishing buffer zones, adhering to designated construction timings, and utilizing best practices for noise and vibration control, the potential disturbances caused by heavy machinery can be minimized. Additionally, regular monitoring and compliance with environmental regulations and guidelines are essential to ensure that construction activities do not pose significant risks to wildlife.

661. Avoid use of floodlights - To minimize disruption to wildlife, it is advisable to avoid nighttime construction activities and the use of artificial lighting whenever feasible. Nocturnal animals are particularly sensitive to light disturbances, which can disrupt their natural behavior patterns and even affect their reproductive cycles. Studies have shown that excessive artificial lighting can interfere with the navigation and foraging behaviors of nocturnal birds, bats, and insects (Gaston, Bennie, Davies, & Hopkins, 2012). These disruptions can have cascading effects on the entire ecosystem, impacting the populations of various species and altering ecological interactions.

662. Coordination with stakeholders - Close coordination with the DFOs and user groups of community forests and collaborative forests will be established during construction. This collaboration will ensure that construction activities align with forest management plans and conservation objectives.

Protection of the Chure Conservation Area

663. Since the transmission line alignment predominantly traverses the Chure Conservation Area, it is imperative to implement thorough and comprehensive mitigation measures to safeguard the environmental integrity of the area.

664. Consultation with President Chure Terai Madhesh Conservation Development Board - NEA will engage in consultations with the President Chure Terai Madhesh Conservation Development Board to ensure alignment with their management plans. This process involves obtaining written confirmation from the conservation area regarding two key aspects:

- NEA will seek clarification on the specific actions required to ensure that their construction works are in accordance with the Chure conservation management plans. The step aims to ensure that

the NEA's activities are carried out in a manner that is consistent with the conservation area's plans.

- NEA will explore opportunities to support and enhance the conservation aims of the Chure Conservation Area. This collaboration may involve identifying ways in which NEA can contribute to the promotion and improvement of conservation efforts within the area. It will seek to establish a mutually beneficial relationship with the conservation development board.

665. Contractor's obligations towards environmental conservation - The contractor must adhere strictly to the requirement of situating all temporary construction facilities away from forested areas. Furthermore, these facilities should be situated beyond the boundaries and buffer zones of existing or proposed protected areas, key biodiversity areas, and forested regions.

- Contractor to undertake alignment review during detailed route survey for the TL, to consider re-siting of angle point towers such that routing will avoid the sensitive areas within the Chure Conservation Area, and the cutting of the tall species of trees will be minimized.

- The contractor might have to review the alignment, which will involve considering the repositioning of angle point tower to avoid sensitive areas within the Chure Conservation Area.

- Additionally, the contractor will make efforts to minimize the felling of trees.

666. Collaboration with President Chure Terai Madhesh Conservation Development Board (Conservation Board) - NEA and the contractor will maintain regular communication and coordination with the Conservation Board throughout the construction period. This will involve providing timely updates on the progress of the construction activities. By maintaining an open line of communication, NEA and the contractor aim to ensure that the Conservation Board is well-informed and can actively participated in the decision-making process.

667. In parallel with the construction works, NEA will implement the agreed-upon promotion and enhancement measures. A dedicated amount of USD 50,000 will be allocated for this program. The purpose of this allocation is to support and carry out initiatives that promote the well-being and conservation of the Chure Conservation Area while construction activities are underway.

Operational Phase

Prevent pressure on the forests

668. The implementation of TL project will inevitably increase accessibility to the surrounding forest areas, leading to potential pressure on these ecosystems. To mitigate such impacts, the following measures will be implemented by supporting the DFOs and user groups from the project area:

669. The project will support to undertake afforestation in the project area, particularly in the immediate vicinity of the construction sites. This proactive measure will help minimize the impact on existing forests and contribute to the restoration and expansion of forest cover.

670. The project will support to undertake a robust vigilance to prevent and deter illegal hunting and poaching activities.

671. The project will support to build awareness amongst stakeholders and local communities about the value of forests and the importance of conserving wildlife. These programs will highlight the ecological importance of the forest ecosystem and foster a sense of responsibility and stewardship towards their conservation.

Conservation of plant of conservation significance

672. During the operation of the project, special attention will be given to nurturing afforested tree species, particularly those under protection category. These trees will be prioritized for nurturing and care over a period of 5 years, after which they will be handed over to DFOs for long term management. The cost for management of these sites have already been included above section.

673. The protected species that will be cleared during the construction include Sal, Sati Sal, and Vijaya Sal. Among these species, Sal is the most abundant in all the surveyed plots. As a compensatory measures, seedlings will be planted following a ratio of 1:10 for each felled tree.

674. "Germinating Sal tree seeds in nursery can be challenging due to their recalcitrant nature (Sinha & Pandey, 2020). This means that they have a very short period of viability and must be germinated quickly after harvesting. As a result, Sal tree seedlings are typically not developed in nursery. However, nursery development is feasible for seedlings of Vijay Sal and Sati Sal. There are several other tree species of indigenous origin that can be planted as substitutes for Sal such as Saaj, Seto Siris, Baanjhi, Barro, etc. These species have relatively similar growth rates and timber qualities to Sal, and they can be more easily germinated in the nursery. Similarly other tree species that can be recommended for plantation are Harro, Amala, Sisau, Khayar, Pyaar, Tindu, Kusum, Chilaune, Rajbriksha etc. that are equally useful for ecosystem protection and environmental regeneration".

Conservation of biodiversity in the TL corridor

675. The conservation of biodiversity along the TL corridor is a priority, and measures will be taken to ensure its preservation. Attention will be given to this aspect, and clear instructions will be provided to the relevant personnel involved in the project. Coordination will also be established with DFO and user groups to perform duty.

676. One of the actions taken to maintain biodiversity is the periodic trimming of tall trees, which will also be necessary to maintain vertical and horizontal clearance between trees and conductors. This practice will help to create a balanced ecosystem by allowing light to reach the lower vegetation layers and promoting the growth of understory plants. By carefully selecting which to be trimmed and when to do so, the project aims to minimize the impact on the overall biodiversity while also addressing safety concerns, such as preventing trees from interfering with power lines.

677. Furthermore, unauthorized encroachment by outsiders will be actively discouraged. This includes preventing any unauthorized activities, such as illegal logging, hunting, or land encroachment, which can have detrimental effects on the biodiversity and ecological balance of the corridor.

Minimize loss and disturbance to wildlife and their habitat

678. The maintenance workers should be strictly instructed for following safety felling activities along the ROW.

679. Restricted tree and vegetation clearance - The tree felling activities should be restricted to lopping and topping of high growing trees and poles. This approach allows for the removal of certain parts of the trees, while retaining the main structure, reducing the impact on wildlife habitat. Furthermore, no ground clearing of the vegetation up to a height of one and half meter should be carried out to preserve important food sources, nesting sites, and cover for wildlife species.

680. Educate M&O personnel on wildlife sensitivity of the project area - It is crucial to provide instructions to maintenance workers about the value of wildlife habitat and emphasize the need to avoid damaging it during maintenance activities along the RoW. According to ADB (2009) the maintenance workers can be educated about the presence of nesting birds or sensitive plant species in the area and trained on how to identify and avoid disturbing them during their work. By promoting responsible practices, the project can contribute to conservation of wildlife and their habitat.

681. To minimize the impact on breeding vultures and their nests, the trees cutting will be scheduled during the non-breeding season (Jan - March). However, if weather conditions restrict access during this period, the clearance of trees during the breeding season will only proceed after thorough checks by an ecologist for the presence of nest. If nests are found, cuttings activities will be postponed until the young vultures have fledged.

682. Vertical clearance for safe passage for wildlife - The project will maintain a minimum vertical clearance of 7 m between the conductor and tree canopy ground. This gap ensures a safe passage for fauna by minimizing the risk of wildlife collisions or obstructions caused by the project infrastructure. For example, this height requirement ensures that larger animals such as deer or elephants, can pass underneath the conductor without risk of collision or entanglement. It also allows for the safe movement of arboreal species like moneys or birds that may use the elevated space for navigation or nesting.

683. Ensuring the safety and unhindered movement of wildlife is a paramount concern in the Lamahi Bottleneck region, as well as in other areas identified as potential wildlife crossing zones within the project's Right-of-Way (ROW). To address this concern comprehensively, the project is committed to strictly upholding vertical clearance standards in these critical regions.

684. Vertical clearance, in this context, refers to the vertical distance between the ground and the lowest part of the infrastructure, such as transmission lines or any other structures. This clearance is essential to prevent any inadvertent collisions between wildlife, particularly large birds like vultures or raptors, and the overhead infrastructure. By maintaining an adequate vertical clearance, the project aims to mitigate the risk of harm to wildlife while they move across their natural habitats.

685. Additionally, the preservation of vegetation within the ROW is an integral component of these conservation efforts. Vegetation, including trees, shrubs, and other forms of flora, plays a crucial role in maintaining ecological connectivity and providing cover and sustenance for various wildlife species. By ensuring that vegetation is retained within the ROW, the project helps to maintain the natural pathways and habitats that facilitate wildlife movements. This approach prevents any undue restriction on wildlife, allowing them to continue their vital migrations and activities unimpeded.

686. Anti-climbing devices - This measure aims to prevent primates from climbing the transmission towers, which can pose risks to their safety and disrupt the functioning of the transmission lines. For example, anti-climbing devices can include physical barriers, such as spikes, or mesh covers, that make it difficult for langurs to climb the towers.

687. Emergency fauna rescue - The project will support the DFOs to establish an emergency fauna rescue and handling procedure to ensure the prompt and appropriate response in case of wildlife incidents or emergencies.

688. Monitoring and record keeping - Maintain written records, accompanied by photographs, of any animal casualties encountered, including the cause of death if known. This documentation helps in understanding the impact on wildlife and contributes to monitoring and mitigation efforts.

689. Regular visual and technical inspections of transmission line will be carried out as required by NEA on a quarterly basis. These inspections aim to ensure compliance with minimum vertical clearance and maintenance of anti-climbing devices.

690. During power line inspections, notes will be taken if any fauna carcasses encountered and record the species as well as assess the cause of death, such as electrocution or collision or others. This information provides insights into potential risks to wildlife and aids in developing strategies to minimize impacts.

Protection of wildlife species with conservation significance

691. The residual impact of electromagnetic fields and collisions with small mammals during flight cannot be eliminated. However, measures can be taken to minimize the risk of collisions by implementing proper design practices and ensuring that trees along the RoW are maintained at an appropriate height.

692. Installation of barricades and anti-climbing devices - To prevent reptiles such as lizard and snakes and mammals such as monkeys, squirrels, and yellow-throated martens from climbing the pylon structures, barricades should be installed around the tower foundations and substations sites to divert them. Additionally, the lower sections of the tower structures should be equipped with thorny protuberances to deter arboreal wildlife from climbing. These measures help protect wildlife and prevent potential disturbances to their natural habitats

693. Training and awareness - It is crucial to provide clear instructions to M&O personnel regarding the importance of preservice endangered wildlife. They should be explicitly instructed not to engage in wildlife poaching activities during maintenance works. By raising awareness among the workforce, the project can contribute to the conservation of endangered species and ensure responsible practices

694. During the operational phase it is recommended that NEA work with a recognized NGO in country to develop enhancement measures for the special status tortoise and turtle. The enhancement measures will be further elaborated during EIA disclosure period with the final EIA updated to include the proposed measures.

Residual Impacts

Table 116: Residual Impacts – Flora and Fauna

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	Trees Cutting	High	Compensatory tree planting will reduce impact significance in the longer term to low residual significance.	Low
C	Pressure on forest and non-forest products	Moderate		Low
C	Forest Fires	Moderate	Training of workers will help reduce the potential risk of forest fires, but they cannot be entirely ruled out.	Low
O	Impact on the surrounding forest area due to increased access to the surrounding forest	High	Access to the towers may remain in some places, which will potentially increase access to these areas. Residual impacts will be moderate.	Moderate
C	Spread of non-native or invasive species	Moderate	Management measures should help manage the issue, but it cannot be entirely ruled out. Residual impacts will be low.	Low
C	Reptiles of Concern	High	Although surveys did not identify the presence of reptiles, they may still be present in areas to be disturbed by works. Management measures should help to reduce impacts to these species, but they cannot be entirely ruled out. Residual impacts are low.	Low
C	Loss of Wildlife Habitat	High	As above, management measures should help reduce significance of impacts to low.	Low
C	Wildlife disturbance due to construction activities	Moderate	Given the sensitive environment of much of the NBTL there remains the risk of wildlife disturbance. Residual impacts should however be low.	Low
C	Poaching and deliberate killing of animals	Moderate	Strict enforcement of code of conduct should help manage this issues, but again, poaching cannot be entirely ruled out.	Low
O	Accidents and risk of electrocution of wildlife	Low	Mitigation measures should help ensure there are no significant residual impacts.	Not significant

7.3.2 Avifauna (Vultures)

695. A large vulture movement dataset would be invaluable in understanding potential vulture exposure to the NBTL and associated risks. In addition to the 149 transpondered White-rumped Vultures, BCN is collecting transponder data from ten Slender-billed Vultures. To date, a subset of the White-rumped Vulture data has been made available to ADB for review. Data from the remaining White-rumped Vultures and the Slender-billed Vultures is constrained by data-use agreements with project partners that currently preclude access by ADB; it is likely more data could be made available in the future with adequate safeguards in place.

696. The data reviewed to date are profoundly useful, however, our understanding of vulture movements is limited due to unavoidable shortcomings in the abbreviated dataset:

- Limited Data: of the ~160 transponders, data from just 8 have been reviewed by ADB, together comprising less than 5,000 bird-days of data and fewer than 57,000 fixes.

- Single Species: Only White-rumped Vulture data have been reviewed; Slender-billed Vulture data have not been reviewed.

- Duty Cycle: data reviewed incorporates hourly fixes; more frequent fixes would be invaluable for understanding detailed vulture movements and behavior in the vicinity of the NBTL. The distance between fixes is frequently 30-50 km, so high exposure transmission line crossing locations cannot be identified with confidence.

Potential Impacts

Operational Phase

697. Electrocution - Because the new line will be 400kV, electrocution risks on the line will be minimal due to the large engineering clearances needed for such construction. Vulture electrocution should not be caused by the NBTL.

698. Collision - Transmission Line collision is a known risk for the NBTL alignment. The Lalmatiya, Dang district vulture restaurant where a vulture collided with a 132kV line in 2012 and subsequently died is within 0.6 km of the original NBTL alignment. It is presumed that this incident, plus the collision mortality of a transpondered vulture recorded by BCN (Pers Comm. 2024) are indicative of a larger issue. These two documented power line collision mortalities are likely a subset of a larger number of vulture collision incidents, mostly unrecorded. Avian collisions with power lines often remain undocumented due to:

- Survey Bias: Few power lines are subjected to scientific study. Carcasses from collision are rarely discovered and reported, in the absence of purposeful searches, especially in rural or forested areas with light foot traffic. Transmission collisions rarely cause outages that would result in a reliability-induced patrol or investigation, and inspection and maintenance patrols are infrequent.

- Detection Bias: Carcasses may be difficult to detect because of undergrowth, or because a falling bird's momentum may carry it to the edge of the right-of way, out of the path of the patroller.

- Crippling Bias: birds injured in a collision often seek shelter to hide from predators, actively moving away from the power line and outside the search area.

- Removal Bias: injured or dead birds are sought by scavengers that consume or remove remains. Most carcasses are removed within hours or days of mortality; thus, only repeat surveys at short intervals can provide a realistic estimate of collision mortality.

- Reporting Bias: community members discovering a carcass may not know they should report the incident or to whom, and power company employees may choose not to report a carcass if doing so will interrupt other activities or create complications.

699. In the absence of proactive repeated carcass surveys at short intervals on existing transmission lines in the region, it is not possible to predict the scale of vulture collision risk with the NBTL, nor to provide a quantitative estimate. However, any mortality to a critically endangered species causes population-level impacts and should be considered "high" in magnitude. Because vultures are highly mobile, a collision mortality might directly affect an established roost or nest site 100 km away or further, thus potential impacts are "regional" in extent. Collision risk will persist for the many-decade life of the NBTL, meaning impacts will be "long-term" in duration. Vulture collision impacts from the NBTL, if unmitigated, would be classified as "highly significant."

Cumulative Impacts

700. The NBTL is only one of several high voltage 400kV transmission lines that will be built to create and East-West energy backbone in Nepal. Transmission taps from the NBTL and related expansion of the distribution grid, combined with the other backbone transmission lines will cause foreseeable additional vulture impacts. Cumulative and induced impacts can be effectively mitigated by elevating NEA's avian-sensitive practices in important habitats for vultures and other at-risk species.

Impact summary and assessment of significance

701. The following table provides an assessment of the significance of potential impacts on birds before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 117: Impact Significance

Component	Potential Impact	Project Phase	Magnitude	Extent	Duration	Significance
NBTL	Collision	O	H	R	LT	High

Mitigation and Management Measures

702. To reduce vulture collision risk, it is imperative to mitigate the NBTL. Based on consultations with BCN and IUCN/RSPB species experts, NEA commits to adjusting the NBTL alignment to reduce vulture

exposure and also marking the overhead static wire (OHS) and Optical Ground Wire (OPGW) to improve visibility and detectability for approaching vultures and other birds.

703. **Localized Realignment -** During the consultation process, BCN and IUCN/RSPB species experts expressed concern that the original NBTL alignment would approach the Lalmatiya, Dang district vulture restaurant within 0.6 km. A transmission line in close proximity to the feeding station would pose elevated risk to vultures as they approach and depart the facility. Because carcasses are provided for consumption at ground level, vultures might pass through the elevation band obstructed by conductors, OHS, and OPGW. Additional distance between the NBTL alignment and the feeding facility will reduce collision risk and allow a longer glide path to safely land and a longer runway to safely gain altitude when departing the restaurant. In the professional opinion of BCN and IUCN/RSPB species experts, the distance between the NBTL and the feeding station should be no less than 1 km.

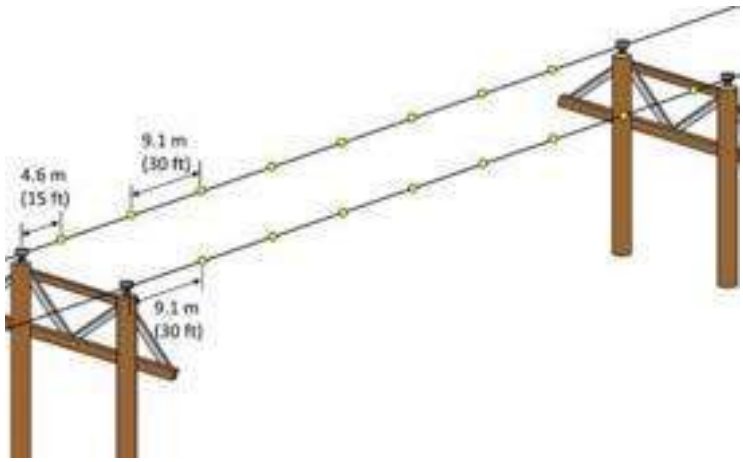
704. To minimize impacts through design, NEA has committed to rerouting the alignment in the vicinity of AP69 such that the distance between the NBTL and the feeding station is no less than 1 km. Similar routing adjustments also will be made Ashnariya nesting colony – as described in the Analysis of Alternatives section of the EIA. The distance to the Kaptangunj nesting colony has not been re-routed further north from its present location on the advice of BCN who were concerned that moving to a higher elevation would have more significant risks to vultures – however, the distance between the NBTL and the nesting site is more than 1km.

705. **Wire Marking -** The primary strategy to reduce avian-power line collisions on existing lines is to improve line visibility for birds (Beaulaurier 1981). Line marking is a tool that typically reduces, but does not eliminate, collision risk. The most robust line-marking studies normalize the number of collision fatalities by the number of bird crossings. The average mortality reduction after marker installation was 78% in such studies, with reports ranging from 55% to 94% (Barrientos et al. 2011). A more recent meta-analysis included grey literature and found that line marking reduced collisions by about 50%, on average (Bernardino et al. 2019).

706. Wire marking factors that are believed to enhance effectiveness include contrast (adjacent light and dark components), phosphorescence and reflectivity, and motion. Although human vision and bird vision are fundamentally different (EPRI 2012, 2016), drone footage suggests high contrast dramatically improves marker conspicuity. Some line markers integrate phosphorescent ("glow-in-the-dark") and reflective elements to improve visibility under low-light conditions, which are associated with elevated avian collision risk (Murphy et al. 2016). Many bird species are keenly attuned to motion (Martin 2012), and researchers agree that it enhances visibility (Martin 2011), however, motion has not been proved to enhance marker effectiveness, and line markers with swivels and pivots tend to have a shorter service life.

707. Line markers should not be used on high voltage conductors (e.g., 400kV) as they can cause corona and negatively impact power quality (Hurst 2004). Wire markers are not necessary on bundled conductors because the wire spacers are highly conspicuous. On high voltage transmission lines, wire markers should be deployed on the OHS and/or OPGW. On tower designs with a single OHS or OPGW, markers should be spaced at 5 m intervals. On designs with both OHS and OPGW, the spacing on each wire should be ~10 m, but staggered, so an approaching bird sees markers every ~5 m.

Figure 123: Schematic showing wire spacing concept for dual overhead wires.



708. Despite imperfect effectiveness, studies demonstrate that line marking results in meaningful reductions in avian collision mortality. Reducing vulture collision risk to the extent practicable is fundamental to securing ADB project financing. Therefore, NEA has commited to marking the OHS and OPGW at an effective interval of 5 m for the entire length of the NBTL. Markers shall be appropriately sized by wire diameter for retention. Markers shall be high contrast, with reflective and phosphorescent components, and manufactured by either Power Line Sentry (Wellington, Colorado, USA) or by P&R Tech (Beaverton, Oregon, USA) due to their established track record of effectiveness and durability.

709. Impacts Assessment of Mitigated NBTL - The impact of localized route realignment near the Lalmatiya vulture restaurant and at nesting colonies is expected to reduce project collision risk, though the benefit cannot be quantified. Wire marking is expected to reduce the number of vulture collisions by 50% (Bernardino et al. 2019). Despite these avoidance and mitigation actions, some level of collision mortality is likely to persist. Because collision mortality would affect critically endangered species, the impact magnitude would remain “high;” realignment and wire marking would not change the spatial extent and duration of impacts. Nevertheless, because these actions would be expected to reduce the overall number of vulture collision mortalities by greater than 50% it is reasonable to categorize the overall impact of the NBTL incorporating impact avoidance and mitigation as “moderately significant.”

Refining Mitigation Recommendations

710. During the consultation process, BCN and IUCN/RSPB species experts posited that additional study could benefit the project by: a) improving the understanding of vulture utilization of habitats within the project area and b) improving our understanding of vulture behavior in the vicinity of transmission lines. NEA has committed to funding further studies, beginning immediately, to shed further light on these issues and support effective and complete mitigation for critically endangered vulture species.

711. Transponder Study Support - NEA has committed to providing the funding necessary to fully support the purchase, deployment, and operation of 20 additional vulture transponders by BCN for a

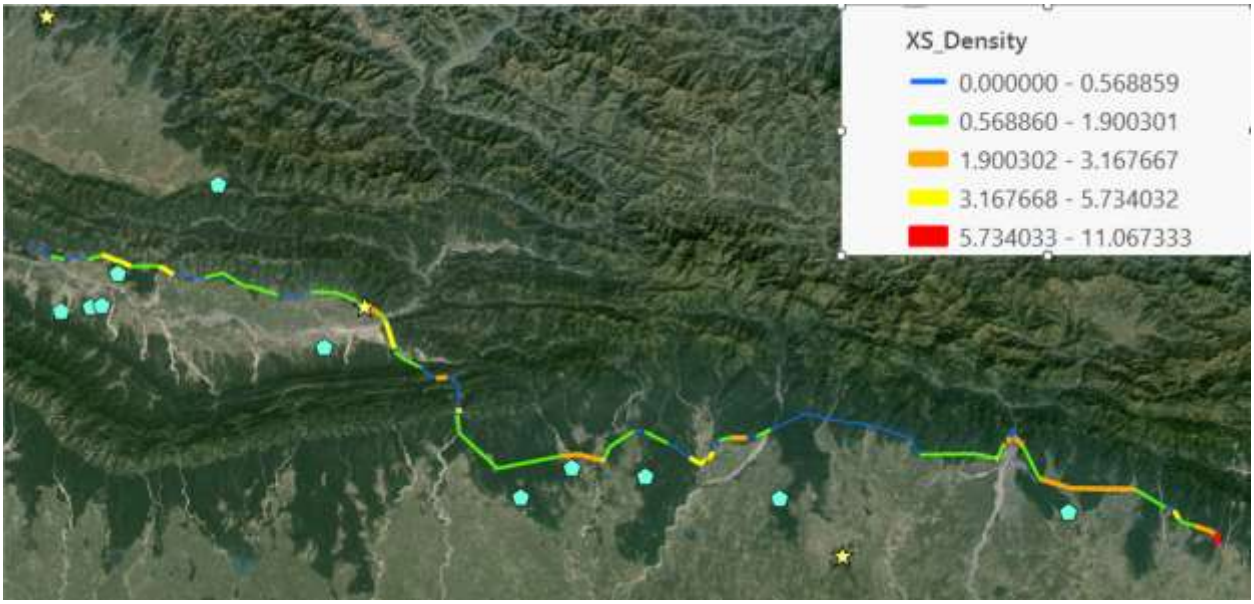
period of two years. These will be fitted on birds in the project area. NEA also will provide funding to support the analysis of all vulture transponder data, including transponders funded by other entities. NEA-funded transponders will be high quality and technically advanced, and capable of providing frequent fixes (high temporal resolution), in order to provide more detailed information on behavior in the vicinity of transmission lines. Transponder specifications and duty cycles will be determined by ADB experts with the assistance of outside consultation, as will procedures to ensure that transpondered vultures improve representativeness of available data (i.e., increased species diversity, and representation of relevant nesting colonies). NEA-funded transponder data and other transponder data accessed will be analyzed by international experts, with a brief report focused on practical learnings that can be used to refine line marking recommendations, micro-siting for specific structures and spans, and inform vulture collision risk assessment.

712. Vantage Point Surveys - NEA commits to funding quarterly vantage point surveys at 12 sites determined by ADB experts in cooperation with species experts. Site selection will include a proactive search for additional vulture feeding sites in the area, such as carcass dumps, abattoirs, and cow shelters. Survey methodology will be adapted for linear transmission line infrastructure in Nepali environments from Scottish Natural Heritage (2017) vantage point survey methodology. The goals of the surveys are to: a) develop a clearer understanding of bird behavior (flight patterns, perching areas) in the vicinity of transmission lines and high use areas such as roosts and feeding sites; and b) assess the degree to which transponder data can be used to develop power of inference, despite known shortcomings. Each site will be surveyed five days per quarter, conducted by two trained BCN technicians for one year. International experts will provide training, support, mapping, and data management/analysis, leading to a succinct summary report of key findings.

713. Use of Study Findings - Study findings may be used to: a) identify additional high use/high exposure areas; 2) refine micrositing, as for the area near the Lalmatiya feeding station and nest/roost sites; 3) focus mitigation in areas where it will be most beneficial and most likely to result in tangible conservation benefits and avoided vulture mortality. Study findings may suggest that the preliminary mitigation recommendations described above are not optimal, and that those funds can be otherwise applied for greater conservation benefit to vulture species.

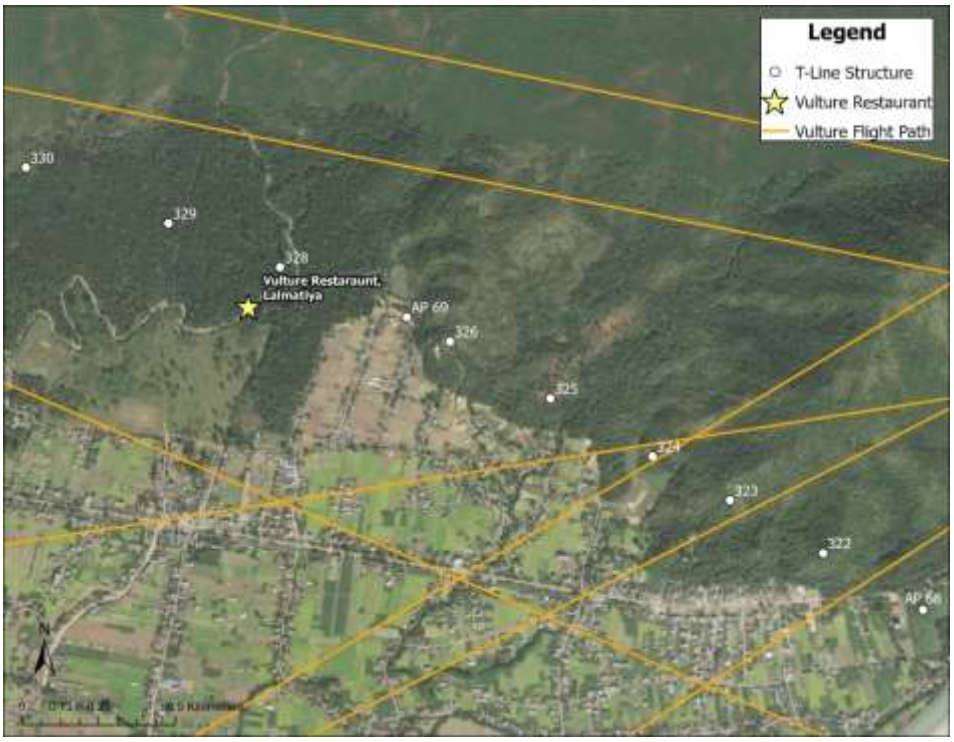
714. For example, a review of data from 8 transponders indicated that the number of vulture crossings of the NBTL alignment varied dramatically. Segments with a high number of crossings per unit length appear to be associated with hydraulic drainages, particularly deltas with high topographic relief (Figure 124). Segments without these features generally show a lower density of crossings. If a much larger dataset indicates that there is extremely low vulture exposure on certain line segments, there may be little conservation benefit to marking these spans. Instead, those funds may be better used in other ways, elsewhere (see residual impact offsets, below).

Figure 124: Vulture crossing density (crossings/km) by line segment based on transponder data from 8 vultures. Restaurants in yellow, nest/roost sites in blue.



715. Transponder data may also help identify previously unknown high vulture use areas. The dataset analyzed to date is not adequate to do so. For example, Figure 125 shows zero fixes at the Lalmatiya vulture feeding site from the 8 transponders available for analysis, and a small number of tracks in the vicinity; however, the community reports that vulture attendance ranges from 100-350 individuals when a large carcass is provided. Additional data from the ~150 transponders not yet analyzed plus the 20 transponders to be funded by NEA may help identify additional concentration areas where direct mitigation through micrositing would be helpful. The appropriate avoidance buffer for the NBTL alignment will be determined from the vantage surveys and transponder data, and may be greater or less than the preliminary 1 km distance determined through initial expert consultation.

Figure 125: Utilization of the Lalmatiya vulture feeding site based on transponder data from 8 vultures; this graphic illustrates the inadequacy of currently available data, as local reports indicate vulture attendance of 100-350 individuals per feeding event at the restaurant.



716. Changes to the preliminary mitigation plan presented above are warranted if NEA-funded studies and ongoing consultation indicate that mitigation funding would provide greater benefit to the species if used in another manner or elsewhere. Such flexibility is essential to ensuring the NBTL causes no net loss in vulture populations. Data driven mitigation is fundamental to meeting NEA and ADB environmental standards and commitments, and additional vulture data collection is a critical component of NBTL project success. **Further, all surveys and data analysis will need to be finalized and this EIA updated with any additional recommended mitigation measures before the commencement of any works.**

717. Post-Construction Carcass Surveys - Because vulture mortality on the NBTL cannot be quantitatively predicted, post-construction carcass surveys will be essential for scaling actual impacts so they can be adequately offset. NEA commits to developing and implementing a post-construction monitoring plan, with the help of international experts, to be integrated in the project CSEMP. Because collision mortalities are projected to be infrequent events, these surveys should prioritize carcass detection through maximizing distance covered, over establishing ongoing collision rates, which would require repeated surveys of the same segment at short time intervals. Likely elements of the plan will include:

- A stratified randomized approach that ensures

a) ongoing monitoring at the highest risk segments (e.g., top 5 segments)

b) strong emphasis on other high-risk segments (e.g., remaining top 30% segments)

c) minor emphasis on low or medium risk segments (e.g., bottom 70% segments)

- Quarterly surveys of 30% of NBTL by length
- Teams of three for each line segment, one technician per wire
- Account for typical carcass survey biases described above, to best international practice, including:

a) Searcher efficiency

b) Detection bias

c) Removal bias

718. Survey results will be analyzed with respect to efficiencies and biases, and used to scale residual impacts on the NBTL, which will then be fully offset by compensatory mitigation in the form of electrocution mitigation for high-risk distribution structures. Surveys will be ongoing for three years, or as determined in consultation with international and national experts.

719. Cumulative Impact Mitigation - NEA has committed to developing and implementing, in consultation with international experts, an avian best practices guidance document to reduce avian risk posed by the NEA transmission and distribution grid in sensitive avian habitats. The guidance document will include avian friendly standards for construction and mitigation, procedures for incident response and reporting, and a discussion of mitigation techniques and approaches. The guidance document will be accompanied by a generalized assessment to identify high value avian habitat for species of elevated conservation concern. Document rollout will include in-person training by international experts and QA/QC of the distribution pole electrocution mitigation completed to date.

Residual Impacts

720. Because line marking is less than 100% effective, some level of vulture collision mortality is anticipated from the NBTL, although the data do not support a quantitative estimate. Meaningful residual impacts that occur, despite the implementation of all practicable mitigation, must be offset to meet the project standard of no net loss of biodiversity. Because two vulture species are critically endangered, any residual mortality must be offset through mitigation of non-NBTL infrastructure.

Offsets

721. The use of compensatory offset mitigation has been used throughout the world to facilitate beneficial projects that cause otherwise-unacceptable impacts to a particular species. For example, eagle take by wind turbines is legally permitted in the United States if it is offset through the prevention of eagle electrocution (i.e. “avoided loss”) on high-risk distribution power poles (Mojica et al. 2022). Conservation offsets must occur at a ratio greater than 1:1 to ensure a margin of safety. That is, offsets must prevent more anthropogenic mortalities than the residual impact of the mitigated

project to ensure *net benefit* to the species, despite the inevitable uncertainties of residual impact scale and offset effectiveness.

722. Electrocution Mitigation - BCN telemetry data indicate that power line electrocution (Figure 6) is a greater source of anthropogenic vulture mortality than power line collision. This conclusion is supported by other evidence. Surveys in five regions of Nepal between 2018 and 2021 found 54 electrocuted raptors and vultures (Joshi 2023), data that will be published in a forthcoming study. Additionally, residents of Bhorletar in Tanahun district informed researchers that 30 to 40 vultures were electrocuted in 2020 and 2022, in an area where distribution lines pass close to a cow rescue site, a favorite feeding ground for vultures (Joshi 2023). Reducing or eliminating vulture electrocutions in areas of high use, where exposure to electrocution risk is also high, could fully offset unavoidable residual vulture impacts associated with NBTL collisions.

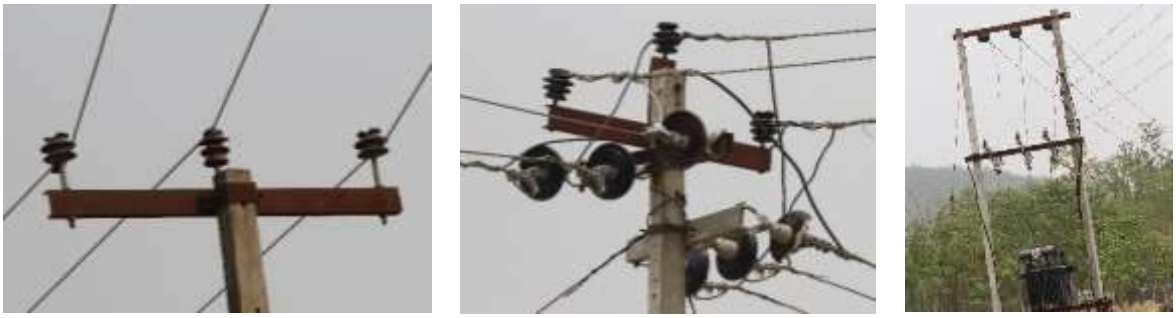
Figure 126: Vulture electrocuted on a 3-phase tangent structure in Chantrauta, Kapilvastu. Note small clearance between center conductor and grounded metal crossarm (Photo: Bhojraj Thapa, BirdLife International)

723. Typical Nepali distribution construction utilizes concrete poles and metal crossarms. These materials are highly conductive and are functionally grounded. Birds perched on a grounded crossarm become electrocuted if they contact conductors or another energized element. Distribution systems that utilize grounded poles and grounded crossarms are extremely hazardous to large and small birds because clearances between energized components and grounds are small. Such systems are highly lethal, and can have population-scale impacts on at-risk vulture and raptor species (Eccleston and Harness 2018).

724. Electrocution mortality is elevated at hazardous poles with a high level of bird utilization. Electrocutions can occur at hazardous poles that offer an advantageous perch, such as those in favorable habitat, or those near a feeding site or nest. Repeated mortalities at specific poles are common if mortality poles remain unmitigated.

725. Electrocution risk can be mitigated by insulating energized wires and equipment to prevent contact. Distribution pole mitigation has been shown to be effective in preventing electrocution throughout the world, if proven materials are used and utility personnel exercise care in installation (APLIC 2006, Eccleston and Harness 2018). One study documented a 95% reduction in eagle electrocution following power pole mitigation (APLIC 2006), and product efficacy has substantially improved in subsequent decades.

Figure 127: Typical Nepali distribution structures pose high electrocution risk to large and small birds due to inadequate clearances between energized elements (conductors, jumper wires, energized equipment) and grounded elements (poles, crossarms, equipment housings).



726. NEA commits to implementing electrocution mitigation on distribution poles to offset residual risk associated with vulture collision with the NBTL. Distribution poles shall be fitted with insulating devices to provide clearances protective of vulture species according to best international practice. Insulating devices shall be of best available quality as assured by third party testing in strict accordance with the IEEE 1656-2010 standard testing sequence. Testing shall be conducted at voltages representative of NEA's highest voltage distribution lines, or greater.

727. Mitigation will be applied to poles determined to be high risk due to:

- Previous vulture electrocution;
- Proximity to vulture use area (feeding site, nest/roost);
- Habitat; or
- Other factors determined by experts.

728. The scale of electrocution mitigation will be refined based on available data collected prior to construction and during NBTL operation; a preliminary estimate is 440 distribution poles. Principles of adaptive management will be employed to ensure that electrocution mitigation is used to meet or exceed the project standard of no net loss of biodiversity. Thus, detection of vulture collisions with the NBTL would result in mitigation of additional distribution poles. An adaptive management approach ensures that the NBTL, combined with compensatory or offset mitigation, has no effect on the vulture population or a net positive impact on the population. **The integration of**

compensatory/offset mitigation will mean that the significance of NBTL impacts to vulture populations will be non-significant (zero) or beneficial (offsets exceed NBTL impacts).

7.4 Socioeconomic

7.4.1 Social Infrastructure (including Utilities)

Potential Impacts

729. Construction of NBTL is unlikely to have highly significant impact upon physical infrastructure as towers can be sited to avoid sensitive sites or pass over them. However, impacts such as safety beneath lines crossing roads other transport infrastructure during construction still needs to be considered. Further, checks will need to be completed around tower bases outside of forests to ensure they are free of utilities, this area makes up a small percentage of the NBTL alignment. Checks will also be required around the SS.

730. NEA have already considered potential issues associated with existing highways (re-routing some sections), planned railways (around Rapti River) and air traffic in their preliminary designs. Currently no further alterations in the design are foreseen to account for these topics.

731. Daily traffic impacts from movement of NBTL and SS traffic are likely, but the volumes of construction traffic moving between tower sites and to the SS will generally be low. In and around villages, and bigger urban areas, such as Butwal, traffic impacts will have to be managed more carefully. NEA have sketched out some potential plans for access roads to tower sites around sensitive locations (Figure 4, Figure 5 and Figure 6). However, these plans need to be further refined by the EPC Contractor prior to the commencement of works in the specific locations. Of specific importance is to ensure that access roads are avoided through Sainamina complex and close to vulture nesting / feeding sites.

732. Only one school has been identified to date close to the alignment, but it appears there will be no direct impacts to the school. No significant pressure on social infrastructure such as hospitals and clinics are anticipated as the number of workers at any one sub-activity will not be significant and it is unlikely that the health facilities would be impacted by periodic visits resulting from accidents at work sites.

733. No significant impacts to water supply are anticipated if permits are obtained for the drilling of boreholes and associated water extraction.

734. No significant impacts to social infrastructure and utilities are anticipated during the operational phase.

Impact summary and assessment of significance

735. Table 118 provides an assessment of the significance of potential impacts before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 118: Potential Impacts to Social Infrastructure

Component	Potential Impact	Project Phase	Magnitude	Extent	Duration	Significance
NBTL	Impacts to utilities, road and rail	C	L	L	ST	Low
All	Access	C	M	L	ST	Moderate
All	Impacts to water supply	C/O	L	L	LT	Low
All	Impacts to schools and other social infrastructure	C/O	L	L	LT	Low

Mitigation and Management Measures

Pre-construction Phase

736. During this phase the EPC Contractors will be responsible for preparing and implementing a Traffic Management Plan. They will also provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions at least 72 hours before the disruptions.

737. Method statements will be prepared for all tower access roads indicating the routes to be used and avoiding any sensitive sites – method statements to be reviewed and approved by PMD before any access route is used. Specifically, the following measures shall be enforced:

- No access route through Sainamina Complex
- No access route within 250m of vulture nests or feeding sites

738. Prior to the commencement of works all activities will be announced in local papers, at least one month in advance of works.

Construction Phase

739. During construction mitigation measures relating to maintaining access to properties, schools, businesses, etc. and managing access roads according to best practice and approved method statements will be implemented by all EPC Contractors (Appendix A). They will also be responsible for liaising with utilities to identify, avoid and maintain their operation throughout the construction period, e.g.; by obtaining necessary clearances from other utilities that could be affected by the Project (water, sewerage, telecommunications, road, rail etc.), and checking with relevant local authorities (water, telecoms) whether there are known pipes, cables, or other utility lines and carry out a scan using cable avoidance tool to identify any unknown underground utilities prior to excavation.

Operational Phase

740. Any access road not required for future maintenance access to tower sites in forest areas will be closed and revegetated to prevent encroachment into these areas during the operational phase of the Project.

Residual Impacts

Table 119: Social Infrastructure Residual Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	Impacts to utilities, road and rail	Medium	Implementation of the Traffic Management Plan and other mitigation measures should ensure that no significant residual impacts remain.	No significant impact
C	Access	Medium		
C/O	Impacts to water supply	Medium	Mitigation measures included in this EIA should ensure that all utilities are identified and impacts to them, including water supply networks, are avoided.	No significant impact
C	Impacts to schools and other social infrastructure	Medium	Implementation of the Traffic Management Plan and other mitigation measures should ensure that no significant residual impacts remain.	No significant impact

7.4.2 Land Acquisition and Temporary Damages

741. This section discusses the issue of land acquisition and compensation and associated mitigation measures to be adopted. This information is based on the RIPP updated in May 2024, but does not take into account the most recent alignment changes proposed for the project by this EIA.

Potential Impacts

742. The impact assessment survey for the subproject (for affected households who are non-titleholders) was completed on 31 December 2023 by PMD with a team of social experts including a Resettlement Specialists and social surveyors, in consultation with PMD and the ESSD of the NEA. According to field investigations, the subproject impacts a total of 744.11 hectares of land, comprising 736.8 hectares of government land and 7.31 hectares of private land. This private land is owned by 57 affected households, involving 315 affected persons. Of these households, 52 are affected by the transmission line alignment/right-of-way (ROW), and 5 due to tower construction. The survey results indicate that no households will be physically or economically displaced due to involuntary land acquisition. The project impacts 28.432 hectares of cropping area, of which 27.292 hectares are within the ROW and 1.14 hectares are under tower foundations while the remaining land area, 715.678 ha are lying barren. The subproject has impacted 10 trees including one forest tree. The field survey conclusively determined that the subproject would preserve and respect the cultural practices and traditions of the indigenous populations, ensuring no negative impacts on their heritage.

743. Access roads to reach in tower foundation area and transporting the tower erection material, in most cases local road might be used because transmission alignment is following close to plain area and assumed that existing roads is available to reach in all tower foundation sites and cable string sites but in case of unavailability of access roads new road need to be constructed and permanent and temporary impacts on private land and non-land assets including other community owned resources might be affected.

744. Vulnerable Affected Land Owners: The affected land owners of the towers are expected to experience the following impacts:

- Severe loss of access to tower-base area which will be in the range of 350 sqm to 450 sqm depending on the voltage level and tower design for each tower.
- Damage to agriculture land and standing crops in an area of 575sqm to 675 sqm area during construction of each tower.
- Any affected land owner whose total land holding is less than 4,000 sqm (approximately less than 1 acre or is a marginal farmer) is expected to experience the impact for more than 10% of their land holding. Therefore, any affected land owner for tower base area whose total land holding is less than an acre shall be treated as vulnerable.

745. The alignment of high voltage power lines pass through predominantly agricultural areas which are privately owned. Although, women are given equal rights in inheritance, land ownership (single or jointly) among women is very low in project area. Hence, it is anticipated that the compensation paid for the ROW will mostly go to men. The project should carry out consultation with women of the project affected families and inform them about the compensation amount and understand their concerns and feedback. Where a woman is the land owner and she needs assistance for completing the required procedures for receiving the compensation, the project shall provide such special assistance.

Impact summary and assessment of significance

746. Table 120 provides an assessment of the significance of potential land acquisition and compensation impacts before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 120: Potential Impacts of Land Acquisition and Temporary Damages

Component	Potential Impact	Project Phase	Magnitude	Extent	Duration	Significance
All	Land Acquisition and Crop and tree loss	PC	M	SS	LT	Moderate
NBTL	Access roads	C	M	L	ST	Moderate

All	Unintentional private property damage	C	M	SS	ST	Low

Mitigation and Management Measures

Design Phase

747. To avoid land acquisition and resettlement the EPC Contractor's design team have carefully selected the route/siting to minimize impacts on existing structures (e.g., buildings) etc. and avoid or minimize crop disturbance where power lines cross private land. Further micro-alignment changes may be made in the detailed design phase to further reduce the limited requirements for resettlement and compensation.

Pre-construction Phase

748. Where properties cannot be avoided in the design and where they are present within national safety clearances the properties will be expropriated following the procedures outlined in the Project RIPP.

749. All temporary construction facilities required for the substation, including laydown and storage areas, will be located within the boundaries of the substation except for overnight accommodation that could be provided in existing properties off-site. Where this is not possible the EPC Contractor will provide a central covered warehouse for storage of construction materials. No public or private land requiring clearance of vegetation or supporting forest habitat or having waterbodies is to be used.

750. Temporary impacts (e.g., land rentals) that are not within the assessed corridor of impact to be compensated based on negotiations between the EPC Contractor and affected persons.

751. Regarding access roads - if the accessibility to reach up to construction site and needed construction of new roads or upgrading the existing roads, the project will undertake impact assessment and RIPP will be updated.

Construction Phase

752. In this phase a range of mitigation shall be applied to limit the significance of impacts:

- Where the Project results in loss of loss of fruit-bearing trees that have economic value compensate in accordance with the entitlement matrix in the Project RIPP; the EPC Contractor will pay any subsequent compensation for loss or damage to private trees due to the fault of the EPC Contractor's work

- Schedule works to avoid or minimize crop disturbance where lines cross private land, such as undertaking works in between crops.

- Provide advance notice to harvest the crops and where feasible, adjust the construction schedule harvest crops; construction works shall not exceed more than one crop season at a particular stretch.

- Repair any temporary damage caused to agricultural fields after construction is completed.

- Saving the top-soil and restoration of land will be done by the EPC Contractor to previous use and farmers will be allowed to continue their cultivation post the construction.

753. Further, it is very important that continuous consultation with affected households and residents continues throughout the construction phase.

Residual Impacts

Table 121: Land Acquisition and Temporary Damages Residual Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
PC	Land Acquisition and Crop and tree loss	Moderate	No significant impacts are anticipated if the RIPP is implemented correctly. A GRM has been prepared to manage complaints received during this process. Other temporary impacts during the construction phase will be managed by the RIPP as noted above.	Not significant
C	Access Roads	Moderate		Not significant
C	Unintentional private property damage	Low		Not significant

7.4.3 Waste Management and Hazardous Materials

754. This section discusses the impacts of waste management during construction and operation of the Project and associated mitigation measures to be adopted.

Potential Impacts

Construction Phase

755. Waste Management - Disposal of waste materials, both hazardous and non-hazardous, from linear power line worksites can be difficult to manage due to the de-centralized nature of the works along the alignments. Without suitable waste containers and without adequate training, workers could dump waste materials haphazardly around the work sites which could create pollution events. Waste management is, however, easier to control at the substation site.

756. Various waste types will be generated at worksites during the construction phase, including:
- Inert construction waste – e.g., concrete, bricks, soil, packaging waste (cardboard, plastic, wood)
- Domestic waste – e.g., food waste.
- Liquid waste, some of which will be classed as hazardous – e.g., waste oil (non-PCB), sanitary discharge.

757. Spoil Material – Excavated material from tower foundations will be backfilled around the tower footings. For the SS, spoil material from the cut slopes will be used as fill material for other portions of the site.

758. Hazardous Materials - Sulphur Hexafluoride (SF6) can have impacts to health of workers and the environment, all of which is discussed above under air quality.

759. Hazardous Liquids - General hazardous liquids will be stored at work sites and at the substation, e.g., fuel, solvents, etc. Spills and leaks of these liquids can result in soil and water pollution. This issue is discussed above under Soils and Hydrology. Polychlorinated Biphenyl's (PCB) will not be permitted for use in transformer oil, or for any other oil containing equipment.

760. Asbestos - The use of asbestos containing materials in the Project is prohibited.

761. Lead Acid Batteries - Batteries in substations are used for back-up power supply. Improper storage of lead acid batteries at the SS could result in pollution events and health impacts to workers.

Impact summary and assessment of significance

762. Table 95 provides an assessment of the significance of potential waste management and spoil disposal impacts before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 122: Waste and Spoil Disposal Potential Impacts

Component	Potential Impact	Project Phase	Magnitude	Extent	Duration	Significance
All	Improper management and disposal of solid / liquid waste	C/O	M	L	ST	Moderate
All	Improper management and disposal of hazardous waste (including contaminated soil)	C/O	M	L	ST	Moderate
SS	Management of batteries	O	L	SS	LT	Low

Mitigation and Management Measures

Design Phase

763. In the design phase it will be important to ensure that substation waste management / hazardous materials storage areas are well designed, and that consideration is given to the battery types and battery room design.

764. The EPC Contractor for substations will provide a well-designed, covered area where materials can be segregated. The waste storage area will be of sufficient size to accommodate all anticipated storage requirements and can be locked, is well-ventilated and will not reach extreme temperatures. Fuel/oil/chemical/waste storage areas must have an impervious floor and be bunded so that the

capacity of each bund is sufficient to contain at least 110% of the maximum design storage capacity within storage area, not connected to the surface water drainage system.

765. 24V, 30V, 48V, 110V, 220V DC batteries will ideally be lithium-ion type instead of lead acid or nickel cadmium to reduce hazardous waste generation although all battery types are e-waste. The batteries will conform to relevant national standards. A separate room for substation batteries will be provided with ventilation and exhaust fan for taking out fume gases and provision of remote monitoring of substation batteries (if not staffed) and exhaust fan will also be made.

Pre-construction Phase

766. The EPC Contractors for all components will prepare and implement a Waste Management Plan dealing with all solid and hazardous waste as well as wastewater generated in an environmentally sound and safe manner. Where possible it will ensure surplus materials will be reused or recycled, disposal will be the last resort.

Construction Phase

767. During the construction phase, typical waste management issues can be managed through simple mitigation measures outlined in Appendix A. Waste materials will be disposed of at licensed facilities. Regarding spoil material, any spoil material which cannot be re-used will be removed from the site and sent to an appropriate state licensed waste management facility.

Operation Phase

768. During this phase NEA will be responsible for ensuring waste management and disposal in line with national waste management regulations.

Residual Impacts

Table 123: Waste and Spoil Material Residual Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	Improper management and disposal of solid / liquid waste	Moderate	No significant residual impacts anticipated.	Not significant
C	Improper management and disposal of hazardous waste (including contaminated soil)	Moderate	Following the requirements of this EIA and the need to audit waste management contractors will ensure that there will be no significant residual hazardous waste impacts.	Not significant
O	Management of lead acid batteries	Low	No significant residual impacts anticipated.	Not significant

7.5 Social and Cultural Aspects

7.5.1 Community Health & Safety

769. This section discusses potential health and safety impacts to the local community during construction and operation of the Project and associated mitigation measures to be adopted.

Potential Impacts

Construction Phase

770. The Project has the potential to increase the threats to community safety and security during the construction phase. The key types of impacts are likely to be:

- Potential conflict between workers, security personnel and local community members resulting in upset or injuries, in particular, gender-based violence and sexual exploitation, abuse and harassment (GBV/SEAH) (as raised on FGDs completed with womens groups in the Project area) and issues due to interaction between Project workers and women in the local communities.
- Increased hazards (e.g., open excavations and worksites) and increased risk of accidents, specifically relating to UG works. Children are specifically vulnerable to these types of hazards.
- Increased risk of road/traffic accidents causing injuries or fatalities. Project activities will result in increased traffic flows on certain roads that are used by local residents (e.g., where such roads are used as haul routes, for UG cables). Children are also specifically vulnerable to road accidents.

771. The most likely potential impacts on community health in the construction phase are:

- Increase in dust, noise and water pollution.
- Increase in disease vectors such as rodents (if food/drink is not stored properly and solid/liquid wastes are not managed adequately) with accompanying increased incidence of vector-borne diseases.
- Increased risk of enhanced incidences of communicable diseases arising from interaction between workers living in the construction camps with local people. There will be a risk of communicable diseases (e.g., COVID-19, TB, and sexually transmitted diseases such as HIV/AIDS) passing through the workforce and possibly into the community.
- Increased risk of water-borne diseases if liquid and solid waste management is not implemented effectively.

Operational Phase

772. Due to the presence of security staff and security perimeter fencing, no operational phase impacts are anticipated relating to the SS as long as they are maintained.

773. However, measures should be put in place to warn the public about the dangers of other electrical equipment in public spaces, e.g., towers. to avoid potential accident and fatalities during the operational phase.

Electromagnetic Field (EMF)

774. Based on a recent in-depth review of the scientific literature, the World Health Organization (WHO) concluded that current evidence does not confirm the existence of any health consequences

from exposure to low level electromagnetic fields. [40] However, to be prudent, this issue has been considered further as part of this EIA.

775. OHL HV – Maximum magnetic fields beneath 400kV lines may also exceed GIIP exposure levels. In line with safety considerations, no houses or other buildings will be permitted within the RoW. Any occupied properties that are located within the designated area will be relocated outside the RoW to ensure the safety of the occupants, and to comply with the regulatory requirements. The maximum electric and magnetic field for a 400kV line is show below.

Table 124: Typical EMF Values from 400kV Transmission Line

	Under line	25m	50m	100m
Electric Field (volts per meter)	6300	1700	230	30
Magnetic Field (µT)	14	3.9	1	0.3

Source: https://www.eirgrid.ie/grid/how-grid-works/safety-standards

776. ICNIRP basic restrictions for exposure at 50 hertz are 360 µT and 9,000 volts per meter. [41]As a reference point it is also noted that there is no restriction in the United Kingdom on EMF grounds on how close a house can be to an overhead line.

777. Given the fact that NBTL will be constructed to respect safety zones (with no people living directly beneath lines) and the typical fields referenced above no significant EMF impacts are anticipated from the NBTL.

778. Substations - Beyond the substation fence, the magnetic field produced by the equipment within the station is typically indistinguishable from the background levels from other sources. Studies undertaken in the United Kingdom showed mean values of 1.1 µT at substation boundaries and 0.2 up to 1.5m from the boundary.[42]

779. Further, there is a misconception that the transformers within substations are a high source of magnetic field. Modern power transformers are built to keep the magnetic field in the core of the transformer to maximize its efficiency.[43] Accordingly, no significant impacts to residential receptors is anticipated. However, a precautionary approach has been taken to this issue and additional checks during the design phase will be undertaken.

Impact summary and assessment of significance

780. The following table provides an assessment of the significance of potential impacts to local community before implementation of the proposed mitigation measures that are discussed in the rest of this section.

[40] https://www.who.int/peh-emf/about/WhatisEMF/en/index1.html

[41] https://cms.eirgrid.ie/sites/default/files/publications/EirGrid-The-Electricity-Grid-and-Your-Health.pdf

[42] Gajsek P, Ravazzani P, Grellier J, Samaras T, Bakos J, Thuroczy G. Review of studies concerning Electromagnetic Field (EMF) exposure assessment in Europe: low frequency fields (50 Hz-100 kHz). Int J Environ Res Public Health. 2016 Sep;13(9):14. Available from: https://www.ncbi.nlm.nih.gov/pubmed/27598182

[43] Source: Understanding Electric and Magnetic Field. https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/safety/understanding-emf-booklet.pdf

Table 125: Potential Impacts to Community Health and Safety

Component	Potential Impact	Project Phase	Magnitude	Extent	Duration	Significance
All	Accidents at work sites (including traffic accidents)	C	M	L	ST	Moderate
All	Social conflicts, including GBV/SEAH	C	M	L	ST	Moderate
All	Accidents involving electrical equipment	O	L	L	LT	Moderate

Mitigation and Management Measures

Design Phase

781. During the design phase it is important that all infrastructure is designed with the safety of the community in mind. The design requirements will be different for the various sub-activities, however, the general theme of design phase is that all Project infrastructure will be constructed in accordance with national safety codes and safety clearances. On a sub-activity basis the following safety measures will need to be followed by the EPC Contractors designers.

782. Substation

- The separation walls or fire barrier walls shall be provided between the transformers / reactors or between transformer / reactor & nearby building.
- Designs will ensure that there can be no illegal access to substations.
- Include a secure boundary fence or wall around the substations that is sufficiently high it cannot be climbed over, provide a gated, surfaced vehicular access for entry/exit off public highway having adequate sight lines for all drivers and warning signs of entranceway for road users.

783. NBTL

- Include in the design of all poles and towers anti-climb features together with posting of written and visual warning signs to include the ISO 7010 “Hazard Type: Electrical Symbol” warning of the risk of electrocution.
- Each tower shall be fitted with a number plate, danger plate and a set of phase plates per circuit. The arrangement for fixing these accessories shall not be more than 4.5 m above the ground level.

784. EMF

- The EPC Contractor for the substation will provide EMF calculations to NEA for review. If the results show that EMF levels above ICNIRP reference levels at properties close to the substation the use of shielding equipment/materials to decrease electromagnetic field exposure included will be provided.

Pre-construction Phase

785. Pre-construction is another important phase for community health and safety. During this phase the EPC Contractors for all phases will be responsible for the preparation and implementation of a Community Health and Safety Plan outlining all of the relevant measures in this EMP relating to community health and safety. The Community Health and Safety Plan shall include flow chart and contact details to deal with that situation should any community member be impacted during the works. Additionally, a Traffic Management Plan will be prepared considering both the safety of pedestrians and vehicles and need to avoid traffic congestion; it is to be developed in consultation with relevant local authorities to ensure proper execution of traffic controls including where temporary blockage of one lane of the road or footpath is needed for installation.

786. Communications with the community will be critical to the success of the Project. Specific mitigation measures to ensure communications with the community are effective and on-going, include:

- Local disclosure of the EIA including an executive summary translated into local language via the NEA website, NEA offices, and other construction site offices.

- Provide brochures and posters on the main findings of the EIA and where the full version can be accessed, as well as a translation of the executive summary of the EIA, will be printed in local language and made available/displayed for public scrutiny at places easily accessible to affected persons.

- Provide notice boards at all substations, construction site offices and active work sites including details of the GRM including the name, designation, contact numbers, address of both the NEA and EPC Contractor's GRM focal persons plus the timeline and process of redressal together with a suggestion box that will be regularly checked for any grievances received.

- Prepare a Project Safety Awareness leaflet to be distributed to all homes within the vicinity of the work sites. The leaflets shall provide information relating to the risks of interfering with the HV network. The leaflets will be written in Non-Technical language and will provide illustrations where practical.

- Provide EMF awareness sessions at villages within 500m of NBTL and the SS. The awareness sessions should provide information regarding the findings of the EIA on EMF and specifically discuss best practice reference limits for EMF and how they have been applied to the Project.

- Local communities as well as individual property owners within 500m are to be consulted when selecting sites for temporary construction facilities outside of substations prior to finalization of their location.

- Directly liaise one-on-one with receptors in the RoW or in the vicinity of entry/exit pits and above ground infrastructure footprint for underground cables including informal settlers/street vendors and specifically notify them about the commencement of work etc.

- NEA will create a WhatsApp Group of CFUG representatives. Before construction representatives will be informed through WhatsApp messages

Construction Phase

787. During construction phase EPC Contractors for all components will review measures to mitigate community health and safety impacts on a regular basis, and consult community leaders every six months and with CFUGs monthly during construction in their CF, informing them on the status of implementation and results, and discussing any changes needed to the Pollution Prevention Plan or the Community Health and Safety Plan in advance of proposed changes. They will undertake face-to-face with all communities/residents, cultural heritage sites within 200m of the substation and 50m of the NBTL RoW to keep them fully informed of the nature of works and latest schedule, notifying them individually at least one month prior to the commencement of works of the intended start date and schedule.

788. A range of other general good practice measures (see Appendix A) will be employed by the EPC Contractors for all sub-components relating to the provision of access and road safety. These measures will be supplemented by specific measures such as erecting guard structures over roads and other infrastructure.

789. Implementation of the GRM will be a key focus of the EPC Contractors activities. The EPC Contractor's safeguards team will act as site GRM Focal and keep affected persons and local communities informed of the status of work and be readily available onsite to receive, document and deal with grievances at site level. The Project will also encourage use of the GRM and clarify that this does not prevent affected persons from pursuing any legal action, if they feel it is needed, and inform communities about the ADB Accountability Mechanism and their possibility to resort to it if any grievance is not resolved by the project level.

790. A strict code of conduct will be applied to the Project with specific requirements relating to worker behavior and GBV/SEAH.

Operational Phase

791. Although no significant impacts have been identified associated with EMF, NEA should still undertake periodic monitoring of EMF at the SS to ensure ICNRP occupational and community EMF exposure levels (reference and peak values) are be achieved within the substation and outside of the fence line respectively.

Residual Impacts

Table 126: Community Health and Safety Residual Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance

C	Accidents at work sites (including traffic accidents)	Moderate	A range of mitigation measures have been provided to help manage the risk of accidents occurring. However, despite these measures it is still possible that accidents could occur due to unforeseen circumstances.	Low
C	Social conflicts	Moderate	Proposed mitigation measures, including the development of and implementation of a community health and safety plan should ensure that social conflicts are minimized during the construction and operational phases. No significant impacts anticipated.	No significant impact
O	Accidents involving electrical equipment	Moderate	The safety measures recommended in this EIA, coupled with national safety standards, should ensure that all infrastructure is constructed and maintained to a standard which prevents significant impacts to community health and safety.	No significant impact

7.5.2 Workers' Rights and Occupational Health and Safety (OHS)

792. The main Project-related activities that may result in OHS issues are:

- Accidents involving the use of heavy equipment.
- Accidents involving working at height.
- Accidents involving live power lines and equipment.
- Accidents involving construction vehicles.
- Accidents due to lack of, or poor application of, personal protective equipment (PPE).
- Accidents involving wildlife e.g. snake bites, leopard attacks
- Interaction with hazardous materials e.g. PCBs or asbestos
- Poor sanitary and welfare conditions at camps and work sites.
- Lack of first aid and medical facilities.
- Lack of fire fighting equipment.
- SEAH
- Exposure to EMF and SF_6.

793. Workers' rights including occupational health and safety need to be considered to avoid accidents and injuries, loss of man-hours, labor abuses and to ensure fair treatment, remuneration and working and living conditions. These issues need to be considered not only for workers who are directly employed by the Project but also sub-contractors and those that maybe informally employed including daily labor.

Potential Impacts

Construction Phase

794. The Project is expected create at least 100-200 direct employment opportunities on NBTL power line and 50 at the SS during the peak of the construction period. Most workers will be engaged by the EPC Contractor and will consist of an unskilled, semi-skilled to skilled workforce. During the operational phase maintenance works will be undertaken by existing NEA staff.

795. The expected impacts on worker rights and H&S because of construction, activities and Project operation are as follows:

- Risk to workers H&S due to hazardous construction activities and inadequate living conditions; and
- Violation of workers' rights.

796. Risks exist to construction workers particularly those who have not received adequate training or are familiar with the hazards associated construction of electrical infrastructure projects or medically unfit for the work involved. Inexperience workers under the age of 18 would be particularly vulnerable from working on a hazardous construction site. Health and safety hazards faced while working at construction sites, handling machines, plant and equipment, driving vehicles etc. could result in minor or major injuries, potentially in the worst-case even death. In particular, work at heights and work with electricity are particularly dangerous activities required to implement the project. Only trained, medically fit workers are permitted to work with electricity and at height. Construction workers will be required to handle materials such as cement, chemicals, fuels, etc. which will increase health risks if personal protective equipment is not used.

797. Poorly designed temporary worker camp/overnight accommodation and sanitation and welfare facilities may pose a health threat and nuisance to the workers due to unsanitary and unhealthy conditions. Uncontrolled vending of food and drinking water at worksites may also pose a risk with respect to the transmission of diseases like typhoid, diarrhea, and dengue fever. Migrant and illiterate workers can be particularly vulnerable.

Operational Phase

798. EMF - The National Institute for Occupational Safety and Health (NIOSH) and other US government agencies do not consider EMF a proven health hazard.[44] However, according to the WBG electric utility workers typically have a higher exposure to EMF than the general public due to working in proximity to electric power lines.[45]

799. Working with Live Equipment - Working with live equipment during maintenance of lines and operation of the substations also involves safety risks specifically relating to working at height and electrocution.

800. SF_6 - When an arc is formed in SF_6 gas small quantities of lower order gases are formed. Some of these by-products are toxic and can cause irritation to eyes and respiratory systems. This is a concern if the interrupters are opened for maintenance or at disposal of the interrupters. Normally these impacts only occur in enclosed areas.

Impact summary and assessment of significance

801. Table 127 provides an assessment of the significance of potential impacts to workers before implementation of the proposed mitigation measures that are discussed in the rest of this section.

[44] https://www.cdc.gov/niosh/docs/96-129/default.html
[45] WBG EHS Guidelines. Electric Power Transmission and Distribution. 2007.

Table 127: Potential Impacts to Workers

Component	Potential Impact	Project Phase	Magnitude	Extent	Duration	Significance
All	Accidents involving workers	C	H	SS	ST	High
All	Inadequate sanitation and welfare	C	M	SS	ST	Low
All	Workers' rights ignored.	C	M	SS	ST	Low
All	Health and Safety of Workers	O	H	SS	LT	High

Mitigation and Management Measures

Design Phase

802. Most mitigation measures for the design phase relate to EMF and the safe design of substation buildings to protected workers. The provided mitigation measures (Appendix A) are based primarily on the requirements of WBG EHS Guidelines. The measure ensure that such as fire safety, sanitation and noise levels are all accounted for in building designs.

803. Further, for all component construction works EPC Contractors will be required to undertake a health and safety risk assessment through a workshop during the design (and at other key stages) so it can inform both design and pre-construction preparations, considering both occupational and community H&S risks resulting from subsequent stages of the project. The facilitated workshop will involve the design and construction team of the EPC Contractors and operational (NEA) staff.

804. A range of design measures have been proposed to ensure the safe management of SF6 under the topic of air quality, above.

Pre-construction Phase

805. During the pre-construction phase an important focus will be on the establishment of plans and workers contracts to ensure that provisions are in place to manage the health and safety of workers and ensure workers' rights are respected. Specifically, the following are required:

a) Occupational Health and Safety Plan & Emergency Response Plan(s). H&S plan to include emergency preparedness and response plan including flow chart and contact details to deal with situation should any construction worker or community member in the event of an incident during the works. The plan will also include an OHS training Plan.

b) Labor Management Plan addressing employment of migrant workers, sanitation and welfare, gender-based violence/sexual exploitation, abuse, and harassment prevention etc.

c) Camp / Accommodation Management Plans depending upon the site location and requirements of EPC Contractor.

d) Code of Conduct (CoC) and information video/brochure/leaflet for distribution to all workers during induction addressing culturally acceptable practices etc. CoC must be informed by the SEMP and address the following aspects:

i. Zero tolerance in respect of health and safety.

ii. Requirement on always wearing PPE on site.

iii. Zero tolerance of bribery or corruption.

iv. Respect for local community and customs, avoiding community conflict situations.

v. Zero tolerance of illegal and unacceptable activities/behavior, including but not limited to engagement in: prostitution; gender-based violence/sexual exploitation, abuse, and harassment; illegal sale or purchase of alcohol; sale, purchase, or consumption of drugs; gambling; fighting.

vi. Alcohol and drugs policy and testing regime.

vii. Role of workers in good housekeeping.

viii. Role of workers in maintaining good hygiene including COVID-19 measures e.g., social distancing.

ix. Respect of wildlife and the environment.

x. Description of disciplinary measures for infringement of the code of conduct and other employer rules (e.g., immediate removal from site, fine etc.) will be included in staff contracts.

806. During pre-construction EPC Contractors shall also establish, through their Labour Management Plan, procedures for engagement of the workforce, for example through setting targets for local employment based on initial assessment of the labor market for unskilled and semi-skilled work force. EPC Contractors shall also ensure mitigation measures included in Appendix A are included in workers contracts, including measures relating to working hours and salary and provision of insurance for workers.

Construction Phase

807. Extensive provisions for the health and safety of workers during the construction phase are included in Appendix A. These measures are based on the requirements of WBG EHS Guidelines.

Operational Phase

808. During the Operational phase NEA will be responsible for following all national labour laws and health and safety laws and regulations (including those for sanitation and welfare). Other best practice

measures will also be employed during the operational phase at the substation, such as ensuring all electrical hazards feature written and visual warning signs that meet the IEEE standards to include the ISO 7010 "Hazard Type: Electrical Symbol" warning of the risk of electrocution and that potable water will be supplied that meets national drinking water standards and ISO 10500 drinking water parameters (full suite).

Residual Impacts

Table 128: Worker Residual Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	Accidents involving workers	Medium	Inclusion of specific mitigation measures recommended by the WBG for power line projects as well as the requirements for preparation and implementation of an OHS plan, training of staff and provision of health and safety specialist on the EPC Contractors team should ensure that no significant residual OHS impacts remain during the construction phase. In addition, the EPC Contractor will be responsible for following all of the relevant national health and safety standards.	Not significant
C	Workers' rights ignored.	Medium	Impacts anticipated not to be significant after application of mitigation measures.	Not significant
C/O	Inadequate sanitation and welfare	Medium	Provision of adequate sanitation and worker welfare conditions should ensure that there are no significant residual impacts.	Not significant
O	Accidents involving workers	Medium	Mitigation measures proposed should help reduce the potential for accidents to occur. However, accidents cannot be completely ruled out during the lifecycle of the Project.	Low

7.5.3 Noise and Vibration

809. This section discusses the impacts of noise and vibration during construction and operation of the Project and associated mitigation measures to be adopted.

Potential Impacts

Construction Phase

810. General - During construction noise will be generated from the removal and/or cutting of vegetation, during the movement of construction vehicles, the operation of plant, equipment, and machinery on-site, presence of construction workers at the construction site, temporary worker camps and any overnight accommodation etc. Depending on ground conditions encountered piling could be required for tower foundation construction (specifically near rivers and marshy areas),

resulting in a large increase compared to the background noise level as well as ground vibration. These project activities will create noise impacts and in the absence of mitigation, short term, localized exceedance of noise standards/guidelines may occur although impacts are readily mitigated and reversible with ease in short term. Noise levels should not exceed those outlined as the Project Standards in Section 2.

811. NBTL Construction Noise - The combination of machinery being used at any one time during the construction phase will vary and noise levels will fluctuate accordingly. Table 129 indicates the timescale for various activities and the types of equipment required.

Table 129: Construction Activities and Sound Levels

#	Activity	Timescale Per Tower	Equipment	Typical Sound Level Data at 10m*
1	Clearing and grading activities	2 days	Grader**	82
			Bulldozer (20t)	81
			Pick-up truck	75
2	Transporting materials to the tower site	2 days	Pick-up truck	78
			Lorry (4 axle)	80
3	Constructing foundations and anchors	2 weeks	Excavator (22t)	71
			Bulldozer (20t)	81
			Backhoe (8t)	88
			Pneumatic Tools	95
			Pick-up truck	75
			Lorry (4 axle)	80
4	Assembling and raising the towers	1 week	Crane (110t)	67
			Pick-up truck	75
			Lorries (4 axle)	80
5	Earthing tower	2 days	Auger drill	79
			Pick-up truck	75
			Backhoe (8t)	88
6	Unreeling and Installing the Conductors	2/3 days	Mobile Bullwheel tensioners	85
			Crane (110t)	67
			Mobile Winch	85
			Pick -up trucks	75
			Lorries (4 axle)	80
7	Restoring the Site	2 days	Bulldozer (20t)	81
			Backhoe (8t)	88

* Based on BS 5228 – 1:2009 – Assumes each piece of equipment working 25% of the day

** Based on data from US DOT FHA (https://www.nrc.gov/docs/ML1805/ML18059A141.pdf)

812. Based on these activities the following noise levels can be assumed based on each piece of equipment in operation for 25% of a ten-hour working day. [46]

Table 130: Estimated Noise Levels for Various Construction Activities

Activity	Sound Level dBA $_{LAEQ\ 10\ HR}$		
	10m	100m	150m
1/ Clearing and Grading	79	59	55
2 / Transporting materials to the tower site	75	56	53

[46] Assumptions are based on the IEE consultants experience of High Voltage power line construction projects in Uzbekistan (Northwest Region Power Transmission Line Project). Construction noise levels are also aligned with other recent ESIAs prepared by NEGU for EBRD (Navoi - Besopan Transmission Line Upgrade, Uzbekistan).

Activity	Sound Level dBA LAEQ 10 HR		
	10m	100m	150m
3 / Constructing foundations and anchors	90	70	67
4 / Assembling and Raising the towers	75	55	52
5 / Earthing Tower	83	63	59
6 / Unreeling and Installing the Conductors	83	63	59
7 / Restoring the Site	83	63	59

813. Table 130 indicates that most of the construction activities are likely to result in some intermittent elevated noise levels for short periods of time (approximately 8 weeks in the location of each tower), especially during foundation works.

814. It is possible that piling could be required at some tower sites, this could result in high levels of localized vibration around the work sites.

815. However, the majority of the alignment passes through forest areas and noise impacts to human receptors will be limited to approximately 60 points along the alignment where residential receptors are located closer than 200m from the tower sites. These areas include towers: 36, 37, 43, 54, 56, 58, 61, 76-AP12C, 86A, 99, 101, 123, 148, 168, 191, 217-219, 259, 260, 263, 278, 279, 289, 292, 298, 305-311, 313-316,320, 321, 325, 327, 344, 352, 353, 360, 365, 367, 378, 391, 406, 412-419, 422, 424, 434. These 60 tower sites represent approximately 14% of the alignment.

816. Notwithstanding the above, construction noise can have an impact upon wildlife. This issue is discussed in other part of the impact assessment.

817. Substation Construction Noise - The combination of machinery being used at any one time during the substation works phase will vary and noise levels will fluctuate accordingly. In general noise levels at 15m distance from the source are anticipated to be no greater than 85 dBA [47], and around 66 dBA at 100m, based on equipment operation for 50% of a ten-hour working day. Installation of an engineered acoustic barrier around the substation sites will be able to effectively reduce the noise levels by 10-20 dBA, and potentially up to 30dBA can be achieved. Substation works will take approximately 30 months to complete, meaning that elevated noise levels during the construction phase can be anticipated during this period potentially affecting around 16 properties within 350m around the substation site, the closest of which is 90m west. The Cow Sanctuary and local cultural heritage site close to the SS will also be affected by elevated noise levels during construction due to their proximity to the SS.

Operational Phase

818. NBTL Corona Noise - Literature studies undertaken by EirGrid indicates that "Corona Noise" only becomes a significant issue from 350-500 kilovolts (kV) and above. The Public Utilities Commission of California also indicate that corona noise is usually not a problem over 230kV. [48] This would suggest that significant "Corona Noise" impacts may be likely on the NBTL [49] EirGrid studies recommend that "in the design and siting of new 400 kV overhead lines it may be appropriate to seek a separation

[47] https://ia.cpuc.ca.gov/environment/info/ene/mesa/attachment/A1503003%20ED-SCE-01%20Q.PD-01%20Attachment%20(Revised%20Noise%20Levels%20Construction%20Equipment).pdf

[48] https://ia.cpuc.ca.gov/Environment/info/aspen/tri-valley/17%20-%20Corona%20and%20Induced%20Current%20Effects.pdf

[49] EirGrid Evidence Based Environmental Studies Study 8: Noise. Literature review and evidence based field study on the noise effects of high voltage transmission development. EIRGrid, 2016

distance of 200m between any property and a 400 kV tower, and 100m between any property and the OHL."

819. Substation Noise - Large zone substations typically have at least two step-down transformers that emit noise most commonly in the low frequencies between 100Hz and 200Hz. In addition, the noise hum is specific to each site. During the day the noise hum from the transformer is typically hidden, or masked, behind noise from traffic and industry. At night, when the background noise drops, the hum becomes more perceptible, annoying residents and in some cases impacting on their health. EirGrid studies recommend a minimum distance of 150m is to be maintained between a 400 kV substation and the land boundary of any noise sensitive receptor. In the case of Lamahi SS, the nearest transformer will be situated more than 200m from the nearest residential receptor. As such, operational noise should not be highly significant.

Impact summary and assessment of significance

820. **Error! Reference source not found.**Table 105 provides an assessment of the significance of potential noise and vibration impacts before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 131: Noise and Vibration Potential Impacts

Component	Potential Impact	Project Phase	Magnitude	Extent	Duration	Significance
NBTL	General land clearing and tower construction noise and vibration	C	M	L	ST	Moderate
Substation	General land clearing and construction noise	C	M	SS	ST	Low
NBTL	Corona Noise	O	L	L	LT	Moderate
Substation	Transformer hum	O	L	SS	LT	Low

Mitigation and Management Measures

Design

821. Key mitigation during the design phase relates to siting equipment within the substation and selecting equipment that guarantees noise levels. Specifically, EPC Contractors will ensure that the design enables operation to always comply with 1-hour LAeq 70 dB(A) at the site boundary and 45 dB(A) at the nearest residential properties.

- Use low noise generating equipment e.g., less than 55dBA sound pressure level at 1m; and

- Layout substations so transformers are the furthest distance possible from the adjacent receptors to minimize corona noise/transformer hum experienced.

822. However, as a precautionary approach, an acoustically designed enclosure or fence will be installed around transformers to enable the required noise level to be met as a permanent installation as part of the design.

823. To prevent corona noise impacts to receptors living within 200m of the NBTL alignment the EPC Contractor shall include in his design measures such as:

- using a surface treatment such as semiconductor layer, high voltage putty or corona dope.
- Usage of a good homogenous insulator, such as a prepared silicone and epoxy potting material.
- Using multiple conductors per phase helps reduce resistance and hence corona loss.
- The use of corona rings help to distribute charge across a wider area.

Pre-construction

824. EPC Contractors for all components will be responsible for the preparation and implementation of a Pollution Prevention Plan covering noise management.

Construction

825. To manage potential noise impacts during construction a range of good practice measures will be applied. Where practical works should avoid the weekend, religious or cultural events near to places of worship. Work close to schools will be scheduled for the holiday periods to avoid disturbance to students.

826. Other measures such as installation of temporary noise barriers can also be applied. All the proposed construction phase measures are outlined in detail in Appendix A.

827. Where possible EPC Contractors will avoid soil compaction, piling, and other vibration inducing activities as much as possible. In locations where this is unavoidable the EPC Contractor will identify properties within the zone of influence and undertake pre-construction structural surveys to identify level of risk. If risk of structural damage to properties identified due to current condition consideration of alternative construction methods or temporary relocation of occupants during works if at risk shall be undertaken. During any piling works the EPC Contractor shall install monitors during construction to monitor structural movement. Structural or cosmetic damage to be repaired by the EPC Contractor to at least pre-project condition at their own cost.

<u>Residual Impacts</u>

Table 132: Residual Noise and Vibration Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	General land clearing and tower construction noise and vibration	Moderate	Some short-term elevated noise impacts may occur during the daytime. Keeping work to short durations and the use of temporary mobile noise barriers should reduce the noise levels to acceptable levels during the working day.	Not significant
C	General land clearing and construction noise	Low		Not significant
O	Corona Noise	Moderate	Incorporation of design measures should ensure that corona noise impacts are not significant.	Not significant
O	Transformer hum	Low	Noise barriers will reduce noise levels to within acceptable limits.	Not significant

7.5.4 Physical Cultural Resources

828. Physical cultural resources can be subjected to a wide range of direct and indirect impacts during the construction and operation of infrastructure projects. Direct impacts consist of physical disturbance or damage to a resource that alters the resource's scientific, historical, aesthetic, religious, and/or cultural value. Indirect impacts are the result of changes to a resource's environment or natural setting that alter its aesthetic, religious, and/or cultural value or project activities that restrict or limit stakeholder access to and/or their ability to use a resource for cultural purposes.

829. The magnitude of impacts to cultural heritage resources are determined through an evaluation of the potential loss of scientific or cultural value due to direct physical damage to the resource; changes in the setting of the resource that negatively affect its cultural value to stakeholders; and restricting stakeholder access or use of the resource. The most important variables considered in assessing the loss of scientific and cultural value are the scale of direct physical impacts (how much of the resource is damaged or removed) or indirect impacts to resource setting (how extensive are the changes to setting); the duration of changes to resource setting; and the duration and frequency of restrictions on stakeholder use or access.

830. Cultural heritage resources are fixed on the landscape and as a result, the proximity of Project activities to physical cultural resources is a key element in assessing the magnitude of impacts. Typically, the closer a project activity is to a cultural heritage resource the greater the magnitude of both direct impacts from construction activities, indirect impacts from temporary and/or permanent changes to resource setting, and indirect impacts from restricting stakeholder access/use.

831. The following sections present summary information on potential sources of impacts to physical cultural resources from proposed Project activities. The potential impacts are divided into those that could occur during the design, construction, and operation of the proposed Project.

Potential Impacts

Construction Phase

832. Table 133 summarizes potential direct and indirect impacts to physical cultural resources during Project construction.

Table 133: Potential Construction Phase Impacts to Physical Cultural Resources

Project Activities	Impact Type	Potential Impacts to Physical Cultural Resources
Transmission Tower Installation: Ground disturbing construction activities within the 214 m^2- 528 m^2 foundations of the 436 proposed transmission line towers. Total impact area estimated to be approximately 13.68 ha.	Direct	Archaeological Resources: Permanent, physical damage previously undiscovered archaeological resources, if present, within the proposed tower foundation locations.
Substations Construction: Ground disturbing activities during civil and building works at the substation locations including land grading, equipment foundation and oil pit construction, control building erection, water supply and drainage implementation, and the construction of the site boundary wall. Total impact area for both substations is estimated to be 20.99 ha.	Direct	Archaeological Resources: Permanent, physical damage to previously undiscovered archaeological resources, if present, within the proposed substation locations.
Access Road Construction: Extending existing roads up to 200 m to access construction right-of-way.	Direct	Archaeological Resources: Permanent, physical damage to previously undiscovered archaeological resources, if present, within new access roads.
Vegetation Clearance: Removing trees over 20 m in height along the right-of-way, tree clearing and vegetation removal at transmission tower locations, and tree removal from 40 areas measuring 200 m x 46 m within right-of-way for drone-based line stringing will result in the permanent removal of an estimated 46,100 trees. Other types of vegetation will be temporarily removed (i.e. will be allowed to grow back) from the 40, 200 m x 46 m drone-based line stringing areas.	Direct	Living Heritage Resources: Physical damage and/removal of culturally significant tree and plant species used in traditional medicine and/or viewed as sacred by local communities. If present, tree removal could result in the permanent removal of sacred trees across the Project right-of-way while associated vegetation clearance could result in the permanent removal of medicinal plants from tower locations and the temporary removal of medicinal plants from drone-based stringing areas.
Noise Pollution: Noise generated by construction activities including, but not limited to, vegetation clearance, foundation excavations, pile driving, earth moving/grading, construction vehicles (excavators, bulldozers, cars, trucks, helicopters, etc.) on local roads and within the right-of-way.	Indirect	Built/Living Heritage Resources: Construction noise could cause temporary, negative impacts on the ability of stakeholders to perform religious rituals, veneration, devotions, and ceremonies at shrines, temples, parks, churches, monasteries, etc. by negatively impacting the setting/ambiance of built/living heritage resources. Living Heritage Resources: Construction noise could cause temporary, negative impacts on the ability of stakeholders to perform religious rituals, veneration, devotions, and ceremonies at sacred trees or collect medicinal plants in forest

Project Activities	Impact Type	Potential Impacts to Physical Cultural Resources
		areas around construction activities. Impacts would be temporary
Restricting Stakeholder Access: Increase in vehicle traffic along local roads to transport equipment and personnel to and from active construction sites. Temporary road closers to move heavy equipment and/or build access roads. Establishment of safety exclusion zones around construction work areas.	Indirect	Built/Living Heritage Resources: Increased road traffic and/or temporary road closers associated with construction activities could temporarily restrict stakeholder access to built/living heritage shrines, temples, monasteries, parks, churches, etc. Living Heritage Resources: Increased vehicle traffic, temporary road closures, temporary safety exclusion zones around construction areas, etc. could restrict stakeholder access to sources of medicinal plants and/or sacred trees within the forested portions of the Project right-of-way.

833. The Project as currently designed will avoid the mapped boundaries of the four archaeological sites identified within 2.5 km of the proposed Project right-of-way. While the Project has been designed to avoid the Sainamaina, Manimukunda Sen Park/ Phulbari, Devdaha Kund, the exact boundaries of these sites are poorly defined. As a result, previously unrecorded components of these sites could extend into the proposed Project right-of-way. In addition to these known sites, the results of the GLA archaeological survey and presence of multiple, large and complex archaeological sites within 2.5 km of the Project right-of-way suggests there is the potential for additional undiscovered archaeological sites to be present within the Project right-of-way, substation location, and/or access roads. As a result, ground disturbing activities during construction of the proposed 436 transmission tower locations, substation, and a currently undetermined number of access roads could result in physical damage or the complete removal of previously undiscovered archaeological resources.

834. The magnitude of any impacts to previously undiscovered archaeological resources will depend on the extent of impacts while the importance of the archaeological resource is based on the scientific information available at the site and/or its cultural or historical importance to stakeholders. source. Generally, the magnitude of potential impacts increases based on the size of the impacted area relative to the overall size of the resource. The importance of the archaeological resource is typically a product of the integrity/preservation level of the site (i.e. extent of any previous disturbance); the size and complexity of the site (does it contain multiple phases of occupation or was occupied for an extensive period of time; the number and types of activities conducted at the site); the uniqueness of the site type and associated information (i.e. is the site type relatively common/well understood); and its association with significant historical individuals or events. In the context of this Project, the magnitude of potential impacts to undiscovered archaeological resources could range from very small to very large (depending on the extent of impacts) on resources of potential local to national significance (depending on the unique characteristics of the resource), resulting in impacts of low to high significance.

835. Vegetation clearance during Project construction could negatively impact sacred tree and/or medicinal plant living heritage resources. The physical cultural resources baseline study documented several culturally significant tree and plant species that are known to occur in the forested areas

through which the proposed Project will be built. The temporary or permanent removal of sacred trees or medicinal plants would impact the cultural ecosystem services the forest environment provides to local communities.

836. Tree removal activities are anticipated to result in the permanent removal of an estimated 46,100 trees as part of transmission tower construction, clearing 20 areas measuring 200 x 46 m for droned based stringing, and removing trees over 20 m tall from across the right-of-way. The removal of any trees that are sacred or culturally significant to local stakeholders or religious communities would result in the removal of locally significant physical cultural resources. In addition, permanent vegetation clearance at transmission tower locations and temporary vegetation removal at the 40 drone-based stringing staging areas could result in temporary or permanent impacts to plant species used by local stakeholders for medicinal purposes, resulting in impacts to traditional local practices and traditional ecological knowledge. Since the number of sacred trees or stands of medicinal plants that could be affected by vegetation clearance is unknown, the magnitude of impacts could range from very small to very large (depending on the number of impacted trees or plants) to locally significant physical cultural resources, resulting in impacts of low to medium significance.

837. Increased noise during substation, access road and transmission tower construction and transmission line stringing could result in auditory impacts to built/living heritage resources during Project construction. Construction activities such as vegetation clearance, excavation, pile driving (if conducted), use of heavy equipment, and increased traffic noise from construction vehicles could create increased levels of noise pollution that could temporarily and negatively impact the ability of stakeholders to use shrines, temples, monasteries, parks, churches, and ponds for ritual, devotional, and/or ceremonial purposes. Based on the noise assessment in the IEE, these impacts would likely be temporary in duration, occurring in any given location only during construction in that area and, of relatively minor magnitude. Stakeholder engagement is, however, necessary to determine to what extent construction noise could affect religious or cultural practices at a given built/living heritage resource.

838. For the purposes of this study it is assumed that built/living heritage resources within 250 m of the proposed Project right-of-way, substation, and access roads could be subject to construction phase noise impacts. It is anticipated that construction noise impacts to built/living heritage resources will be temporary, of very small to moderate magnitude, and negatively effect locally significant resources. This could result in indirect impacts of minor to medium significance based on proximity to the right-of-way, with resources within 100 m subject to temporary impacts of medium significance and resources from 100-250 m subject to impacts of low significance.

839. Temporary increases in road traffic, road closures, and the creation of safety exclusion zones around active construction areas could temporarily restrict stakeholder access to built/living heritage and living heritage resources during Project construction. Increased traffic on local roadways and the temporary road closures/slowdowns during access road improvements or when large pieces of infrastructure are being moved along local roads could temporarily hinder or prevent stakeholders from accessing built/living heritage sites for religious activities. Increased traffic, road closures, and the establishment of safety exclusion zones around active construction areas along the right-of-way could also temporarily obstruct stakeholder access to sacred trees or medicinal plants in forests. These impacts are most likely to occur to resources within 250 m of the Project right-of-way where construction traffic is likely to be more concentrated. These impacts would be temporary and

infrequent, be of very small to small magnitude, and result in impacts of low significance to these physical cultural heritage resources.

Operational Phase

840. Table 134 summarizes potential indirect impacts to physical cultural resources during Project operation.

Table 134: Potential Operation Phase Impacts to Physical Cultural Resources

Project Activities	Impact Type	Potential Impacts to Physical Cultural Resources
Presence of Transmission Towers, Transmission Line, and Substation in Viewsheds: Upon completion, the proposed Project will add two (2) substations, 436 transmission towers ranging from 64 m – 90 m in height, and transmission lines to a currently undeveloped, forested or agricultural landscape. As a result, views from resources which currently consist of forested hillsides will be altered through the introduction of transmission line infrastructure.	Indirect	Built/living heritage resources: Construction and operation of the proposed Project will permanently alter current views from resources through the introduction of modern transmission line infrastructure into currently undeveloped, forested or minimally developed agricultural landscapes Permanent, physical damage previously undiscovered archaeological resources, if present, within the proposed tower foundation locations.
Noise Pollution: Noise levels from transformers at the proposed substation will likely be within the range of 60-80 dBA, which exceeds the WHO recommended noise level for residential areas.	Indirect	Built/living heritage resources: Noise generated by the operation of the two proposed substations could permanently alter the setting of physical cultural resources through the introduction of increased noise. Increased noise could result in permanent, negative impacts on the ability of stakeholders to perform religious rituals, veneration, devotions, and ceremonies at built/living heritage sites near the substations.

841. Viewshed impacts to physical cultural resources occur when the introduction of new, modern buildings or infrastructure permanently alter the setting or context of a resource and thereby diminish its historical, aesthetic, religious, or cultural value to stakeholders. The magnitude of the impact depends on the extent to which the new infrastructure intrudes on or dominates views from the resource (i.e. stakeholders can see the new construction from the resource) or views of the resources (i.e. stakeholders looking at/towards the resource can now also see the new infrastructure), and the importance of those views. The severity of the impacts is assessed based on whether the addition of new infrastructure affects the integrity of the resource, defined as the ability of the resource to convey its cultural, historical, religious, or aesthetic significance through physical features, setting and context.

842. It is assumed that the generally hilly terrain and presence of forest buffers between the proposed Project and most settlements will completely or partially obscure views of the proposed Project from built/living heritage resources that are located over 500 m away from the proposed Project right-of-way, resulting in negligible visible impacts. Resources within 500 m could be subject to more significant impacts depending on how views to and from the resources contribute to their cultural significance or value to stakeholders.

843. Physical cultural resources within 500 m of the proposed Project right-of-way could be subject to greater visual impacts as it is assumed the proposed Project will be more visible in views from or towards these resources. The physical cultural resource baseline study identified 36 built/living heritage resources within 500 m of the proposed Project right-of-way: forty-six (27) Hindu temples, one (1) Hindu park, two (2) Buddhist parks, one (1) Buddhist monastery, two (2) Buddhist ponds, two (2) Christian Churches, one (1) historic park, and one (1) meditation center of unknown cultural affiliation.

844. It is anticipated that the introduction of the proposed Project into viewsheds of the Hindu temples, Buddhist monastery, Christian churches, and the meditation center will result in negligible to minor impacts based on how these resources are likely used by stakeholders. Hindu temples are typically viewed as the home of a deity with stakeholders entering the temple to venerate, worship, or perform rituals in front of a statue, object, or icon associated with the deity. Stakeholder use is focused on the interior, not exterior space with the cultural significance of the site based on what is housed inside the temple rather than the setting or context of the temple in the greater landscape. Similarly, the interiors of the two Christian churches are used by their congregations for worship and religious ceremonies with the cultural and religious emphasis on activities within the structure rather than the exterior setting. The Buddhist monastery is likely also used for meditation, learning/teaching, and other activities in the interior of the structure. Based on the cultural emphasis on the interiors of these structures, it is anticipated that the presence of the proposed Project in the viewsheds of these resources will result in permanent, indirect impacts of minimal to low significance. Additional stakeholder engagement is, however, necessary to fully define the significance of potential Project viewshed impacts to these resources.

845. The three (3) Buddhist parks (Gautam Buddha Park, 108 Pipal Tree Park, and Sahitya Tirtha), one (1) Buddhist pond (Devdaha Kund and , one (1) Hindu parks (Naryanpur Mandir) and one (1) historic park are likely to be more significantly impacted by presence of the proposed Project within their respective viewsheds. These sites are used for outdoor activities, usually at the family or community level for religious devotion and festivals, with an emphasis on outdoor settings and views. The proposed Project will pass over the Sahitya Tirtha Park and proposed monastery site; the right-of-way will border the northern boundary of the Gautam Buddha Park and pass within 5 m of the Naryanpur Mandir pond and temple, meaning the proposed transmission line will be highly visible/dominate views from within these parks.

846. The Devdaha Kund pond is another outdoor site and is reportedly used by members of the local community for ritual bathing. The proposed Project will be located approximately 75 m from the northern edge of the pond, meaning it will be highly visible/dominate views to the north, significantly altering the outdoor setting of the resource. Similarly, the Harshedadha Park and temple are used by the local Tharu indigenous community for individual and community ritual and bathing. For example, on Magh 1st (Maghe Sankranti) the Tharu community have a large celebration at the temple and bathe in the pond. The proposed Project will pass within 12 m of the Harshedadha Park, permanently changing views from this outdoor focused resource. In addition, the proposed Project will pass within 40 m of Ramapithecus Park, significantly altering the setting the park which is focused on an outdoor statue of *Ramapithecus.*

847. Due to the likely importance of the outdoor setting of these resources and the proximity of the proposed Project, it is anticipated that the presence of the proposed Project in the viewsheds of these resources will result in permanent, indirect impacts of moderate significance to these locally

important physical cultural resources. Additional stakeholder engagement is, however, necessary to fully define the significance of potential Project impacts to these resources.

848. Noise levels from transformers at the proposed substation will likely be within the range of 60-80 dBA, which exceeds the WHO recommended noise level for residential areas. Two built/living heritage resources are located within 100 m of the proposed Lamahi substation and could be subject to noise impacts. Site 1 is located within 25 m of the proposed substation and described as a Cow Refugee in Google Earth Pro. Site 2 is a small, Hindu Shrine located approximately 85 m from the proposed substation footprint. Due to the proximity of both locally significant and their anticipated uses, these sites could be subject to permanent noise from the proposed substation, resulting indirect impacts of minor significance.

Cumulative Impacts

849. Construction and operation of the proposed Project will contribute to cumulative impacts on physical cultural resources from additional planned electrical transmission projects and an anticipated increase the construction and operation of small- and large-scale infrastructure, residential, and commercial projects within the agricultural areas, village, towns, and forests surrounding the proposed Project.

850. It is anticipated that the NEA will undertake additional electrical transmission and electrification projects as part of its stated drive to expand access to electricity. The construction of additional transmission lines in the region will likely result in similar direct and indirect impact to physical cultural resources as those identified for the proposed Project: physical damage to archaeological and living heritage resources; visual and noise impacts to built/living heritage resource; and potential restrictions on stakeholder access to built and living heritage resources. It is anticipated that these impacts will affect archaeological sites of local to national significance and built and living heritage resources of local significance; be of roughly the same magnitude as those of the proposed Project, and result in direct and indirect impacts of similar severity.

851. Operation of the proposed Project will also likely lead to induced impacts on physical cultural resources within the communities served by the proposed Project. Increased access to electricity in the region is likely to contribute to increased levels of economic development and prosperity which will likely result in the construction of additional residential, commercial, and/or industrial projects. The construction and operation of these anticipated projects will likely result in additional impacts to physical cultural resources. Ground disturbing activity from the construction of new infrastructure and buildings/facilities could result in physical damage to archaeological resources and living heritage resources such as sacred trees or medicinal plants. Construction activity and increased vehicle traffic will likely cause additional temporary noise related impacts to built/living heritage resources. Construction of modern infrastructure and commercial or industrial buildings will alter views to and from built/living heritage resources, permanently impacting their current rural or forested setting.

852. Adoption and implementation of the recommended physical cultural resource management measures in this assessment by the government of Nepal and/or project proponents/developers will reduce potential cumulative impacts by avoiding, minimizing, and/or mitigating anticipated impacts to physical cultural resources.

Impact summary and assessment of significance

853. The following table provides an assessment of the significance of potential impacts to cultural heritage before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 135: Cultural Heritage Potential Impact

Component	Potential Aspects / Impact	Project Phase	Magnitude	Extent	Duration	Significance
NBTL	Chance finds from Tower foundation excavation and land clearing	C	H	SS	ST	High
SS	Chance finds from Substation earthworks	C	M	SS	ST	Low
All	Chance finds from Access road construction	C	H	L	ST	High
All	Physical damage and/removal of culturally significant tree and plant species	C	H	SS	ST	High
All	Noise pollution to cultural heritage sites, ceremonies, etc	C	M	SS	ST	Low
All	Reduced access to cultural heritage sites	C	M	L	ST	Moderate
All	Impacts to viewsheds from towers and substation	O	M	R	LT	High
SS	Substation noise affecting cultural heritage	O	L	L	LT	Moderate

Mitigation and Management Measures

854. Table 136 outlines GIIP and feasible and cost-effective measures to prevent or minimize impacts to physical cultural resources during the construction and operation of the Proposed Project.

Table 136: Mitigation and Management Measures

Project phase	Mitigation and management measures
Pre-construction	Develop and Implement a Project specific Physical Cultural Resources Management Plan (PCR MP) as part of the Project EMS. Plan should include: • Physical Cultural Resources Stakeholder Engagement Plan (PCR SEP) • Physical Cultural Resources Treatment Plans to avoid, minimize, and/or mitigate impacts to individual physical cultural resources. • Chance Finds Procedure (CFP) to address potential impacts to previously unidentified physical cultural resources. • Physical Cultural Resource Grievance Mechanism
Construction and Operation	Implement PCR MP as part of the Project EMS: • CFP to be implemented by one or more physical cultural resource monitors. • Physical Cultural Resources Grievance Mechanism to be incorporated into overall project Grievance Mechanism

855. Based on the results of the physical cultural resources impact assessment and to align the Project with the ADB Safeguard Policy Statement, the Project will need to develop and implement a Physical Cultural Resources Management Plan (PCR MP) to be incorporated into the Project EMS. The PCR MP will include the following elements:

a) Physical Cultural Resources Stakeholder Engagement Plan (PCR SEP);

b) Based on the results of the PCR SEP, individual physical cultural resource treatment plans to avoid, minimize, and/or mitigate impacts to individual resources;

c) A Chance Finds Procedure (CFP); and

d) Incorporation of physical cultural resources reporting into the Project Grievance Mechanism.

856. The PCR SEP will be developed by the EPC contractor prior to and implemented during the final design phase of the proposed Project. The PCR SEP will include the following elements:

a) Engagement with the Nepalese Department of Archaeology (DoA) to confirm avoidance buffers around the Sainamaina, Manimukunda Sen Park/ Phulbari, Devdaha Kund archaeological resources;

b) Stakeholder mapping, in consultation with local community leaders, to identify affected communities that use the potentially impacted built/living heritage resources within 500 m of the proposed Project right-of-way and stakeholders who may have sacred trees within or harvest medicinal plants from the forested portions of the Project right-of-way;

c) Stakeholder engagement with affected individuals and/or communities that use the potentially impacted built/living heritage resources within 500 m of the proposed Project right-of-way to determine the types and frequency of religious, devotional, ritual, and/or ceremonial activities performed at the site and solicit feedback on how potential noise and visual impacts could affect the cultural, religious, historical, and/or aesthetic significance of the resource.

d) Stakeholder engagement with affected communities that may have sacred trees or harvest medicinal plants from within the forested portions of the right-of-way to identify specific trees and harvesting areas.

857. Based on the results of the stakeholder engagement with community leaders and affected communities, develop resource specific treatment plans to avoid, minimize, and/or mitigate impacts to built/living heritage resources within 500 m of the proposed Project right-of-way and sacred trees or medicinal plants within Project vegetation clearance areas. Treatment plans could include, but are not limited to, the following management measures:

a) **Avoidance:** micro-reroutes/micro-relocation of proposed Project components; relocating tree and vegetation clearance areas to avoid areas with sacred trees and/or medicinal plants; scheduling construction activities around significant rituals, ceremonies, festivals, etc. to avoid construction noise and traffic impacts; and incorporating avoidance of roadways near built/living heritage resources into the Project traffic management plan.

b) **Minimization:** micro-reroutes/micro-relocation of proposed Project components to reduce visual and noise impacts or reduce the number of sacred trees or medicinal plants impacted by vegetation clearance; planting trees or shrubs between built/living heritage resources and the Project right-of-way to screen/block views of the Project and/or reduce noise during Project construction; scheduling construction activities to minimize disruption of daily, weekly, monthly, and/or yearly rituals, devotions, and/or religious ceremonies at resources.

c) **Mitigation:** if culturally/religiously appropriate, relocating resources away from the proposed Project; compensating affected communities by providing funds to repair or improve structures and infrastructure and/or expand impacted resources; and planting or replanting areas cleared by the Project with sacred tree and/or medicinal plant species.

858. The CFP will be developed by the EPC contractor, in consultation with the DoA and affected communities, during the final design phase of the proposed Project and implemented during the construction phase. A chance find is any physical cultural resource encountered unexpectedly during Project construction or operation. A CFP is a project-specific procedure that outlines what will happen if previously unknown physical cultural resources (i.e. archaeological, paleontological, built heritage, and living heritage resources) are encountered during project construction or operation.

859. The CFP will include the following elements:

a) One or more qualified, physical cultural resources specialists to be part of the EPC contractor's environmental and social management team to monitor construction activities for chance finds and respond to potential chance finds reported by EPC contractor staff or their subcontractors;

b) Construction monitoring by the physical cultural resource specialist(s) during all construction works within 250 m of a previously recorded archaeological resource.

c) Resource specific procedures for identifying, documenting, assessing and resolving the discovery of all types of physical cultural resources (i.e. archaeological, paleontological, built heritage, and living heritage) developed in consultation with relevant Nepalese government authorities and potential affected communities identified through the PCR SEP;

d) Clear criteria and procedures for temporary work stoppages and reporting to address potential chance finds;

e) Due to the length of the proposed Project right-of-way and the anticipated travel times to the Project area, develop a multi-tiered classification system for resolving chance finds in consultation with the DoA, affected communities, and other relevant government authority to define:

    a. **Minor Chance Finds**: finds that can be documented and addressed by the physical cultural resources monitor onsite without consultations or development of a treatment plan and reported to the DoA, affected communities, and/or relevant government authorities at a later date as part of regular Project reporting;

    b. **Major Chance Finds**: finds that need to be immediately reported to the DoA, affected communities, and/or government authorities and will require a site visit, consultation, and the development of a resource specific treatment plan to avoid, minimize, and/or mitigate impacts to the find.

f) Roles and responsibilities and reporting and response timelines for EPC staff and their contractors as well as the DoA, affected communities, and/or relevant government authorities. Reporting and response timelines to be agreed in consultation will include:

    a. Immediate reporting of all potential chance finds to EPC physical cultural resources monitor;

    b. Roles and responsibilities and a timeline for reporting Minor Chance Finds to the DoA, affected communities, and/or relevant government authorities;

    c. Roles and responsibilities and a timeline for reporting Major Chance Finds to the DoA, affected communities, and/or relevant government authorities

    d. Roles and responsibilities and a timeline for DoA, affected communities, and/or relevant government authorities to conduct a site visit;

    e. Roles and responsibilities and a timeline for consultations with the DoA, affected communities, and/or relevant government authorities to develop and implement treatment plans to address chance finds;

g) Record keeping and expert verification procedures for documenting chance finds and compliance with the CFP.

h) Chain of custody instructions and requirements for movable finds.

i) CFP implementation and physical cultural resources awareness training to be included in EPC and EPC contractor induction materials to ensure all Project staff can identify potential chance finds during their day-to-day activities and know how to report potential finds.

860. The EPC Contractor will be responsible for incorporating procedures for reporting physical cultural resources or impacts to physical cultural resources into the overall Project Grievance Mechanism. The physical cultural resources components of the Grievance Mechanism will include procedures for

communicating reported grievances related to physical cultural resources to the physical cultural resources specialists and consultation procedures for addressing grievances.

Residual Impacts

861. The extent to which restricting user access to physical cultural resources can be avoided through construction scheduling and traffic management is currently unknown.

Table 137: Residual Noise and Vibration Impacts

Phase	Potential Impact	Significance	Residual Impact	Residual Impact Significance
C	Chance finds	High	Portions of archaeological or living heritage resources will likely still be impacted during construction if they are discovered as chance finds, with implementation of the CFP minimizing post-discovery impacts.	Moderate
C	Physical damage and/removal of culturally significant tree and plant species	High	Implementation of the management measures outlined will reduce the severity of physical impacts to archaeological and living heritage resources and viewshed impacts to built/living heritage but it is unlikely they will completely eliminate the impacts.	Moderate
C	Noise pollution to cultural heritage sites, ceremonies, etc	Low		Not significant
C	Reduced access to cultural heritage sites	Moderate		Low
O	Impacts to viewsheds from towers and substation	High	Management measures to address noise and viewshed impacts will similarly reduce the severity of these impacts but will not completely remove the impact without re-routing or re-locating project impacts.	Moderate
O	Substation noise affecting cultural heritage	Moderate	Implementation of the management measures outlined will reduce the severity of physical impacts but it is unlikely they will completely eliminate the impacts.	Low

VIII. STAKEHOLDER ENGAGEMENT, INFORMATION DISCLOSURE AND GRIEVANCE MECHANISM

8.1 Public Consultation Requirements

862. According to the ADB Safeguard Policy Statement (2009):

"The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation. Meaningful consultation is a process that:

- Begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle;
- Provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people;
- Is undertaken in an atmosphere free of intimidation or coercion;
- Is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and
- Enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

Consultation will be carried out in a manner commensurate with the impacts on affected communities. The consultation process and its results are to be documented and reflected in the environmental assessment report."

8.2 Stakeholder Engagement Activities

863. To date a wide range of consultations have been undertaken with the community and with government departments and NGOs. 602 community members have been consulted during public meetings, 144 of which were female. A further 161 women have been consulted during gender specific focus group discussions. Meetings have also been held with various organizations such as Bird Conservation Nepal, Royal Society for Protection of Birds and WWF Nepal. Further, NEA have communicated directly with all 71 community forest user groups affected by the project and with all five Division Forest Offices.

Table 138: Public Hearings and Meetings

#	Date	Location	Total	Male	Female	Discussion Topic
1	17-Nov-21	Ward Office-4 Lamahi Municpality	4	3	1	Presentation of the proposed project to CFUG
2	18-Nov-21	CF OfficeNamdi Municipality	4	3	1	Presentation of the proposed project to CFUG

#	Date	Location	Total	Male	Female	Discussion Topic
3	17-Nov-21	Ward Office-7 Lamahi Municpality	6	6	0	Presentation of the proposed project to CFUG
4	17-Nov-21	Satbariya-2	3	3	0	Presentation of the proposed project to CFUG
5	24-Nov-21	Satbariya-8	3	3	0	Presentation of the proposed project to CFUG
6	25-Nov-21	Shivapur-1	8	7	1	Presentation of the proposed project to CFUG
7	28-Nov-21	Sainamaina-10	9	9	0	Presentation of the proposed project to CFUG
8	29-Nov-21	Sainamaina-4	7	4	3	Presentation of the proposed project to CFUG
9	27-Nov-21	Bhumahi-1	6	4	2	Presentation of the proposed project to CFUG
10	28-Oct-21	Jyotinagar-3, Butwal	8	7	1	Presentation of the proposed project to CFUG
11	29-Oct-21	Butwal-2	4	4	0	Presentation of the proposed project to CFUG
12	29-Oct-21	Jiteshworf CF	1	1	0	Presentation of the proposed project to CFUG
13	29-Oct-21	Sainamaina-1	2	2	0	Presentation of the proposed project to CFUG
14	29-Oct-21	Butwal-12	2	2	0	Presentation of the proposed project to CFUG
15	27-Oct-21	Gadhwa	12	11	1	Presentation of the proposed project to CFUG
16	27-Oct-21	Gupteshwor Mahadev Temple	12	11	1	Presentation of the proposed project to CFUG
17	28-Oct-21	Gadhwa-1	7	5	2	Presentation of the proposed project to CFUG
18	28-Oct-21	Gadhwa-1	7	4	3	Presentation of the proposed project to CFUG
19	28-Oct-21	Gadhwa-1	9	7	2	Presentation of the proposed project to CFUG
20	28-Oct-21	Sitganga	10	6	4	Presentation of the proposed project to CFUG
21	29-Oct-21	Jawutepani CF	8	6	2	Presentation of the proposed project to CFUG
22	29-Oct-21	Ram gadhi CF	11	10	1	Presentation of the proposed project to CFUG

#	Date	Location	Total	Male	Female	Discussion Topic
23	29-Oct-21	Kalika CF	11	8	3	Presentation of the proposed project to CFUG
24	31-Oct-21	Dharandev CF	16	7	9	Presentation of the proposed project to CFUG
25	03-Sep-21	Banganga-7	19	14	5	Presentation of the proposed project to CFUG
26	07-May-23	Municipal Office Lamahi Municipality	38	33	5	IEE findings
27	08-May-23	Seetganga-8, Argakhachi	121	79	42	IEE findings
28	09-May-23	Banganga-7, Motipur, Kapilbastu	64	48	16	IEE findings
29	10-May-23	Butwal SMC	58	38	20	IEE findings
30	11-May-23	Bhumahi, Sunwal	29	27	2	IEE findings
31	14-Mar-24	Lamahi Substation	56	39	17	Key issues and impacts relating to NBTL
32	15-Mar-24	Moitpur SS	9	3	6	Key issues and impacts relating to NBTL
33	16-Mar-24	Davdaha Municipality	29	25	4	Key issues and impacts relating to NBTL
34	16-Mar-24	Devdaha-9	4	1	3	Buddha pond
35	16-Mar-24	Rohini CF, Kamal Chowk, Devdaha-10	5	4	1	Use of CF and biodiversity
36		Banbasa Village, Tower 278 KBA				Biodiversity
37		Gabdahawa, Buddhabhumi-9				Biodiversity
Total			602	444	157	

Table 139: Women's Focus Group Discussions

SN	Location	Total Female Participants	Date
1	Dhankhola Dang	12	12/05/2024
2	Kalkate Dang	11	12/05/2024
3	Pakhapani, Dang	15	14/05/2024
4	Majhengadh, Dang	12	14/05/2024
5	Kolhawa, Dang	14	13/05/2024
6	Kaudiya, Dang	10	13/05/2024
7	Narayanpur, Dang	12	12/05/2024
8	Asani, Dang	9	13/05/2024

SN	Location	Total Female Participants	Date
9	Dhodre, Arghakhanchi	8	12/05/2024
10	Dubiya, Kapivastu	10	11/05/2024
11	Shivraj, Minargaun	11	11/05/2024
12	Women Devdaha	12	10/05/2024
13	Ganganagar, Rupandehi	10	10/05/2024
14	Jhimjhime, Rupandehi	15	11/05/2024
Total		161	

Table 140: Meetings with Government Departments and NGOs

#	Date	Department/NGO	Persons Consulted
1	16-Jan-2024	Division Forest Office, Administers Shivpur Forest KBA	Prem Kumar Prasad Shiv Shankar Prasad Ganesh Chaudhary
2	Various	Department of Archaeology	Saubhagya Pradhananga Ram Bahadur Kunwar Shobha Maharjan Nawaraj Adhikary
3	Various	Bird Conservation Nepal	Ishana Thapa Ankit Bilash Joshi Mohan Bikram Shrestha Dilip Chand Bhopal Nepali Deu Bd. Rana
4	14-Mar-24	Banke National Park	Manoj Shah – Park Warden
	15-Mar-24	Community Vulture Restaurant, Lalmatiya Dang Vulture Resturant, Lalmatiya Dang	Lal Madi Bhusal Lalmatiya - Anti Poaching Group member of Kalika CF Atma Ram Pokharel - Former President of Vulture Center Shiva Ram Magar - Member of Kalika CF Tika BM - Vulture Feeding Center Krihsna Pokharel - Officer of Kalika CF Dil Bahadur Kumal - Guard of the Kalika CF Yam Bahadur Rokka Magar - Tresurer CF
5	03-May-24	Nepal Conservation and Research Center	Santosh Bhattarai - Wildlife Biologist specialized in Reptiles
6	15-May-24	WWF Nepal	Ek Raj Sigdel - Head of Policy and Governance
7	09-May-24	Globally Threatened Species Officer & SAVE Programme Manager Co-chair IUCN Vulture Specialist Group, Royal	Chris Bowden, MBE

#	Date	Department/NGO	Persons Consulted
		Society for Protection of Birds	
8	24-May-24	Chure Terai Madhesh Conservation Development Committee	Kiran Paudyal - Chairperson, Chure Conservation Board Sharad Bd. Pageni - Under Secretary, Chure Conservation Board Prem Nath Poudel - Geologist, Chure Conservation Board

Figure 128: Consultation

Figure 129: Consultation – 'Buddha Pond'

Figure 130: Consultation - Lahami

Figure 131: Consultation

864. The following section summarizes the key findings from the environment safeguard consultations completed to date.

8.3 Public Consultations

8.3.1 Initial Consultation Findings for IEE

865. The following table presents the findings of the consultations completed on the national IEE. The findings exclude land acquisition and compensation comments which are discussed as part of the Project RIPP.

Table 141: IEE Consultation Summary

SN	Public hearing	Comments	Responses
1	Lamahi, Dang	• Engaging with the affected HHs is crucial for awareness of the project impact and confidence building of public towards the project. • Such engagement will ensure minimizing the conflicts during the project implementation. • Coordination with the police is essential to prevent conflicts. • The project must adhere to GoN's tress removal and forest land acquisition process and working closely with DFO and affected community forests. • All the affected CFUGs shall be engaged in the process. • Lamahi Substation site, currently used by "Sari Bagar Baba Gaudham" for cow protection initiative, will collaborate with the project for smooth implementation. • Enhanced electricity supply with the project will support regional economic growth by boosting industries and entrepreneurship.	Engagement has been ensured throughout the IEE Study. All issues are included in the mitigation measure.
2	Shitganga, Arghakhanchi	• All of the CFUGs affected by the project shall be engaged and coordinated during the project implementation. • Social assistance program shall accompany the project implementation.	Engagement has been ensured throughout the IEE Study. All issues are included in the mitigation measure.
3	Banganga, Kapilvastu	• Re-route the TL alignment away from the Buddha Bhumi	Engagement has been ensured throughout the IEE Study. All issues are included in the mitigation measure. Rerouting of the TL alignment away from Buddha Bhumi has been performed to avoid the settlement and cultivated land.
4	Butwal, Rupandehi	• The complete transmission line alignment should be installed underground if it is possible technically and financially. This can ensure avoidance of most of the social issues.	Engagement has been ensured throughout the IEE Study. All issues are included in the mitigation measure.

SN	Public hearing	Comments	Responses
		• The proposed TL alignment through Chetana Pasang tole intersects areas prone to landslides. Detailed planning to prevent landslides is essential for project benefits and local residents' welfare. • Given the substantial impact on extensive forest areas consisting of the community forests, engagement with all affected CFUGs is crucial. • Local engagement in survey work is vital, ensuring their participation and input. • Compensatory plantation often occurs away from tree cutting sites, limiting benefits for affected areas and potentially impacting watersheds by reducing water yield. • The project's enhanced forest access could inadvertently encourage illegal harvesting of forest resources and poaching activities.	Underground installation of all the TL route was found not possible financially, thus, this approach has not been pursued after the consultation with the project design team in NEA. The design team will reassess the landslide and geo-hazard assessment study. This is, currently, being undertaken by NEA. Including locals in the survey team has been suggested to survey team.
5	Sunwal, Nawalparasi	• The project traverses through the district's forested area, potentially impacting water sources. • Establish a robust Grievance Redressal Mechanism for locals to voice concerns effectively. • Allocate the CSR budget to the community for optimal utilization. • Enhance communication channels with Community Forest User Groups (CFUGs). • Address carbon sequestration loss due to tree cutting in the report. • Detail the compensation plantation procedure in the report. • Provide support for schools' drinking water through the project. • Anticipate conflict during implementation, necessitating strong conflict resolution through an empowered grievances redressal mechanism.	Engagement has been ensured throughout the IEE Study. All issues are included in the mitigation measure. NEA allocates budgets for CSR.

8.3.2 Women FGD Findings

866. Fifteen separate FGDs were conducted within villages close to NBTL. A range of questions were posed to the participants by a female lead in the meetings using a structured questionnaire. The participants were also provided with a project information brochure summarizing key aspects and impacts of the Project. The following key points were raised:

- Water Pollution issues from the project can be of concern.

- Encroachment of forest from project construction and operation could occur.
- Safety concerns from electricity infrastructure to women going to the forest for fodder and firewood
- Project can possibly destroy old buildings if routed through them.
- Concerns on Health effects from EMF of the Project infrastructure to women.
- Women friendly environment needs to be created by the Project.
- Currently power outages can increase women work load and hence provide less time for studies.
- Improved electricity supply can generate extra income through activities such as in agriculture, sewing, electric vehicle such as Safari etc.
- Major health issues women can face include depression and fear of domestic violence.

8.4 Consultations with Government Departments and NGOs

867. The following table summarizes the key points raised to date by government departments and NGOs.

Table 142: Key Feedback from Government Departments and NGOs

Department/NGO	Key Points Raised
Division Forest Office, Administers Shivpur Forest KBA	1. No surveys have been carried out by DFO on tortoise in these forests. 2. Turtle collected between Surahi River to Chirahi River during monsoon season in last one year but did not survive. 3. Other important species found in these forests include Golden Monitor Lizard, Python, Cobra and Great Hornbill.
Department of Archaeology	1. The Sainamaina Site the alignment crossed over has archaeological surface evidences in the forest. 2. Consent from the Department of Archeology will be necessary prior to any works in the area. 3. The NBTL's inclusion of DoA in Archaeological Assessment is a positive example of interdepartmental cooperation for infrastructure development projects in Nepal. 4. HIA assessment was carried out from NEA, DoA collaborationin April. The report to be received by Mid-May will be reviewed by DoA. Followed by notification to NEA with briefing on findings, decisions made and during the process it is suggested that HIA expert from ADB provide their suggestion, recommendation. This can be used as a combined report. DoA has a procedure according to which DoA recommended consultant from its roster will need to be hired for HIA. Otherwise, such HIA will not be recognized by DoA. 5. Currently DoA can immediately recommend for NBTL that tower construction sites needs to include the position of Archaeologist rather than an Archaeological Officer (so that experts from DoA in addition to consultants will be involved in monitoring) on Areas considered by DoA as Archaeologically important sites. Any Archeologically sensitive areas that are encountered need to abide by DoA conditions as well as prevalent laws.

Department/NGO	Key Points Raised
Bird Conservation Nepal	1. The Kaptangunj Vulture Nesting Site: The Site north of the transmission line is Chure Hills and shifting the alignment north will raise the height of the tower location hence may pose greater risk of collision to the vulture. Since realigning to the hills or moving to the south (where more vulture movements have been observed compared to the north of the existing nests) does not appear to increase the safety hence incorporating mitigation measures to reduce collision in the existing alignment here can be considered practical (based on existing identified site conditions by BCN). 2. Ashnariya Vulture Nesting Site: The region north of the existing line appears flat land and hence realigning north and, if to remain in the forest, keeping the tower height low i.e preferentially below canopy layer can reduce risk of vulture collision. 3. The Requested Vulture Flight Data can be provided for one vulture location (live vulture location data for all the vultures may be difficult to provide). The tagged vultures majorly are from Western parts of Nepal (Suklaphanta Region) and Nawalparasi District in Central Nepal.
Banke National Park	1. Tiger Population Increased to 25 and migrate outside the national park. 2. 4 Elephants migrated from India are in the National Park. 3. Park has vulture as well. 4. Forests outside national park are corridor for movement of tigers. 5. The park is in need to establishing more posts in the central region of the core area where monitoring is not possible and constraints of water exists as in Chure Region water is scarce.
Community Vulture Restaurant, Lalmatiya Dang Vulture Resturant, Lalmatiya Dang	1. In one feeding 100 to 350 vultures come. 2. 7 species of vultures are identified feeding among these Egyptian, White Rumped, Himalayan Griffon, Long Billed, Slender Billed, Eurasion Griffon and Cenerous Vultures are known to visit. 3. One vulture wing got injured in winter with collision with existing 132kV TL close to the Vulture Feeding site and died, however since then no collision incident have been reported. 4. 11 members work in the shed, the building being built is for religious purpose, 200 cows live in the area.
Bird Conservation Nepal	1. There are 11 vulture nesting sites/colonies alongside the transmission line alignment. 2. Among the vulture nesting sites, nesting site of White-rumped vulture and Slender-billed vulture at Kaptangunj, Dang (27.880202 82.456013) and White-rumped vulture nesting colony at Ashanariya, Kapilvastu (27.687605 82.968695) is about 1.2 kilometers south of the existing transmission line. 3. There is higher risk of collision and electrocution to vultures in these two sites while movement between foraging and nesting sites. Thus, translocating transmission line further north about 3 kilometers from the nesting site (2 km from the existing TL alignment) is suggested. 4. Besides, the largest White-rumped vulture nesting sites/colonies among recorded sites is in Rajapani, Kapilvastu (27.657004 83.202196). A total of 113 nests are in this particular site. Though, this site is 7 kilometers south from the TL alignment, it is significant site. Thus, halting construction works during breeding season (September to April) is suggested.

Department/NGO	Key Points Raised
	5. The two closest nesting sites need to have specific mitigation measures if rerouting is not needed. 6. Rapti River a bird congregatory and migratory sites need to include mitigation measures 7. The nesting site have White Rumped and Slender Billed Vultures
Nepal Conservation and Research Center	1. In addition to species of turtles, tortoises flagged in the critical habitat assessment Elongated Tortoise Indotestudo elongata, Three-keeled Land Tortoise Melanochelys tricarinata, Indian Eyed Turtle Morenia petersi (can be ruled out) in Shivapur Forest Key Biodiversity Area located at Kapivastu District. Endangered Species of Golden Monitor Lizard (Varanus flavescens), other lizards (IEE have recorded in total 14 species of lizards of which Siwalik Fan Throated Lizard being original home to the Shivapur Forest) needs to be studied considering how much of prime habitat will be modified by the project. 2. Although in the Shivapur Forest Area approximately half of the alignment is close to the highway, river crossings can be important habitat or feeding sites for the tortoises.
WWF Nepal	1. Documents such as DPR and IEE if provided then give specific recommendation from WWF can be given. 2. Sensitivities such as Conservation Area, Biodiversity Hotspot areas needs to be considered during assessment of the project. 3. Indigenous people, local community, women group at project site is presumed to have been consulted. Currently FPIC is followed under good international practices. 4. WWF presumes that species such as Tiger and elephant have been considered into the process of Environment Assessment. 5. MoFE will have soft web portal for EIA where the process Environmental Assessment Process of development can be observed. 6. Wildlife Friendly Infrastructure Directives need to be followed 7. WWF may be in a better position to provide more details after seeing the DPR, IEE and EIA.
Globally Threatened Species Officer & SAVE Programme Manager Co-chair IUCN Vulture Specialist Group, Royal Society for Protection of Birds	Written response from Mr. Bowden (21-May-24): We're obviously very concerned to understand the routing of the transmission line, and how at least two Critically Endangered species of vulture, White-rumped and Slender-billed are clearly likely to be directly impacted. This region of Nepal also supports breeding populations of two more highly threatened vulture species, Red-headed and Egyptian Vultures which is a further concern. Slender-billed Vulture in particular having such a tiny population (less than 1,000 pairs globally) is of special concern, and the Nepal populations of both these species (White-rumped and Slender-billed) are currently the only ones anywhere which have shown at least initial signs of recovery anywhere (Galligan et al. 2020, Prakash et al. 2024). We recognise there may be limited flexibility in such a major, national economic priority project to prevent, bury or divert the route of the proposed powerline, but would very much hope and expect that some significant efforts to minimise the impact can be taken-up to reduce collision and electrocution risks in particular – and serious consideration given to options to shift locations or routing where this can be clearly justified. With this in mind, we raise the following points: 1. If understood correctly, there is detailed information on the movements of some nesting vultures in the area – their main trajectories (and potentially their heights?). Further information needs to be collected on this in order to plan the best route to avoid vulture collisions.

Department/NGO	Key Points Raised
	a) The best route will not always be the furthest away from nests, depending where vultures cross the route and at what height. b) Note that there is some satellite tagging information from the area, and this will be the most efficient way to collect more data before and after the line is installed. Each bird may behave differently, but a practical approach would be to satellite tag and closely monitor at least two birds from each nesting colony in the area. c) At least one year's data will be necessary before finalising the route, as seasonal movements will vary. d) There may also be opportunities to further exploit and compile data referred to and collected by Mallord et al. 2024 on height of birds. 2. Is there detailed information on vulture feeding sites in the area? This will be important to incorporate, and if more information is needed on this, it could be generated? Cattle carcass dumps, abattoirs, and cow shelters are of special significance in this context. 3. The fitting of safely insulated poles will be a further priority. I believe you are already looking at the options on this and with the scale of movements expected, may be needed for long stretches through the area? 4. Post-operation monitoring to such a project will be very important for monitoring vulture nesting and in particular, mortality causes. Continuing the satellite tagging work well beyond the first tow years after any installation will be a very useful and important tool towards this. 5. As I mentioned on the call, although regular walking/monitoring of such lines can monitor the mortalities, if vultures are satellite tagged and well monitored, this will reveal not only mortality linked to the wires, and infrastructure, but importantly, also other mortality causes, and supporting this could be a positive outcome, and may indeed indicate other threats being more important. So we recommend investing in such monitoring for at least a year before and for 2-3 years after the line is in place, to best plan the line route and to understand the impacts.
Bird Conservation Nepal	1. BCN vulture monitoring (conducted three times a year) indicates several accident incidents, 43 incidences between 2000 to 2022 across the countries, with 3 cases (+1 in India) with suspected case of electrocution and collision with power distribution lines. The higher movements of the vulture have been recorded during the morning and evening for food. 2. During the breeding season from the months of September to May Vultures tend to keep themselves to approximately 3km radius of their nests however beyond that season they spread to larger areas. Hence according to BCN it may be difficult to specify that the current distance of the alignment of the TL is risky or safe. Nevertheless, ensuring that the towers are not raised to higher elevation regions and not rerouted to southern region can reduce risk since they prefer southerly movements in relation to their nesting sites and while soaring the higher elevation towers may induce higher collision risk. 3. According to international bird expert Richard Harness, site visits and analyzing satellite tagged data of vultures will provide him better understanding of the risks. At present it can be considered incorporating effective mitigation measures with better management of the diverters with conservation measures of insulating distribution poles can be very means to address vulture sensitivity in the area (considering the existing proposed route) on collision risks with Transmission and Distribution Power Lines.

Department/NGO	Key Points Raised
Chure Terai Madhesh Conservation Development Committee	1. There are landslide risks, specifically around Butwal and in the Shivapur area. The project needs to ensure that this is taken into account during design and erosion is not increased by land clearing works. 2. A restoration plan for Chure is being prepared this year, with a goal of managing landslide risks. This should be taken into account during detailed design. 3. The pass from Kapilvastu to Dang valley is a key bottleneck for migrating species. 4. Implementation of the mitigation measures is vitally important – following up on the EIA mitigation measures during construction and operation is critical. 5. Access roads constructed to the alignment should be removed after use to prevent further encroachment into the forest areas by the community. 6. Would be interested to explore options for cooperation with ADB on on-going and future conservation projects. 7. Would like to be kept informed of project progress on a regular basis.

8.5 Feedback from CFUG and DFO

8.5.1 DFO Feedback

868. Letters have been sent to division forest offices (DFO) in the Project area. The following provides a summary of the written responses to the letters.

869. **Division Forest Office - Rupandehi**

a) From the planning stage itself project needs to abide by the prevailing nations environmental and social laws.

b) During the pre-construction phase the enumeration of trees need to be documented with GPS coordinate.

c) During construction soring construction materials and discarding wastes in forest land and rivers should be avoided.

d) During pre-construction, construction and operation phase Mitigation measures on Habitat loss is to be carried out, preventive measures for forest fire, encroachment, hunting, smuggling and poaching needs to be undertaken.

e) From the report the recommendations in ToR and IEE need to be addressed and is mandatory and project will be responsible for the quality and standards of facts and figures in the report.

f) To delineate the areas of the National Forest the following is to be used for the project Subrule 4 of Rule 87 of Forest Rule 2079.

870. **Division Forest Office - Kapilvastu**. The positive impact outweighs the negative impacts with improved power quality and regional power trade. During planning in conditions of not avoiding the forest land prioritize to align the NBTL through Stream Banks and Road Side areas. During construction the compensatory planation sites needs to be conserved and managed.

871. **Division Forest Office – Nawalparasi.** No major issues were raised from Forest Office. They expect the project during all the stages to follow he laws of the nation on Forest Environment and Biodiversity Conservation.

872. **Division Forest Office – Dang**. Benefits of the project will result from better power quality in the area, industrial growth, electric vehicles, economic development while adverse impact will include to the collision risk to the resident and migratory birds, wildlife habitat loss and biodiversity. During planning the alternative alignment needs to be identified to reduce loss of forest as 92% of the TL is in forest, for report preparation IEE report needs to have a clear Environmental Management Plan, measures of minimizing habitat fragmentation be in place, construction and operation phase to include forest, wildlife and environment friendly measures. Specific conservation measures to be included for Bijaysal *Pterocarpus marsupium*, Bhyakur or Dioscorea species, Sunakhari (Orchid).

8.5.2 CFUG Feedback

873. Meetings were held with CFUGs as part of the National IEE. The following table summarizes the key findings of the meetings

Table 143: CFUG Feedback

Date	Location CF	Issues
17-Nov-21	Ward Office-4 Lamahi Municpality	Employment Opportunities, Trees to be handed to CFUG, Project to do the Compensatory Plantation
18-Nov-21	CF OfficeNamdi Municipality	Employment Opportunities, Trees to be handed to CFUG, Project to do the Compensatory Plantation
17-Nov-21	Ward Office-7 Lamahi Municpality	Employment Opportunities, Trees to be handed to CFUG, Project to do the Compensatory Plantation
17-Nov-21	Satbariya-2	Employment Opportunities, Trees to be handed to CFUG, Project to do the Compensatory Plantation including fencing in the forest and support forest conservation works
24-Nov-21	Satbariya-8	Employment Opportunities, Trees to be handed to CFUG, Project to do the Compensatory Plantation

Date	Location CF	Issues
25-Nov-21	Shivapur-1	Surahi CF at Kapilvastu the CFUG has requested to shift the alignment south ward in the CF area and if not possible to provide the CF similar Shorea robusta dense forest land to the CFUG and Employment Opportunities and Trees to be handed to the CFUG
28-Nov-21	Sainamaina-10	Employment Opportunities, Trees to be handed to CFUG, Project to do the Compensatory Plantation including fencing in the forest and support forest conservation works, Bhulke Drinking Water Source to be conserved, Pahila Kohola Irrigation works to be supported, upgradation of Phulbari Park, Jhimjhime Irrigation Project to be enhanced
29-Nov-21	Sainamaina-4	Pakha CF Employment Opportunities, Trees to be handed to CFUG, Project to do the Compensatory Plantation, A Temple Bhairavsthan will be affected by the project it needs to be managed and supported and the bridge to the temple also supported for repair, 8 biha land to be affected by the project and equivalent land to be provided
27-Nov-21	Bhumahi-1	A temple to be affected by the TL needs to be relocated and Drinking Water Tank also to be affected by the TL hence needs to be relocated
28-Oct-21	Jyotinagar-3, Butwal	AP 11 to AP12C to be affected the area has been experiencing landslides recently and experts are doing survey hence recommend the TL to do necessary study to relocate the Line from the area. Employment Opportunities and Benefit sharing, Forest Products to be handed to CFUG
29-Oct-21	Butwal-2	AP 12 D to AP 16 Employment Opportunities, Trees to be handed to CFUG, Project to do the Compensatory Plantation
29-Oct-21	Jiteshworf CF	AP 16 to AP 17 Employment Opportunities, Trees to be handed to CFUG, Project to do the Compensatory Plantation in 1:25. Tower Number AP17 falls in water park Jabbai and hence it needs to be shifted
29-Oct-21	Sainamaina-1	AP 17 to 18 Employment Opportunities, Trees to be handed to CFUG, Project to do the Compensatory Plantation, NTFP to be promoted and support Community Development Works
29-Oct-21	Butwal-12	At Dhankhola Public Toilet to be under the TL hence needs to be relocated

Date	Location CF	Issues
27-Oct-21	Gupteshwor Mahadev Temple	Gupteshwor Mahadev Temple, Toilet and Waiting Shed to be affected by the TL hence land to be provided
28-Oct-21	Gadhwa-1	Employment Opportunities, Trees to be handed to CFUG, Project to do the Compensatory Plantation, Infrastructure for forest
28-Oct-21	Gadhwa-1	Trees to be handed to CFUG, Project to do the Compensatory Plantation, Support Conservation Efforts of the CFUG
28-Oct-21	Gadhwa-1	Furke Saini CF Biodiversity Conservation Activities to be carried out
28-Oct-21	Sitganga	Jabune CF Employment Opportunities, Trees to be handed to CFUG, Project to do the Compensatory Plantation, support in Biodiversity Conservation
29-Oct-21	Jawutepani CF	Project to cause destruction of biodiversity hence water recharge ponds to be created by the project
29-Oct-21	Ram gadhi CF	Kalika CF Project to cause destruction of biodiversity hence water recharge ponds to be created by the project, compensatory plantation to be carried out and forest products to be handed over to the CFUH
29-Oct-21	Kalika CF	Employment Opportunities, Trees to be handed to CFUG, Project to do the Compensatory Plantation, fencing to be supported, water recharge ponds to be made
03-Sep-21	Banganga-7	Motipur Danda the Motipur Substation Area Occupies in parcel number 749 Bramhadev Temple therefore local people needs to be consulted for acquiring the land. Crematorium, Dharmasala needs to be supported Construction of the Janjyoti Secondary School needs to be compensated. Employment Opportunities, Trees to be handed to CFUG, Project to do the Compensatory Plantation

8.6 Summary of Key Issues and their Incorporation into the Project

874. The following table contains the key issues raised during the consultations and indicates where these issues have been addressed in the report.

Figure 132: Addressed Comments

Topic	Issue Raised	How Addressed
Poaching & Access	The project's enhanced forest access could inadvertently encourage illegal harvesting of forest resources and poaching activities.	Measures to manage poaching are included in Section 7.3.1
	Access roads constructed to the alignment should be removed after use to prevent further encroachment into the forest areas by the community.	Section 7.4.1 describes measures to close and revegetate access roads where they are not needed for maintenance.
Stakeholder Engagement	Engaging with the affected HHs is crucial for awareness of the project impact and confidence building of public towards the project. All the affected CFUGs shall be engaged in the process. Coordination with the police is essential to prevent conflicts.	Section 7.3.1 includes requirements for collaboration with CFUGs throughout the project.
	Chure Terai Madhesh Conservation Development Committee Would like to be kept informed of project progress on a regular basis.	Section 7.3.1 has specific requirements for continual dialogue with Chure officials.
Future Conservation Initiatives	Chure Terai Madhesh Conservation Development Committee would be interested to explore options for cooperation with ADB on on-going and future conservation projects.	ADB will continue to explore opportunities to ccoperate with Chure Terai Madhesh Conservation Development Committee in the future as part of on-going commitments to the project.
Forests & Plants	The project must adhere to GoN's tress removal and forest land acquisition process and working closely with DFO and affected community forests.	Section 7.3.1 clearly describes the requirements for tree cutting.
	Detail the compensation plantation procedure in the report.	Section 7.3.1 clearly describes the requirements for compensation planting.
Landslides	There are landslide risks, specifically around Butwal and in the Shivapur area. The project needs to ensure that this is taken into account during design and erosion is not increased by land clearing works.	Landslides have been assessed by NEA and problematic areas mapped. Further assessment of the issue will take place during detailed design.
	A restoration plan for Chure is being prepared this year, with a goal of managing landslide risks. This should be taken into account during detailed design.	This issue is noted and will be taken into account as part of the detailed design.
Grievances	Anticipate conflict during implementation, necessitating strong conflict resolution through an empowered grievances redressal mechanism.	A GRM for the project is included Section 8.9
Gender	Concerns on Health effects from EMF of the Project infrastructure to women.	This EIA has noted that there will be no significant impacts from EMF, but a project information program discussing EMF will be undertaken in the community.

Topic	Issue Raised	How Addressed
	Major health issues women can face include depression and fear of domestic violence.	The project will include the requirements for a contractors code of conduct which will include specific sections relating to GBV/SEAH.
Fauna	Endangered Species of Golden Monitor Lizard and other lizards needs to be studied considering how much of prime habitat will be modified by the project.	The EIA included a reptile survey focused on several species including lizards.
	Have species such as Tiger and elephant been considered into the process of Environment Assessment.	The project CHA included and assessment of the species.
Cultural Heritage	Tower construction sites needs to include the position of Archaeologist rather than an Archaeological Officer on Areas considered by DoA as Archaeologically important sites.	An archeologist will be engaged as part of the EPC Contractors team as well as Environmental Support Consultant Team.
	Re-route the TL alignment away from cultural heritage sites	Several re-routings away from cultural heritage sites have been completed as part of this EIA.
	Lamahi Substation site, currently used by “Sari Bagar Baba Gaudham” for cow protection initiative, will collaborate with the project for smooth implementation.	Consultation will continue throughout the project with affected stakeholders.
Vultures	Recommend investing in vulture monitoring for at least a year before and for 2-3 years after the line is in place.	The EIA includes the requirement for these monitoring requirements in section 7.3.2.
	Post-operation monitoring to such a project will be very important for monitoring vulture nesting and in particular, mortality causes. Continuing the satellite tagging work well beyond the first tow years after any installation will be a very useful and important tool towards this.	The EIA includes the requirement for these monitoring requirements in section 7.3.2.
	The fitting of safely insulated poles will be a further priority.	Section 7.3.2 includes the requirements for fitting bird diverters on the NBTL
	Is there detailed information on vulture feeding sites in the area?	Detailed information on the nesting areas has been provided by BCN and included in this EIA.
	Ensure towers are not raised to higher elevation regions and not rerouted to southern region.	Higher elevation areas have been avoided on the advice of BCN.
	Translocating transmission line further north about 3 kilometers from the nesting site (2 km from the existing TL alignment) is suggested.	Re-routing north of one nesting site in Kapilvastu has been completed based on BCN recommendations. Other areas have not been re-located

Topic	Issue Raised	How Addressed
		at this stage due to the comment above relating to moving the alignment to higher elevation.
	Rajapani, Kapilvast - halting construction works during breeding season (September to April) is suggested.	This requirement is included in Section 7.3.2
	The two closest nesting sites need to have specific mitigation measures if rerouting is not needed.	Re-routing has been performed for one nest site. Bird diverters will be placed on all sensitive portions of NBTL
	Rapti River a bird congregatory and migratory sites need to include mitigation measures.	Bird diverters will be fitted to the NBTL in this location.

8.7 Continuous Consultation

875. The next stage of the consultation process will include formal public meetings in five municipalities to present the findings of this draft EIA. Consultations will be completed during the document disclosure period with the EIA being updated based on the comments received during these meetings.

876. Following on from this, consultations will continue during construction and operation phase. The responsibility of consultation with local community and project affected persons during this phase will be handled by the EPC contractors. The EPC contractor will prepare a site level information disclosure and stakeholder engagement plan with a calendar spread across the construction period. The information to be shared with local communities and affected persons, as well as with organizations such as BCN and Chure Terai Madhesh Conservation Development Committee by the EPC contractor will include the following:

- Project design (substation sites, locations of towers, power line ROWs) and their potential impacts. Specifically a workshop will be conducted by the EPC Contractor, NEA and ADB on the final design with all key stakeholders.
- Construction/implementation schedule.
- Measures taken by the project to avoid and minimize these potential impacts such as re-routing, adjusting tower locations, adoption of better tower design etc.
- Grievance Redress Mechanism which affected persons and local communities can use to register their concerns and seek appropriate redress.

8.8 Information Disclosure

877. NEA with support from EPC contractor and their Project Supervision Consultant (PSC), will provide relevant information in a timely manner, in an accessible place, and in a form and language understandable to affected persons and other stakeholders. The EIA will be made available in corporate and site offices of NEA and at the project site office of concerned EPC contractors. The executive summary of the EIA will also be made available in local languages (Hindi) in the form of

leaflet for distribution during consultation. The draft EIA herewith will be disclosed on the website of ADB and in NEA websites. Subsequently, the updated EIA as per the final design will also be disclosed on ADB's website and in NEA websites. The environmental monitoring reports on EMP implementation will also be posted on the ADB website and on the websites of NEA.

8.9 Grievance Redress Mechanism

8.9.1 Background

878. A grievance redress mechanism (GRM) will assist the affected persons in resolving queries and complaints. Due to its critical role in smooth project implementation, this GRM shall be constituted upon loan effectiveness and prior to the commencement of construction of project components if earlier.

8.9.2 Need of the Grievance Redress Mechanism for the Project

879. NEA will institute a transparent and timebound GRM to receive and resolve the affected persons' grievances and complaints. GRM is an accessible and trusted platform for all the affected persons to seek solutions and relief for their project-related problems and grievances, without resorting to lengthy and costly judicial process. The GRM will not deal with matters pending in a court of law. Its success and legitimacy will depend on the affected persons' capacity for consultations and desire to resolve grievances through discussion and negotiation. Culturally appropriate, gender responsive, and accessible mechanisms formulated but shall not impede access to the country's judicial or administrative remedies. The presence of GRM or seeking relief from GRM is not a bar to take grievances and complaints to courts for arbitration. The courts can be approached at any time in the GRM process. Access to the national judicial system is not contingent to the resolution through the project's GRM. The ADB Accountability Mechanism[50] whereby people adversely affected by ADB-financed projects can express their grievances; seek solutions; and report alleged violations of ADB's operational policies and procedures, including safeguard policies can be approached as a last resort once the complaint has been raised to the Project through the GRM and ADB Nepal Resident Mission.

880. ADB Safeguard Policy Statement (2009) requires the establishment of a responsive, readily accessible, and culturally appropriate grievances redress mechanism capable of receiving and facilitating the resolution of affected persons' concerns and grievances about the physical, social and economic impacts of the projects. The GRM aims to: (i) reduce conflict, risk of undue delay and complication in project implementation; (ii) improve quality of project activities and outputs; (iii) ensure that the rights of affected parties are respected; (iv) identify and respond to unintended impacts of projects on individuals; and (v) maximize participation, support, and benefit to local communities.

8.9.3 Objectives

881. Inconveniences and dissatisfactions, if not managed appropriately at the beginning may snowball into a bigger issue. In order to manage these risks, an internal mechanism is required to be in place where the aggrieved parties can lodge their complaints and get it amicably settled prior to approaching the formal mode of solution (i.e., access to legal system through courts) available to

[50] There are two parts to ADB's Accountability Mechanism, (i) problem solving led by ADB's special project facilitator can assist the complainant in finding solutions to their problems, (ii) providing a process through which those affected by projects can file requests for compliance review by ADB's Compliance Review Panel.

them. Hence, one of the important objectives of the GRM is to provide a formal forum to the aggrieved parties to deal with issues arising out of project. The GRM will help to establish accountability towards the stakeholders' concerns. There will be a single grievance redress mechanism for both environmental and social related issues. The objective of the GRM shall be to provide an accessible mechanism to the affected people, community or any stakeholder(s) having a stake in the project to raise their issues and grievances in regard to project functioning. The GRM will resolve any social (including design or route alignment issues, compensation, inconveniencies during construction, labour, contractor, community relation issues amongst others) and environmental related grievances, locally in consultation with the aggrieved party to facilitate smooth implementation of project related work activities.

882. The fundamental objectives of the Grievance Redress Mechanism are:

- To provide an accessible mechanism to the affected people, community or any stakeholder(s) having a stake in the project to raise their issues and grievances in regard to project functioning;
- To reach mutually agreed solutions satisfactory to both, the project and the affected persons, and to resolve any project-related grievance locally, in consultation with the aggrieved party;
- To facilitate the smooth implementation of the Environmental Management Plan and prevent delay in project implementation;
- To democratize the development process at the local level, while maintaining transparency as well as to establish accountability to the affected people;
- To facilitate an effective dialogue and open communication between the project stakeholders; and
- To have clear definition of roles and responsibilities

8.9.4 GRM Structure

883. NEA's PMD will establish and publicize the GRM to receive and manage any grievances that may arise from the project and facilitate prompt resolution of affected person's issues, concerns, problems, or claims using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to the affected persons at no costs and without retribution.

884. Affected peoples can approach the court of law at any time and independently of the project's grievance redress process. Affected peoples may (subject to eligibility criteria) also access ADB's Accountability Mechanism whereby people adversely affected by ADB-financed projects can express their grievances, seek solution, and report alleged violations of ADB's operational policies and procedures, including environmental and social safeguard policies. The GRM will be set up upon loan effectiveness and be operationalized prior to the commencement of any civil works, including enabling works. Besides, at the construction sites and the PMD offices, boards will be set up which give the contact details of persons to be contacted in case of any grievances. The information will be specifically related to the construction works and provided in local language describing the project, the grievance mechanism and where and whom stakeholders can deliver their complaints, and in what form, verbal or written. Communities within the project's area of influence will be made aware

of this GRM through (i) community awareness raising during community meetings, (ii) pamphlets distributed to the public in the direct vicinity of the project site, in Nepali and translated in local language as applicable; and (iii) notices on the radio and/or local newspaper, at local NEA offices, and on NEA's website.

885. PMD and the EPC Contractor will appoint community engagement officers/GRM focal (PMD project level focal and Contractor site level Focal). All staff of NEA, PMD and the EPC Contractors, as well as local and central government and other entities directly involved in the GRM process will receive training prior to the start. Any concerned person or group of people can file a complaint through the project's GRM, at any time and at no cost.

886. GRM focal will actively engage with the affected local communities and construction workers throughout pre-construction, construction and at the onset of operation, providing an opportunity for community members or workers to approach them with any grievance/complaint. Affected peoples may also lodge grievances/complaints online through NEA's website, by phone at numbers provided, by submitting a note in a suggestion box kept on site, by sending a letter, or in person at a project-site office or at the closest NEA office. The GRM will follow a three-tier structure namely:

887. ***1st Level Grievance (Site Level):*** During the first level grievance, the EPC Contractor's site level focal will be in charge. All grievances/complaints will be sorted by the focal for their eligibility, level of urgency and by nature of the project. Within 3 days of receiving the application, the focal will contact the applicant to acknowledge the receipt of the grievance, provide a complaint registration number, and set up a meeting in presence of the contractor's project manager. A formal reply will be addressed to the complainant and will be informed about the process and of his/her possibility to subsequently escalate the complaint in case no resolution was found at this stage. The contact to the second GRM will also be included. Other participants such as contractor's environment, health and safety, subcontractor's representative, PMD's EO when on site etc. can be called to this meeting. The affected person(s) may come in presence of two representatives of their choice (selected to be gender inclusive), including a representative of their IP group if applicable. To keep this first level simple, the number of meeting attendees will be kept as much as possible to between 4 and 8, but ideally 4, for flexibility and ease of dialogue.

888. The first meeting shall take place no later than one week after receipt of the grievance/complaint. The complainant and the contractor's site level focus will discuss and try to agree on the course of action to be taken to resolve the complaint. The duration for this course of action will also be discussed and agreed upon. Minutes of the meeting will be kept with signatures of all the participants to document the GRM process and will be annexed in the GRM file. If both parties agree on the resolution, steps will be taken as per agreed resolution. If both parties do not agree on a resolution, the complaint may be escalated to the second level of GRM.

889. The timeline for addressing the resolution will be 7 days. If the complainant has difficulty to travel to meeting location upon short notice, the location of the meeting may be flexible and focal will take remedial action, keeping the complainant informed at each stage or every fortnight, whichever the shortest will take remedial action, keeping the complainant informed at each stage or every fortnight, whichever the shortest. Such actions should be taken in the briefest delay, within a maximum time frame of 30 days. However, all simple complaints will be resolved within 7 days of the meeting being held. Following resolution, if the complainant is not happy with the resolution or if no action has been taken within the agreed timeframe, they can escalate the grievance to the second level of GRM.

890. A log of all active complaints, even if resolved within the first level of GRM, must be communicated to PMD's focal fortnightly by the EPC Contractor's on-site focal.

891. ***2nd Level Grievance (PMD Level):*** The second level of GRM is headed by the PMD's project manager, supported by PMD's project-wide focal. If a complaint has not been resolved at the first level of GRM, it is escalated to the second level. If workers wish to file a complaint and are not comfortable logging it with the first level GRM, they can file it directly to this second level of GRM. All complaints will be sorted by eligibility and level of urgency and by nature (suggestions or comments, grievances/complaints related to adverse impacts of the project on an individual or group, violations of law, etc.). Just as for the first level, all grievances will be properly recorded, and the concerned person or group will be formally informed of the receipt; timeline; and resolution. PMD's focal will send within 3 days of receipt a letter to the complainant acknowledging receipt; within 15 days a meeting should be held, and resolution action plan and timeline agreed upon with the complainant.

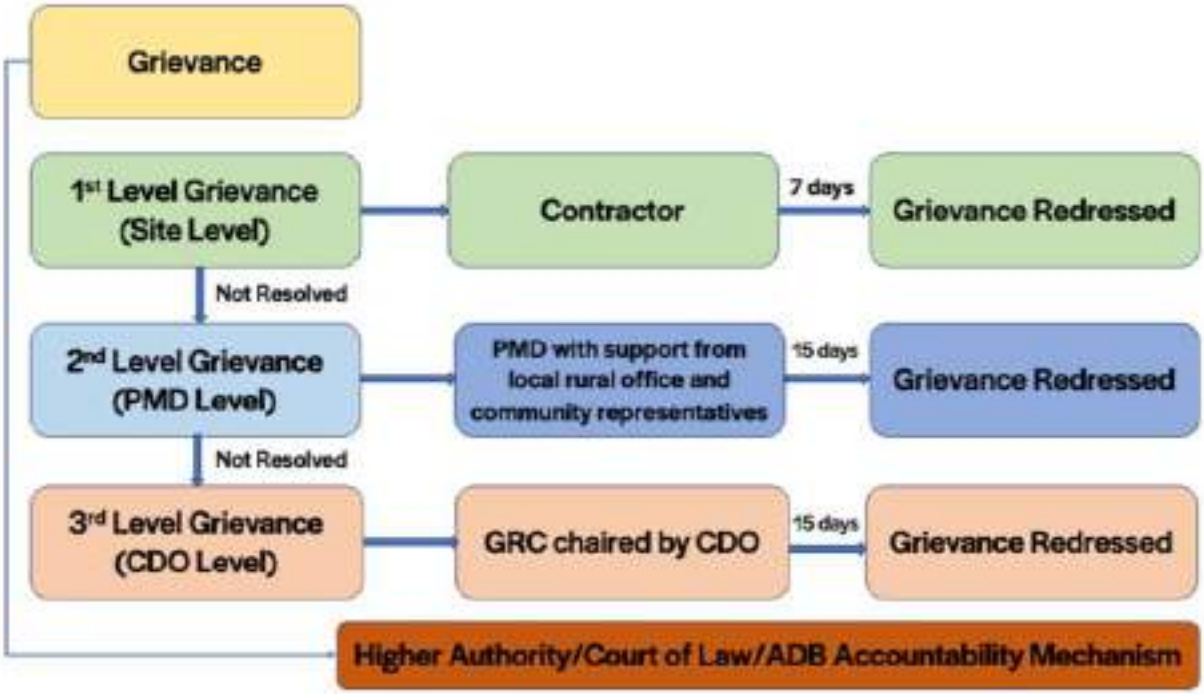
892. The meeting should aim to have between 4 and 8 members, including PMD's project manager, PMD's focal, the complainant who may be accompanied by or represented by two representatives including one IP representative if applicable, PMD's environment, health and safety officers, as well as other members if applicable, including EPC Contractor's representative, local rural office representative, community organization representative etc. As for the first level, the second level may have two outcomes: if the parties found a resolution and the complainant signed their approval of the resolution, such actions should be taken in the briefest delay, within a maximum time frame of 30 days. However, all simple complaints will be resolved within 7 days of the meeting being held. If no resolution has been reached, the grievance is forwarded to the third level of the GRM.

893. ***3rd Level Grievance (CDO Level):*** In the third level GRM, the same process of logging the grievance/complaint, communicating with the complainant and reporting will be followed. The third level of GRM is handled by NEA's TL project manager who will form a grievance redress committee chaired by the Chief District Officer, District Administration Office and made up of PMD's focal and environment or health and safety officers (depending on the nature of the complaint), two representatives of the complainant including indigenous peoples representative if applicable, as well as, as applicable, a representative of the contractor, government representatives for environment or social issues (such as but not limited to land revenue, survey, forest office, agriculture office, municipality representatives etc.), NGOs or CSOs representatives, etc. For ease of discussion, the meeting will try to gather no more than 10 participants.

894. The grievance redress committee will agree on the resolution approach and action plan, inform concerned parties about actions to be taken and their timeline, and will monitor progress through regular follow-ups. Resolution will be as prompt as possible; receipt of complaint will be acknowledged to the complainant within 3 days, the resolution approach agreed upon within 15 days and actions taken within 45 days. However, all simple complaints will be resolved within 7 days of the meeting being held. Approval of the resolution by the complainant will be sought in writing. If the complainant is still dissatisfied after this stage, they may avail of the court of law or ADB's Accountability Mechanism.

895. All entries to the site's grievance/complaints register, whether resolved at initial informal level on site or at any of the three levels of the GRM, along with updates on ongoing or completed actions taken to address the grievance/complaint, will be included in monthly reports by the Contractor to PMD and in periodic monitoring reports from PMD to ADB.

Figure 133: GRM Process



896. PMDs ESMU Grievance Redressal Unit and M&E unit will monitor the overall grievance resolution process along with PMD and will recommend any improvements to increase the efficiency, timeliness, and fairness of the process.

Table 144: Summary responsibilities and timeline of GRM at different levels

GRM Level	Composition	Maximum timeline
First Level of GRM (site-level)	Responsibility: Contractor's project manager supported by contractor's community engagement officer/GRM focal Other parties involved, as applicable: – 2 representatives of affected person (gender inclusive, including 1 representative of IP group as applicable) – EPC Contractor's representative – Subcontractor's representative – PMD relevant lot EO when on-site Total Meeting members: 4-8	3 days: confirmation of receipt to complaint 7 days: meeting between contractor's project manager and complainant and action plan agreed upon (or escalation to level 2) Maximum 30 days: action taken, and grievance resolved, although any environment safeguard grievances that are an emergency or pose a health and safety risk to workers or community members must be resolved immediately by the contractor. Information and reporting to PMD community engagement officer/GRM focal on two-weekly basis by contractor.
Second Level GRM (project-level)	Responsibility: PMD's project manager supported by PMD community engagement officer/GRM focal	3 days: confirmation of receipt to complaint 15 days: meeting between EGMP project manager and complaint and action plan agreed upon (or escalation to level 3)

GRM Level	Composition	Maximum timeline
	Other parties involved, as applicable: – 2 representatives of affected persons (gender inclusive, including 1 representative of IP group as applicable) – Representative of the contractor – PMD senior environment, health and safety officer as applicable depending on environment or social issues being resolved. – Local rural office and community organization representative Total meeting members: 4-8	Maximum 30 days: action taken, and grievance resolved. Information and reporting to NEA board and management by PMD community engagement officer/GRM focal.
Third Level of GRM (committee-level)	Responsibility: Chief District Officer, District Administration Office as chair; PMD EGMP project manager as facilitator Other parties involved, as applicable: – 2 representatives of affected persons (gender inclusive, including 1 representative of IP group as applicable) – PMD community engagement officer/GRM focal – Representative of the contractor – Government representatives as applicable depending on environment or social issues being resolved (e.g., land revenue, survey, forest office, agriculture office, municipality representative etc.) – NGOs/CSOs representatives depending on environment or social issues being resolved. – Other as applicable Total Meeting Members: <10	3 days: confirmation of receipt to complaint 15 days: grievance redress committee meeting and action plan agreed upon. Maximum 45 days: action taken, and grievance resolved. Information and reporting to NEA board and management by PMD community engagement officer/GRM focal.

Table 145: Template for grievance/complaints register entries

Registration Number	Date of Complaint	Details of complainant (Name, Address, Email, Contact Number) if confidentiality is requested, highlight here	Entry point of complaint (person/entity)	Description of complaint	Date and content of communication to complainant (date complaint acknowledged by level 1/2/3, feedback sent etc.)	Date of meetings held and outcome (attach minutes of meetings)	Timeline agreed upon for resolution and action plan	Status (outstanding, overdue, solution agreed upon, solution under implementation resolved)	Other remarks

8.9.5 Disclosure on GRM

897. The formation and effectiveness of GRM will be communicated to the affected people across the project area as part of overall consultation and disclosure process of the project. It will be publicized widely through community meetings and pamphlets and information on focal contact persons, how to file grievance etc. will be placed on the billboards of the construction sites/project site offices in local language so that people are aware of their rights and obligations, and procedure of grievance redress. The EPC contractors and PSCs will assist NEA in disseminating the GRM related information to the people. Special efforts should be made to ensure that poor and vulnerable households are made aware of grievance redress procedures and entitlements. Grievances will be filed without any fear and stress and stakeholders may also raise grievances anonymously if they so wish through a drop box on site. ADB's accountability mechanism will also be informed to the Affected People by PMD.

898. All costs involved in resolving the complaints/grievances (meetings, consultations, communication, and reporting/information dissemination) will be borne by NEA and any complaints resolution pertaining to EPC contractors and the EMP related complaints will be borne by the EPC contractors.

IX. ENVIRONMENTAL MANAGEMENT PLAN

9.1 General

899. ADB's Safeguard Policy Statement (SPS) 2009 requires that an Environmental Management Plan (EMP) be prepared to ensure construction and operation of the project will be undertaken in accordance with its safeguard requirements. The project-level EMP is an overarching document that will guide environmental management implementation, supervision, and monitoring of NEA and their EPC Contractor's activities under the project. It aims to ensure compliance with (i) ADB's Safeguard Policy Statement 2009 requirements and international good practice as set out in the related International Finance Corporation (IFC) Environment, Health and Safety (EHS) general and Electric Power Transmission and Distribution guidelines, and (ii) applicable environmental, health and safety requirements of the GoN including the international agreements which the GoN is a signatory too, as well as having cognizance of the sensitivity of local ecological and human receptors in the project area of influence.

900. The EMP provides summary information of the types of impacts and risks anticipated because of the project and provides detailed information about the required mitigation and monitoring measures with respect to the following stages: (i) design, (ii) pre-construction, (iii) construction, and (iv) operation and maintenance, as well as implementation arrangements and reporting requirements. Prior to the approval of designs NE will consult ADB regarding the need to update the EIA based on the final route alignments put forward by the contractors. As required, the EIA will be updated for clearance and disclosure by ADB before design approval and the start of any related works including construction site establishment. To ensure the mitigation and monitoring measures are implemented a program of environmental supervision and monitoring will be undertaken during the project implementation by the Project Management Department (PMD) and their Project Supervision Consultants (PSCs).

901. The definitive version of the project-level EMP cleared by ADB is the most recent version disclosed on its website. The EMP is dynamic and can be updated as appropriate during the project implementation. However, any update to the EMP will first need to be cleared by ADB. The EMP will form part of all bidding and contract documents for all contract packages/lots and during design and pre-construction, and construction the contractors will be responsible for implementing all relevant measures for the works in their contract package/lot under supervision and monitoring of NEA. Any updates to it will be incorporated into the contract document. The contractors must always follow the definite version of the EMP which is the version disclosed on ADB's website. This includes any updates in response to unanticipated impacts. In addition, for any requirements for corrective action due to non-compliance, appropriate action will be agreed with ADB and taken by NEA and their EPC Contractors to bring project implementation back on track. The EPC Contractors will cover the costs where corrective action is required due to non-compliance on behalf of the EPC Contractor, its subcontractors or third parties with the EMP.

9.2 Environmental Mitigation Plan

902. The tables in Appendix A provide the feasible and cost-effective environmental mitigation and project standards required during the design, pre-construction, construction and operational phases for all project components/activities to reduce potentially significant, adverse environmental impacts

and risks to acceptable levels and generally ensure international good practice, and national environmental, health and safety requirements are followed.

903. Some commitments that must be commenced during the design and pre-construction phase will continue to be implemented by the contractor during the construction phase. Operational phase mitigation measures are primarily for NEA. However, all maintenance works during this phase including by the EPC Contractor during their defect liability period and operation/maintenance obligations will be undertaken following the construction measures.

9.3 Environmental Monitoring Plan

904. The environmental monitoring plan (EMoP) (Appendix B) sets out the minimum provisions for quantitative environmental monitoring and performance standards to be achieved.

905. Monitoring activities including laboratory analysis for air quality, noise, surface water and groundwater quality are to be carried out by accredited suitably qualified and experienced third-party monitoring experts. Quantitative monitoring activities may be modified during project implementation, depending on the EPC contractors' performance and analytical results obtained. If performance is worse than expected, corrective action will be identified, and environmental monitoring activities adjusted accordingly by NEA to help resolve any unsatisfactory performance.

906. In addition to quantitative monitoring there will also be supervision and monitoring of EMP implementation, the performance standard being all EMP measures are implemented in full at the appropriate time.

9.4 Construction Specific Environmental Management Plan (CSEMP)

907. The CSEMP is the document that the EPC Contractor will prepare outlining how they intend to implement the project-level EMP and ensure that all the mitigation and monitoring is completed according to the implementation arrangements specified in the EMP and the EIA as a whole.

908. The CSEMP will describe the precise location of the required mitigation / monitoring, the persons at the contractor responsible for the mitigation / monitoring, the schedule and reporting methodology etc. The CSEMP and all its topic and site-specific plans will be submitted to the relevant PSC and PMD for their approval at least 30 days before the EPC Contractor taking possession of any work site. No access to the site will be allowed until the CSEMP is approved by the PSC and PMD. The CSEMP will include the following topic specific plans:

a) Construction Method Statement

b) Pollution Prevention Plan & Emergency Response Plan (including SF6 measures)

c) Occupational Health and Safety Plan & Emergency Response Plan

d) Community Health and Safety Plan & Emergency Response Plan

e) General Construction Biodiversity Management Plan

f) Tortoise Management Plan

g) Vulture Management Plan

h) Physical Cultural Resources Management Plan & Physical Cultural Resources Stakeholder Engagement Plan

i) Waste Management Plan

j) Traffic Management Plan

k) Labour Management Plan

l) Communication Plan

m) Training Plan

909. The following site-specific plans will also be required:

a) Construction Camp / Labor Accommodation Management Plan

910. The EPC Contractor will also be responsible for the following documents:

a) Code of Conduct.

9.5 Overarching Implementation Arrangements

911. PMD will be responsible for ensuring correct implementation of the Environmental Management Plan (EMP) and approving the EPC Contractors CSEMP to comply with ADB's safeguards requirements and environmental, health and safety (labor) national regulations.

912. For this, PMD will include environment and health and safety staff of NEA in the **Environmental and Social Management Unit (ESMU**). The PMD will be assisted by **environmental, labour, health and safety specialists of the PSC** in supervising the implementation of the EMP / CSEMP who will provide environment, labor and health and safety expertise.

913. The Project will be further supported by a team of **Environmental Support Consultants**, comprising a team of specialists with expertise relating to; a) Ornithology, b) Archaeology/Cultural Heritage, c) herpetology, and d) Ecology.

914. The cost for implementing mitigation and monitoring measures as outlined in this EMP will be included in the EPC contract, unless specifically assigned to NEA to implement.

915. If any change in design including sites/routes or other unanticipated environmental or social impacts become apparent during project implementation, PMD will be required to immediately inform ADB and (i) assess the significance of such unanticipated impacts; (ii) evaluate the options available to address them; and (iii) update the EIA and EMP taking corrective action where necessary.

916. The following sections provide the specific implementation requirements for all parties.

9.6 Implementing Agency Management

917. The management of the implementing agencies notably their established PMD are responsible for supervising their PSC, EPC Contractor and EMP implementation for overall compliance with ADBs SPS (2009) requirements and project environment-related legal covenants.

918. To support the PMD in meeting these responsibilities an Environmental and Social Management Unit (ESMU) will be established within the PMD. ESMU will report directly to the PMD and will comprises four units, namely – Social Management Unit, Grievance Redressal Unit, Monitoring and Evaluation Unit, and Environmental Management Unit. The following summarizes the key roles of each unit.

919. The Environmental Management Unit (EMMU) – oversee the implementation of physical and biological mitigation and enhancement programs so that the environmental commitments are fulfilled during the project implementation phase. Its primary activities involve – developing, updating, and implementing EMP, conduct regular monitoring and evaluation of the project's environmental performance, identifying the potential environmental risks and impacts, and taking corrective actions as needed, provide guidance and training to project staff, contractors, and other stakeholders on environmental issues. It will be responsible for ensuring that the project is implemented in an environmentally responsible manner, and that any negative environmental impacts are minimized, mitigated, and appropriately managed.

920. The Social Management Unit – will be responsible for tasks such as land acquisition and compensation, resettlement and rehabilitation, community development, livelihood programs, and others.

921. The Monitoring and Evaluation Unit will oversee the monitoring of environmental and social programs implemented by the project and contractors in compliance with the contractual agreement and will report on compliance.

922. Grievance Redressal Unit will be responsible to provide an avenue for affected parties and stakeholders to express their concerns and grievances related to the project's environmental and social impacts. This unit is responsible for receiving, recording, and addressing complaints and grievances raised by the local people and communities. The grievance redressal unit is expected to be transparent and accessible system for resolving grievances and ensuring that complaints receive timely and appropriate responses.

9.6.1 ESMU / EMMU

923. ESMU /EMMU shall include the following staff:

- Senior Environmental Officer (PMD ESO)– responsible for overall management of the unit.
- Environmental Officer (PMD EO1) – providing oversight of lot 1 Activities.
- Environmental Officer (PMD EO2) – providing oversight of lot 2 and SS Activities.

- Senior Health and Safety Officer (PMD SHSO) – responsible for overall health and safety management of the unit.

- Health and Safety Officer (PMD HSO1) - providing oversight of lot 1 Activities.

- Health and Safety Officer (PMD HSO2) - providing oversight of lot 2 Activities.

- Health and Safety Officer (PMD HSOSS) - providing oversight of SS Activities.

9.6.2 Primary Responsibilities

924. PMD and ESMU responsibilities include the following, but not limited to:

- Implement and update the EMP developed within the EIA (if required). All updates are subject to ADB clearance.
- Locally disclosing the EIA and other environmental safeguards documents, including publication on the NEA website. Help with translation of the EIA into local languages or an explanation of its content will be extended free of charge to affected persons on request.
- Incorporating the EMP into the bidding and contract documents before issuing tenders and contract awards.
- Reviewing bids to ensure they are in accordance with the EMP requirements prior to contract award.
- Reviewing and approving the contractor's detailed designs as well as CSEMP and EMP sub-plans to ensure they incorporate and are in accordance with the EMP requirements.
- Preparing and submitting semi-annual environmental monitoring reports (annual during operation) to ADB for disclosure on their websites.
- Ensuring adherence to all applicable national and state environment, health, safety, and labor laws and regulations in force at the time.
- Ensuring adherence to ADB's Safeguard Policy Statement (2009) and the related WBG Environment, Health and Safety (EHS) general and power transmission and distribution guidelines (2007).
- Ensuring adequate management support, budget, staff, and other resources are allocated to satisfactorily implement, supervise, and monitor implementation of the EMP during all phases.
- Preparing a detailed training plan, providing training venues, and providing with support of PSC a suite of training activities for NEA staff and EPC Contractors in relation awareness raising on EMP implementation.
- Adopting a zero-tolerance approach to OHS and enforcing all NEA staff to comply with OHS requirements of the EMP including wearing of appropriate PPE on site to set a good example to the EPC Contractor and their workers.
- Implementing the EMP throughout all phases or, if responsibilities are delegated, supervising, and monitoring its implementation by the contractor.
- Ensuring that necessary compensation is made for cutting of trees before the commencement of related work.
- Ensuring the EPC Contractor secures all necessary permissions before the commencement of related work, maintain records with copies of all the clearances, permits, licenses, and insurances obtained.

- Ensuring the EPC Contractor provides adequate training to their subcontractors and all workers including daily EHS toolbox talks and emergency response drills; suggesting topics for the trainings based on site observations.
- Reporting to ADB of any non-compliance or breaches with ADB safeguard requirements in a timely manner and take corrective actions promptly.
- Updating the EIA/EMP as required in consultation with ADB prior to approval of the contractor's route alignments with respect to any changes from the indicative routes assessed. Obtaining ADB's clearance for the EIA/EMP update prior to the commencement of any work, including site establishment and vegetation clearance. Once cleared, ADB will disclose the updated EIA on its website whilst NEA will locally disclose it;
- Building up and sustaining institutional capacity in environmental management, health and safety, including conducting public awareness programs.
- Preparing a community liaison plan to elaborate on ongoing consultation and information disclosure in relation to EMP implementation considering gender, vulnerable groups, and indigenous peoples; preparing consultation materials for distribution to affected communities.
- Undertaking and documenting all ongoing consultation, details of consultations such as minutes of the meetings, photographs to be documented in the EMRs submitted to ADB.
- Establishing and operationalizing the GRM for affected persons (construction workers and local community members) in line with the EIA, including appointing GRM Focals and establishing a GRC, disseminating contacts, recording and promptly resolving grievances received. All ongoing grievance-related information will be documented in the EMRs submitted to ADB.
- Once operational, any contractors hired for maintenance works or decommissioning will be supervised and monitored by NEA with roles and responsibilities the same as those of the contractor for construction
- Undertaking environmental monitoring as set out in the EMoP during all phases, documenting quantitative and qualitative monitoring results; for quantitative monitoring hire accredited, and quality assured, third-party laboratories.
- Undertaking with the support of PSC monthly EHS meetings including site walkover inspection to determine the status of EMP implementation by the contractor during construction as well as random "spot check" site visits to audit their EMP implementation. Minutes of meetings and findings of site walkover inspections will be attached to the EMRs to be submitted to ADB.
- Identifying areas for improvement, unsafe acts, and any non-compliances with the EMP by the EPC Contractor and/or NEA staff and instructing for corrective actions to be taken by them to bring implementation back on track.
- Thoroughly investigating all unanticipated impacts, near-misses, accidents, and chance finds; preparing a detailed incident report where applicable, identifying and instructing on corrective actions particularly to avoid any repetition of near-misses and accidents.
- Monitoring and reporting on EMP implementation including reporting on EMP implementation in quarterly progress reports and preparing semi-annual EMRs for submission to ADB up until the completion of construction, reverting to annual up until the ADB project completion report, or for longer period if it is required by the ADB PCR.
- Reporting any unanticipated impacts, accidents, and chance finds to ADB within 48 hours of them occurring along with a corrective action plan.
- Reporting to ADB any grievances submitted to the third formal stage of the GRM upon receipt.
- Developing and taking all requisite corrective action in case of any non-compliance with the EMP including repair of any property damages and financial compensation (insurance) for health and safety incidents.

925. **NEA, through their PMD will also be responsible for implementing the required biodiversity offsets outlined in this EIA – including all those commitments relating to vultures.**

9.6.3 Reporting

926. PMD /ESMU will be responsible for the following documents and reports:

Table 146: Reporting Responsibilities

Documents	Responsible Person	Destination of the documents	Submission timing		
			Design period	Construction period	Operation period
Bid and Contract Documents (addition of environmental, health and safety requirements per EMP)	PMD ESO with support PMD SHSO	ADB	X		
Updated EIA /EMP	PMD ESO with support PMD SHSO	ADB	X (When EIA is finalized in response to final route alignments and substation layouts)	X (When any changes are made to EIA / EMP due to unanticipated impacts)	
Training Plan	PMD ESO with support PMD SHSO	NEA / EPC Contractor	X		
Community Liaison Plan	PMD ESO with support PMD SHSO	NEA / EPC Contractor	X		
Consultation Reporting (included in Quarterly Progress Reports (QPRs))	PMD ESO with support PMD SHSO	ADB	X (Quarterly)	X (Quarterly)	
Incident Reports (included in QPRs)	PMD SHSO and PMD ESO	ADB		X (Quarterly)	
QPR	PMD ESO with support PMD SHSO	ADB	X (Quarterly)	X (Quarterly)	
Fatalities and Chance Find Reports (immediate reporting with 48 hours of occurrence)	PMD SHSO and PMD ESO	ADB		X	X
Semi-annual environmental monitoring reports (EMR) semiannual up until completion of construction reverting to annual on operation, including details of grievances	PMD ESO with support PMD SHSO	ADB	X (every 6 months)	X (every 6 months)	X (annual)

9.6.4 Environmental Monitoring Reports

927. Following loan effectiveness, environmental monitoring reports (EMRs) will be submitted to ADB on a semi-annual basis by NEA up to the completion of construction reverting to an annual basis during operation up to the ADB project completion report with safeguards inputs provided to quarterly progress reports. EMRs will be due for submission to ADB within 15 days of the month following period end, e.g., before mid-July and mid-January each year. EMRs will be submitted until the ADB Project Completion Report is issued, or later if required therein. The EMRs will describe project implementation progress, any scope or design changes, compliance against safeguard requirements that are covenanted in the legal agreements, progress with environment mitigation and offset implementation, quantitative monitoring results in accordance with the EMoP, and grievances received.

928. EMRs, and updated EIA, if any, submitted by NEA during project implementation will first be reviewed by ADB to ensure quality and acceptability and then, once cleared by ADB, are to be disclosed locally (in the same places as the EIA report was originally disclosed) by NEA and on the ADB website upon receipt.

9.7 EPC Contractors

929. Through the contract, NEA will delegate responsibility for implementing all relevant measures during design, pre-construction, and construction. The EPC contractors will be required to comply with the EMP during the design, preconstruction, and construction phases, closely supervised and monitored by NEA. The EPC Contractors will be responsible for reporting environmental safeguards progress and performance at least monthly to the PMD including record data required by the EMoP and providing necessary inputs to the quarterly progress reports and semi-annual EMRs for the duration of their contract. The requirement to undertake relevant mitigation and monitoring actions as set out in this EMP applies to the construction sites as well as to any temporary workers camps or overnight accommodation provided by them.

930. The EPC contractors have the responsibility for EMP implementation. However, the EPC Contractors are required to ensure that the EMP requirements are cascaded down to all sub-contractors undertaking works relating to the project, regardless they are formally or informally employed, and to be responsible for supervising and monitoring their sub-contractors in turn. Construction workers will need to abide, in their behavior and work, to directives issued by their employer with regards to environmental, health and safety management.

931. The EPC Contractors will be responsible for the preparation of their CSEMP. The CSEMP will need to be fully compliant with the project-level EMP and the EIA and will need to be prepared within 30 days of Contract award and approved 30 days prior to access to the site.

9.7.1 Specific Responsibilities

932. In addition to the above, the EPC Contractors will be responsible for:

- Implementing all measures and responsibilities allocated to the EPC Contractor under the EMP for the full duration of the contractor's involvement.

- Ensuring adherence to all applicable national and state environment, health, safety, and labor laws and regulations in force at the time.
- Ensuring adherence to ADB's Safeguard Policy Statement (2009) and the related WBG Environment, Health and Safety (EHS) general and power transmission and distribution guidelines (2007).
- Ensuring the detailed design reflects the EMP requirements; seeking to ensure it has the same or no worse impact than the indicative designs/route alignments which were assessed in the EIA.
- Supporting NEA to update (as required) the EIA in respect of the detailed design by providing sufficient details to inform a revised project description and any subsequent reassessment of impacts and risks.
- Undertaking and documenting a facilitated health and safety (H&S) risk assessment considering for all phases.
- Preparing a CSEMP and sub-plans as specified in the EMP for review and approval by NEA prior to the commencement of works including site establishment.
- Ensuring adequate budget, staff and other resources are allocated to comply with and implement the contractor's responsibilities under the EMP and to supervise and monitor the active construction site to protect the environment and ensure the health and safety of all workers and affected communities.
- Ensuring suitably qualified and experienced environment, health and safety safeguard officers, as per the EMP requirements have been appointed to undertake regular on-site supervision and monitoring activities before the commencement of works.
- Adopting a zero-tolerance approach to OHS on the project, enforce all workers to comply with the OHS requirements of the EMP including the wearing of appropriate PPE on the construction site.
- Obtaining all necessary permissions before the commencement of related work, share copies of all clearances, permits, licenses, and insurances obtained.
- Providing – in part with the support from NEA – and ensuring attendance at EHS trainings for formal and informal construction workers and other personnel as required.
- Ensuring that all construction workers including all formal and informal employees and subcontractors understand their responsibilities to implement the EMP and mitigate environmental impacts and risks associated with pre-construction and construction activities.
- Supporting NEA in undertaking ongoing consultation and implementing the site-level GRM; in particular, the EPC Contractor's GRM Focal shall thoroughly document details of complaints and make its best efforts to resolve the complaints at project site level; all this information is to be included in the contractor's monthly reports to NEA.
- Undertaking environmental monitoring as set out in the EMoP during pre-construction and construction and documenting qualitative and quantitative monitoring results; for quantitative monitoring the contractor is to hire accredited, and quality assured, third party laboratories.
- Submitting monthly environmental management reports to NEA (monthly EMP reports will be stand-alone but included as part of the contractors' monthly progress reports) relating to the work undertaken over the reporting period and documenting the environmental measures including monitoring activities that have been carried out, problems encountered, record data including near misses and accidents, grievances received, and follow-up actions that were taken (or will be taken) to correct the problems.
- Informing NEA immediately in case of any approved detailed design changes or unanticipated environmental impacts occurring during implementation, and as required, provide any

information needed to NEA to enable them to promptly update the EIA/EMP for clearance by ADB before any changes are implemented.

- Informing NEA within 24 hours in case of chance find or accident on site and providing within 48 hours an incident report with corrective action detailing how reoccurrence will be prevented.
- Informing NEA immediately in case of any non-compliance and help them to prepare as necessary a corrective action plan for clearance by ADB, the contractor is required to implement all necessary corrective action requested by NEA to ensure the project remains in compliance with national and state regulatory requirements, ADB's SPS 2009, the project's loan covenants and EMP requirements.

9.7.2 EPC Contractor Reporting

933. The EPC Contractors will establish their own internal systems for monitoring and reporting their EMP implementation. The EPC Contractors will formally submit monthly summary environmental management reports per an agreed template to the PMD. Complete photographic records will be kept by the EPC Contractor covering all activities on site as well as key locations such as the construction site, receptors adjacent to the substations and RoWs, off-site access roads, stores, sanitation and welfare facilities, temporary worker camps or overnight accommodation etc. Photographs of key areas will be taken prior to construction activities beginning, to provide the environmental baseline. Copies of all geo-referenced photographs will be submitted to PMD along with the EPC Contractor's monthly report. Specifically, the EPC Contractors will be responsible for the following documents and reports:

Table 147: EPC Contractor Reporting Responsibilities

Documents	Responsible Person	Destination of the documents	Submission timing		
			Design period	Construction period	Operation period
Health and Safety Risk Assessment	HSM	PSC / PMD	X	X (annually updated)	
Final design/ alignments for approval	EM, HSM	PSC / PMD	X (Once, prior to the start of construction)		
CESMP (including OHS plan, waste management plan, etc.)		PSC / PMD	X (once, prior to the start of construction)	X (updated through construction as needed)	
Environmental, health and safety checklists		PSC / PMD		X (every week. to be completed daily)	
Monthly progress reports		PSC / PMD	X (every month)	X (every month)	
Record of monthly training and daily toolbox training		PSC / PMD	X (every month)	X (every month)	

9.7.1 EPC Contractor Staff

934. To prepare and implement the CSEMP and to supervise and monitor the EMP/CSEMP implementation a team of specialists will be required as part of the EPC contractor's team as described

below. If an EPC contractor is awarded more than one contract package/lot then an entirely separate EHS team is to be employed for each of them.

935. **Environmental Manager (one for each lot and SS)** - During construction, EPC Contractors must retain the expertise of an Environmental Manager (EM), one for each contract package/lot, to implement and continually update the CSEMP and to oversee and report on the operation of the EMP/CSEMP throughout the contract period. The EM will be the EPC Contractors main focal point for all environmental, social, labor, gender, health and safety issues associated with the Project and will lead the other team members listed below. The EM will be a suitably qualified and experienced full-time member of staff on the EPC Contractors roster and should be on site at least five days per week. The required qualifications of the ESO are as follows:

- Degree in environmental sciences and related expertise.
- At least 5 years' experience in on-site environment supervision.
- Experience of at least five construction projects of a similar type, location, size and scale.

936. Specifically, the EM shall be responsible for:

- Identifying any areas of ecological sensitivity that may need to be avoided with support of field ecologist and botanists.
- Translate mitigation requirements written in the CSEMP and its sub-plans into practical measures on the ground.
- Ensure that all staff are fully aware of the environmental sensitivities of the site and their responsibilities, as outlined in the management plans (e.g., via practical toolbox talks ahead of the construction).
- Take field notes and photographs to demonstrate compliance with the management plans.

937. In addition, the EM will be responsible for the preparation of weekly environmental checklists and an environmental section of the EPC Contractor's monthly progress reports that shall be submitted to the PSC and PMD for review. The PSC shall provide a template of the checklist to the EPC Contractor.

938. The monthly reports, which will include the weekly environmental checklists, shall contain sections relating to:

- General Progress of the Project.
- Environmental Incidents, e.g., spills of liquids, accidents, etc.
- Progress of any environmental initiatives, e.g., energy savings, recycling, etc.
- Records of any environmental monitoring.
- Conclusions and Recommendations (corrective action).

939. The EM shall provide daily toolbox training at the construction camp and at construction sites. The EM shall keep a record of all monthly training and toolbox training undertaken.

940. **Health and Safety Manager (one for each lot and SS)** - The EPC Contractors shall hire a suitably qualified and experienced Health and Safety Manager (HSM), one for each contract package/lot, for the Project duration. The HSM shall have at least ten years on-site experience of supervising similar type and sized electrical infrastructure Projects with NEBOSH/IOSH certification or similar qualification. The HSM shall report directly to the EM. The main responsibilities of the HSM will be:

- Provide H&S training, including daily toolbox training sessions at each work site.
- Approve H&S Plans for specific work activities.
- Conduct routine site inspections and issue internal stop notices, if necessary, for unsafe activities.
- Maintain H&S statistics log for near misses, as well as incidents.
- Provide H&S input to EPC Contractor reports.

941. **Health and Safety Stewards** - Further, each active construction site is to have adequate health and safety supervision to ensure the health and safety of all workers and local communities. This is to include a suitably qualified and experienced Senior Engineer having NEBOSH/IOSH certification or similar qualification who is based on-site full-time and nominated to the role of EHS Supervisor with responsibility for ensuring EMP implementation, acting on the advice of, and reporting to their environment safeguards team. Each Senior Engineer nominated to the role of EHS Supervisor will be supported by full-time, dedicated, on-site Health and Safety steward(s) with at least one steward to each 50 persons.

942. **Labour Manager (one for each lot and SS)** – A labour manager (LM) will be employed on a full-time basis for all lots. The LM will be responsible for ensuring all labour and working conditions are satisfactory throughout the construction phase. The LM shall have at least 5 years experience of managing labour issues at large construction sites / camps.

943. **Botanist (one for each lot)** - For any works in areas within 500m of international/national biodiversity sites (as detailed in the EIA) or otherwise passing through forest habitat, the EPC Contractors shall engage a Botanist for the period of works in these areas (part-time basis). The Botanist will have a degree in botany or similar, and at least ten years' experience of biodiversity surveys (flora) and supervision of similar projects in forest area/habitat. The specialist will report directly to the EM and will be responsible for the following:

- Pre-clearance surveys.
- Oversight of land clearing activities and removal of vegetation.

944. **Ecologist (one for each lot and SS)** - The EPC Contractors shall engage an Ecologist for the duration of the construction phase for NBTL and on a part time basis for the SS works. The Ecologist will have a degree in ecology or similar, and at least ten years' experience of biodiversity surveys (flora and fauna) and supervision of similar projects in forest area/habitat. The specialist will report directly to the EM and will be responsible for the following:

- Pre-clearance survey with Botanist.

- Monitoring of ecological aspects of the EMP.

945. **Archeologist** – The specialist will be a full-time member of the EPC Contractors staff for Lot 1 and part-time for Lot 2 and the SS. The specialist will have a degree in archaeology or similar, and at least ten years' experience of the supervision of works sites where major cultural heritage sites have been present, or possibly present. The specialist will be responsible for implementing all aspects of the EMP relating to cultural heritage and shall be on-site during all excavation / land clearing works relating to the project.

946. **Pollution Control Specialist (one for SS)** – The specialist will be engaged be part of the SS EPC Contractors team to ensure that all pollution prevention mitigation required by the EMP is implemented. The part-time position will be filled by a professional with at least five years of pollution control experience for major infrastructure projects.

9.7.2 Management Systems

947. EPC Contractors will have a corporate EHS policy and environmental management certifications preferably such as ISO 14001 (or equivalent) and EHS certification such as OHSAS 18001 or equivalent.

9.7.3 Staff Costs

948. The following table provides a summary of the anticipated staff costs.

Table 148: EPC Contractor Environmental, Social, Health and Safety Staff Costs (BOQ)

#	Position	Estimated No. of Months (TL/SS)	Month Cost ($)
1	Environmental Manager	42/30	1,000
2	Health and Safety Manager	42/30	1,000
3	Health and Safety Steward(s)	TBD	800
4	Labour Manager	42/30	1,000
5	Botanist	20/0	1,000
6	Ecologist	42/30	1,000
7	Archeologist	42 (Lot1)/20(lot2)/6 (SS)	1,000
8	Pollution Control Specialist	0/30	800

9.7.4 Control of Records

949. The list of records that must be available by the EPC Contractor for review must include:

- Definitive EIA and EMP (as disclosed on the ADB website)

- Legal register (of applicable national and state legislation)

- Tree felling permits, vehicle emission test certificates etc.
- Training plan and training records (including inductions)
- Community liaison plan, community awareness documentation and records of all consultations undertaken
- Records of emergency preparedness and response drills
- Document review and approval records
- Contractor's CSEMP and sub-plans and copies of approval records
- Contractor's certifications and insurances
- Completed site checklists and photographic records
- Corrective action instructions
- Corrective and preventive action request records
- OHS Risk Assessment
- Contractor's and operational accident record and incident reports
- GRM register
- Work program and schedule
- Environmental permits and licenses
- List of equipment
- List of mitigation measures
- Route/program of construction material transportation
- Copies of correspondence related to environmental issues
- Records of maintenance and cleaning schedules for sediment and oil/grease traps
- Records of sewage disposal (if relevant)
- Records of quantity of discharged wastewater and concentration of pollutants
- Waste disposal records
- Written designation of waste disposal sites and instructions for waste transportation from local authorities

- Log of material inventories and consumption
- Chance find records (if any)
- Equipment control and maintenance log
- Staff contracts and timesheets
- Campsite / Accommodation Audits
- Water Quality sampling results
- Air Quality and Noise test results
- EMF measurement results
- Property surveys
- Pre-construction biodiversity surveys

950. These records shall be kept on-site by the EPC Contractors EM and available for inspection at any time.

9.8 Project Supervision Consultant

951. The PSC will support the PMD in ensuring the correct implementation of the Project's EMP, and all related documents. The PSCs will have environment, labor and health and safety expertise who will support supervision and monitoring and provide safeguards capacity building for NEA to help ensure satisfactory EMP implementation.

9.8.1 Responsibilities Prior to Commencement of Works

952. The PSC shall be responsible for the following:

- Support PMD /ESMU in preparing a detailed training plan.
- Support delivery of safeguard training and capacity building activities and provide on-the-job guidance to PMD /ESMU staff and the EPC Contractors on ensuring compliance with the EMP requirements.
- Supporting PMD /ESMU in reviewing the EPC Contractor's detailed designs, their CSEMP and EMP subplans for compliance with the EMP to ensure these documents incorporate and are in accordance with EMP requirements.
- Provide guidance to the PMD /ESMU Specialists on the environmental and social aspects of the project with emphasis on compliance monitoring and reporting.
- Assist the PMD /ESMU with establishing the grievance redress mechanism.

- Evaluate the environmental aspects of the EPC Contractors' method statements and working drawings and recommend corrective actions needed, if any, to ensure compliance with the project's environmental and social requirements.

- Review the EPC Contractors' CSEMP and all topic specific (such as waste) and site-specific plans; recommend modifications to these documents to be compliant with: (a) the environmental and social requirements of the construction contracts as reflected in the EMP, and (b) the conditions of environmental approvals of the Government, where required.

- Develop the compliance monitoring system to be used during the construction period for monitoring the EPC Contractors' performance relative to environmental requirements, including the preparation of: (a) monitoring and corrective action forms and checklists, (b) inspection procedures, and (c) documentation procedures.

- Conduct orientation sessions with the EPC Contractor on the compliance monitoring system to be used, notification of non-compliance, and the process of requiring contractors to implement corrective measures when necessary.

- Provide guidance to the EPC Contractor on how their respective CSEMP will be implemented including the: (a) requirements for each mitigation measure, and (b) implementation schedule of each mitigation measure taking into consideration the general requirement that no specific construction activity will be approved to be commenced if the associated mitigation measures for such activity are not ready before work commences.

- Supporting PMD /ESMU in ensuring the EPC Contractor provides adequate EHS training to their subcontractors.

- Supporting PMD /ESMU in updating the EIA/EMP as required in consultation with ADB prior to approval of the detailed designs to reflect any national environment clearance conditions and any changes from the indicative route alignments assessed by the EIA.

- Supporting PMD /ESMU in ensuring that their contractors secure all necessary permissions before the commencement of related work, maintain records with copies of all the clearances, permits, licenses, and insurances obtained. Checking laborers have valid ID cards to access the site and contractor has valid labour licenses and insurances including provisions for community liability during the period of construction.

- Supporting PMD /ESMU in preparing a community liaison plan.

- Developing formal systems and templates for NEA staff, contractor, and PMD safeguard staff to supervise, monitor and report on day-to-day implementation all aspects of EMP implementation, including the immediate reporting of non-compliances, unanticipated impacts, accidents, chance finds, grievances etc.

9.8.2 Responsibilities During Works

953. The PSC shall be responsible for the following:

- Guiding PMD /ESMU on the implementation of the EMP during the pre-construction and construction.

- Supporting quarterly EHS meetings including site walkover inspection to determine the status of EMP implementation by the EPC Contractor during construction as well as random "spot check" site visits to audit their EMP implementation.

- Supporting PMD /ESMU in reporting on EMP implementation within the quarterly progress reports and preparing semi-annual EMRs for submission to ADB.

- Supporting PMD /ESMU with updating of the EIA/EMP as necessary if any unanticipated impacts (including project scope or design changes) occur during implementation

- Supporting operationalization of the GRM and assisting PMD /ESMU in resolving grievances received.

9.8.3 Responsibilities Upon Completion of Works

954. The PSC shall prepare a report on the Project's environmental and social compliance performance, including lessons learned that may help PMD /ESMU in their environmental monitoring of future projects. The report will be an input to the overall project completion report.

9.8.4 Reporting

Table 149: PISC Reporting Responsibilities

Documents	Responsible Person	Destination of the documents	Submission timing		
			Design period	Construction period	Operation period
Compliance reports	ES / OHSS (LS	PMD/ ADB	X (every month)	X (every month)	
Lessons report	ES / OHSS	PMD/ ADB		X (at completion)	

9.8.5 PSC Staff

955. The PSC shall have the following staff on their roster to support EMP implementation, other staff will be there for social safeguards support etc.

956. **Environmental Specialist (ES)** - The ES will work closely with the EPC Contractor's EM and the PMD and work on general environment focused tasks such as conducting environmental trainings and briefings to provide environmental awareness on ADB and government environmental safeguards policies, requirements and standard operating procedures; ensure baseline monitoring and reporting of EPC Contractor's compliance with contractual environmental mitigation measures during the construction phase.

957. The ES will (i) review all documents and reports regarding the integration of environment aspects including EPC Contractor's CSEMP, (ii) supervise the EPC Contractor's compliance to the EMP/CSEMP, and (iii) prepare quarterly compliance reports.

958. Qualified with a degree or diploma in environmental sciences or equivalent. Preferably fifteen years' experience in conducting environmental impact assessments and implementation of environment mitigation plans and/or monitoring implementation of environmental mitigation measures and health and safety plans during implementation of projects including electricity HV projects funded by developing partners.

959. **Occupational Health and Safety Specialist (OHSS)** - Professionally qualified specialist in all health and safety aspects of major civil works construction, preferably with 5 years of experience with HV substation and power line projects. The specialist will be responsible to the Project Manager for ensuring that all aspects of the project comply with the health and safety provisions of the project's civil works contracts, EMP/CSEMP, and with relevant national laws and regulations.

960. **Labour Specialist** – Provides oversight of labour related aspects of the Project. Qualified with a degree or diploma in social sciences or equivalent. Preferably ten years' experience in managing labour issues and implementation of labour management plans during implementation of projects including electricity HV projects funded by developing partners.

9.8.6 Staff Costs

961. The following table provides a summary of the anticipated staff costs.

Table 150: PSC Environmental, Social, Health and Safety Staff Costs

#	Position	Estimated No. of Months (TL/SS)	Month Cost ($)	Total Cost ($)
1	Environmental Specialist	10/6	15,000	150,000/90,000
2	Occupational Health and Safety Specialist	10/6	15,000	150,000/90,000
3	Labour Specialist	10/6	15,000	150,000/90,000

9.9 Environmental Support Consultants

962. The Project will be supported by a team of environmental support consultants, including

- **Ecologist** – Engaged part-time for six months. Qualified with a post-graduate degree in ecology and having familiarity with the local environment.
- **Ornithologist** - Engaged part-time for 12 months. Qualified with a post-graduate degree in ecology and having extensive ornithology experience and familiarity with the local environment.
- **Herpetologist** - Engaged part-time for 3 months. Qualified with a post-graduate degree in ecology and having extensive experience of reptile surveys and management and familiarity with the local environment.
- **Archeologist** - Engaged part-time for 3 months. Qualified with a post-graduate degree in archaeology and having extensive experience of regional archeology issues and the ability to communicate in Nepali.

963. The specialists will provide oversight of the Project, periodically visiting site to ground truth monitoring reports and reporting findings directly to PMD and ADB.

9.10 External Environmental Monitor

964. In accordance with ADB's Safeguard Policy Statement (SPS) 2009 an external (independent) expert who is not involved in the day-to-day implementation of the Environmental Management Plan (EMP) will be engaged to verify environmental monitoring information for the project. Separate to the day-to-day supervision and monitoring activities of PMD/PSC the external expert will be responsible for reviewing their periodic environmental monitoring reports and with reference to their own review of EMP implementation, supervision, and monitoring activities verifying to ADB the environmental monitoring information provided, confirming if environmental impacts are as anticipated, and advising on compliance issues and any corrective action required for the project to ensure full compliance with ADB's SPS 2009, loan agreement, EMP, Project Administration Manual (PAM) and national requirements.

965. **Scope of Work -** In order to verify the environmental monitoring information the external expert will assess the EMP implementation performance of NEA and all third parties involved including the EPC contractor, qualitatively through desk and field-based review or by conducting additional quantitative environmental monitoring to confirm results where required, discuss the findings of their assessment with NEA and their EPC contractor flagging any actual or potential compliance issues or implementation challenges or problems being faced to which attention is required, and suggest time-bound improvements and/or corrective actions as required. The external expert will prepare stand-alone periodic environmental monitoring verification reports (external environmental monitoring reports) documenting their findings and validating or otherwise the environmental monitoring report of NEA for the corresponding reporting period.

966. **Detailed Tasks and/or Expected Outputs -** The activities of this position include, but are not limited to the following:

- To be familiar with the EMP as disclosed on ADB's website as well as the environment safeguard requirements set out in the loan agreement and PAM, and the requirements of the national Environmental Clearance and any other national permissions required,
- To obtain through NEA and review all relevant contract, detailed design and environment safeguard related documentation to inform the assessment of EMP implementation performance,
- To confirm the EMP was adequately reflected in the contract documentation,
- To confirm the project is being designed, constructed and/or operated on the ground as described in the EIA,
- To confirm that pre-construction documentation required by the EMP is in order,
- To undertake quarterly site visits together with the environment, health and safety staff of PMD and their EPC Contractors when on board from loan effectiveness up to issue of the project completion report in order to conduct on-site environmental audit of EMP implementation,

- To time site visits to enable oversight of the quantitative environmental monitoring activities being undertaken by PMD or their EPC contractor (as required by the environmental monitoring plan) to confirm appropriate methodologies are being used and the results are being correctly documented and interpreted,

- To consult during site visits with potentially affected people (community and project workers) and other stakeholders with an interest in the project, to obtain their general feedback on EMP implementation, as well as to ascertain that they have had the opportunity to raise any environment, health, and safety grievances and that those who did raise them are satisfied with progress and/or the resolution obtained,

- To meet with NEA and their EPC Contactor at the conclusion of each site visit to feedback on findings,

- To make recommendations on and agree with NEA and their EPC Contactor a time-bound improvement and/or corrective action plan to address any actual or potential compliance issues observed and to which attention is required,

- To prepare periodic external environmental monitoring reports for submission to ADB within 30 days of period end.

- To immediately report to ADB with recommendations to address on becoming aware of any major non-compliance issues, unanticipated impacts such as design changes that have not been reflected upon in the EIA, health and safety lost-time incidents or fatalities, change finds of physical cultural resources etc.

967. **Minimum Qualification Requirements -** The external expert must have a basic and advanced degree in environmental management, environmental science or equivalent. They must have at least 20 years of experience in conducting environmental assessment and management, with at least 10 years of experience in conducting project-level environmental audit of projects following Nepali requirements and funded by IFI. They should be able to demonstrate they have acted as an external environmental monitor for at least four IFI funded projects in the past 10 years. The external expert must have at least 10 years of experience in the environmental assessment and management of power plants having worked on at least four such projects in the past 10 years. They must also be familiar with ADB's SPS 2009 environment requirements.

9.11 EMP/CSEMP Review and Update

968. The contents of the EMP/CSEMP will be reviewed and updated periodically to evaluate the environmental controls and procedures therein to make sure they are still applicable to the activities being carried out and effective. Reviews will be undertaken by the EPC Contractor and PSC as follows:

- The full EMP/CSEMP will be reviewed in detail on an annual basis;

- Relevant parts of the EMP/CSEMP will be reviewed following a reportable incident;

- Relevant parts of the EMP/CSEMP will be reviewed in case of any issues/grievances or failure of mitigation to reduce impacts occurs;

- Relevant parts of the EMP/CSEMP will be reviewed following the receipt of an updated site specific or topic specific plan; and

- At the request of stakeholders.

969. The review will include analysis of the monitoring data, monitoring reports, incident reports, complaints/grievances, and feedback from stakeholders. Any update to the project-level EMP requires ADB review and clearance, whilst any update to the CSEMP requires PMD review and clearance.

9.12 Corrective Actions

970. If any performance standards are breached or any of the safeguard requirements that are covenanted in the loan agreements are found not to be satisfactorily complied with by PMD and their EPC Contractors, an appropriate, time bound, budgeted, corrective action plan (CAP) will be developed and implemented as agreed upon with ADB to rectify unsatisfactory performance or safeguard noncompliance.

9.13 Meetings and Site Visits

971. PMD will convene monthly EHS meetings to be attended by the EPC Contractor's management and safeguard team to discuss progress; initially progress will be discussed in relation to design actions and as the project progresses will move onto pre-construction and contraction actions. During the monthly EHS meetings areas for improvement, unsafe acts, and any non-compliances, time-bound corrective actions and responsibilities to address them will be discussed, agreed, and documented. PMD will be given delegated authority to instruct the contractor to take corrective action at any time in relation to EMP implementation.

972. For any ADB supervision missions to ongoing construction works contractors will provide all ADB staff with a project site health and safety induction and adequate PPE in accordance with Table 2.7.1 of the WBG EHS General Guidelines - Occupational Health and Safety Section.

9.14 Capacity Development

973. To build capacity of both PMD and the EPC Contractors for implementation of the EMP and other safeguard requirements, a training program will be delivered. The training program will be implemented as per training modules provided in Table 125, training needs will be further determined and elaborated in a training plan prepared by PMD. Training modules can be changed during construction phase based on requirements of the contractors. The basic objective of giving training to the different stakeholder is to enhance their capabilities for implementation of the EMP and EMoP during construction and operation.

974. Delivery of the training program is part of the project cost that includes institutional strengthening, capacity building and training whilst the EPC Contractor will factor in their attendance within the contract amount. It is recommended that the training be given:

- Upon the award of contracts to the contractor

- Before the start of construction work
- Refresher during construction
- Before demobilization of contractor and commencement of O&M

Table 151: Training Requirements

Training Session	Required Attendees/Recipients	Delivery Mode/Duration	Training Conducted by	Budget Source
Introduction to ADB's Safeguard Policy Statement (2009),WBG EHS Guidelines, GON requirements, and Project EMP including EMOP	PMD, EPC Contractors' Management and Environment Safeguards Teams	Lecture session, presentation, and discussion. In Person/ 1 day	ESMU & PSC	PSC Budget
EMP implementation for detailed design (design requirements including issues like prohibition on asbestos containing materials, use of lead-acid batteries, transformer oils, bunding etc.)	PMD EPC Contractors' Design Teams and Environment Safeguards Teams	Lecture session, presentation, and discussion. In Person/ 1 day	PSC	PSC Budget
Bird sensitive design awareness raising	Power line staff of PMD, EPC Contractors' Management, Design Teams and Environment Safeguards Teams	Lecture session, presentation, and discussion. Online/ 0.5 day	ESMU / PSC	PSC Budget
PCB awareness raising	SS staff of PMD EPC Contractors' Management, Design Teams and Environment Safeguards Teams	Lecture session, presentation, and discussion. Online/ 0.5 day	ESMU / PSC	PSC Budget
SF_6 awareness raising	SS staff of PMD, EPC Contractors' Management, Design Teams and Environment Safeguards Teams	Lecture session, presentation, and discussion. Online/ 0.5 day	ESMU / PSC	PSC Budget
GRM operation (initial run at start of project, and then again on handover to operational staff)	All GRM levels- GRM Focal Points, GRC, PMD Contractors Management, Environment Safeguards Team, Local Government Representatives GRM Focal Points of Contractors	Lecture session, presentation, and discussion. In Person/ 1 day	ESMU / PSC	PSC Budget
EMP implementation for pre-construction and construction, including workshop on CSEMP preparation	PMD, Contractors' Construction Teams and Environment Safeguards Teams	Lecture session, presentation, and discussion. In Person/ 1 day	ESMU / PSC	PSC Budget

Training Session	Required Attendees/Recipients	Delivery Mode/Duration	Training Conducted by	Budget Source
Environmental assessment checklist and consultation proforma completion for IEE update	PMD, Contractors' Construction Teams and Environment Safeguards Teams	Lecture session, presentation, and discussion. In Person/ 1 day	ESMU / PSC	PSC Budget
Facilitated H&S workshop (construction stage)	PMD, Contractors Management, Construction, and Environment Safeguards Staff	Facilitated workshop In Person/ 1 day	ESMU / PSC	PSC Budget
Environmental quality monitoring requirements; site supervision and monitoring including use of detailed monitoring framework (checklists) and preparing period Environmental Monitoring Reports	PMD, Contractors Management and Environment Safeguards Teams	Lecture session, presentation, and discussion. In Person/ 2 days	ESMU / PSC	PSC Budget
Site restoration	PMD, Contractors Management, Construction, and Environment Safeguards Staff	Lecture session, presentation, and discussion. Online/ 0.5 day	ESMU / PSC	PSC Budget

9.15 EMP Implementation Schedule

975. Strictly no contracts will be awarded before the EMP has been incorporated into the contract documentation. Further, no site establishment or construction activity is to take place before PMD has received and approved the contractor's CSEMP including all sub-plans. Tentative implementation schedule of the project is listed in the following table. The contractors will submit a more detailed implementation schedule for the detailed design, pre-construction, and construction once the contract is awarded.

Table 152: Key EMP Milestones in Implementation Schedule

#	Description	Indicative Time Frame
1	Project Implementation NEA	
A	Bidding Documents	TBD
B	Procurement	TBD
C	Construction commencement	TBD
D	Construction Completion	TBD
E	Defects Liability Period	24/12 months
2	Pre-Construction Phase	

#	Description	Indicative Time Frame
A	Implementation of mitigation measures and conduct environmental monitoring for which PMD is responsible	Immediate implementation, noting EMP requirements must be reflected in contract for which bidding documents may be issued prior to ADB project approval
B	Establishment of GRM	Immediate implementation, latest within one month of loan effectiveness
C	Appointment of PMD E&S staff	Latest within one month of loan effectiveness for the PMD safeguard support, before start of works on site.
D	Appointment of PSCs	PSCs must be appointed within three months of loan effectiveness and prior to the approval of detailed design, CSEMP approval, site establishment, site preparation, etc.
E	Implementation of mitigation measures and conduct environmental monitoring for which contractor is responsible	Upon award of the contract
F	Updating the EIA/EMP to reflect final route alignments and obtaining ADB clearance of update	Prior to approval of the detailed design
G	Submission and approval of the Contractor's CSEMP	One month before the start of works including any site establishment, site preparation, demolition, and earthworks
3	Construction Phase	
A	Implementation of mitigation measures and conduct of environmental effects monitoring following the EMP.	After award of the contract
B	Monthly EMR for Project's Monthly Progress Report	5th day after effective month (covering the month prior)
C	Semi-Annual EMR during construction for submission to ADB	15th day after effective 6-months; the last construction EMR will be submitted after the commissioning and DLP of all works by the implementing agency documenting in depth how all pre-construction and construction activities were complied with
D	Restoration of construction sites	Before demobilization of contractor
4	Operation Phase	
A	Implementation of mitigation measures and monitoring activities for operational period	Upon commissioning
B	Annual EMR during construction for submission to ADB	15th day after effective 6-months; the first operational EMR will be submitted 12 months after the last construction EMR was submitted up until the ADB PCR is issued

9.16 Budget

976. Costs will be associated with implementation of the mitigation plan, EMoP and capacity development. Necessary budgetary provisions must be planned and allocated by NEA for implementing the environmental measures of their components as part of the EMP. The main EMP budget items have been identified for implementing the environmental management and monitoring and capacity development activities required, and an indicative budget allocated for each. The budget will be refined during project implementation but enables preparedness for financial requirements.

977. For contract/consultant related costs these are only an estimate based on an estimate of the construction and installation cost, since the contracts are subject to competitive bidding it will be for the contractor/consultants to reflect in their BOQ and ensure adequate budget is provided in their bids for the EMP implementation. The construction EMoP will be part of the EPC Contractor's contract, whereas the operational EMoP will be the responsibility of NEA O&M team. Operational cost is an annual cost, it will be incurred annually for each year the HV components are in operation.

Table 153: Indicative Implementation Budget

Item	Quantity	Estimated Rate ($)	Estimated Total Amount ($)	Budget Source
PRE-CONSTRUCTION				
Vulture surveys and analysis	Lum sum		330,000	NEA
CONSTRUCTION				
PMD Safeguard Unit during construction				
PMD ESO	42	1,000	42,000	NEA
PMD SHSO	42	1,000	42,000	
PMD EO1	42	800	42,000	
PMD EO2	42	800	33,600	
PMD HS01	42	800	33,600	
PMD HS02	42	800	33,600	
PMD HSOSS	30	800	33,600	
Training session expenses	500/session x 20	-	10,000	
Expenses for consultation, GRM etc.	100/42months	-	4,200	
PSC Safeguard Specialists				
Environmental Specialist (TL)	10 months	15,000	150,000	PSC Contract
Environmental Specialist (SS)	6 months	15,000	90,000	
Occupational Health and Safety Specialist (TL)	10 months	15,000	150,000	
Occupational Health and Safety Specialist (SS)	6 months	15,000	90,000	
Labour Specialist (TL)	10 months	15,000	150,000	
Labour Specialist (SS)	6 months	15,000	90,000	
EPC Contractor's Environment Safeguards Team / NBTL				
Environmental Manager	42 months	1,000	42,000	EPC Contract
Health and Safety Manager	42 months	1,000	42,000	
Health and Safety Steward(s)	TBD	800	TBD	
Labour Manager	42 Months	1,000	42,000	
Botanist	20 months	1,000	20,000	
Ecologist	42 months	1,000	42,000	
Archaeologist	42/20 months	1,000	42,000/20,000	
EPC Contractor's Environment Safeguards Team / SS				
Environmental Manager	30 months	1,000	30,000	EPC Contract
Health and Safety Manager	30 months	1,000	30,000	
Health and Safety Steward(s)	TBD	1,000	-	

Item	Quantity	Estimated Rate ($)	Estimated Total Amount ($)	Budget Source
Labour Manager	30 months	1,000	30,000	
Pollution Control Specialist	30 months	800	24,000	
Ecologist	30 Months	1,000	30,000	
Archaeologist	6 months	1,000	6,000	
EMP Implementation Costs				
NBTL Contractor's EMP implementation cost (including PPE provision and bird divertors) – estimated at 1% of civil works costs	Lump sum	-	2,000,000	Construction Contract
SS Contractor's EMP implementation cost (including PPE provision and bird divertors) – estimated at 1% of civil works costs	Lump sum	-	500,000	Construction Contract
Pre-construction/construction/commissioning environmental quality monitoring EMoP (Table 130)	Lump sum	-	33,474	Construction Contract
Tree Compensation			16,490,933	NEA
Bird Diverters			730,000	Construction Contract
OPERATION				
NEA Safeguard Units during operation	Annual Cost per Unit	43,200	43,200	NEA
Vulture Surveys and Offsets	Lump sum		627,000	NEA

Table 154: Environmental quality monitoring budget

Parameters per Monitoring Plan	Sites	Rate in USD	Quantity/ location[51]	Frequency	Total in $
Pre-Construction					
Noise	Substation	36	1	1	36
Air quality		157	1	1	157
Ground water quality		54	1	1	54
Drinking water source for potability	Substations for operational supply and construction sites (worker supply)	60	1	1	60
Noise	NBTL	36	15	1	540

[51] For purposes of budget estimation, exact numbers to be determined by the contractors in accordance with EMoP requirements

Parameters per Monitoring Plan	Sites	Rate in USD	Quantity/ location[51]	Frequency	Total in $
Air Quality		157	15	1	2,355
Groundwater Quality		54	10	1	540
Construction					
Noise	Substations	36	1	6	216
Air quality		157	1	6	942
Ground water quality		54	1	6	324
Drinking water source for potability	Construction sites (worker supply)	60	1	3 times during construction	180
Noise	NBTL	36	15	8	4,320
Air Quality		157	15	8	18,840
Groundwater Quality		54	10	8	4,320
Commissioning					
Noise	Substations	36	1	1	36
SF6		500 per leak detector	1	N/A – Monitors purchased for all substations	500
Drinking water source for potability		54	All substations	1	54
		Total Monitoring Budget for Contract Cost			33,474
Operation (annual cost)					
Drinking water source for potability		54	1	1	54

X. CONCLUSIONS AND RECOMMENDATIONS

10.1 Conclusions

978. This EIA has established that generally there are no significant environmental issues that cannot be either totally prevented or adequately mitigated to levels acceptable to the national standards and international guidelines for project activities. During the development of this EIA extensive consultations have been undertaken with stakeholders and international specialists to refine the Project alignment to reduce, where technically feasible, the risk of significant impacts affecting the sensitive Project environment. Impacts to cultural heritage have been significantly reduced due to realignments, including around Sainamina where the alignment was re-routed through consultation with the Department of Archaeology. The number of trees to be cut has also been significantly reduced by adopting higher tower designs. However, a number of significant residual impacts remain, including those relating to special status vultures and reptiles.

10.2 Recommendations

979. A wide range of mitigation and monitoring measures have been included in the Project Environmental Management Plan (EMP) incorporated into the EIA. NEA and the EPC Contractors will implement the EMP measures ensuring adequate budget and human resources are allocated to this.

980. However, some of the identified impacts will require offsetting, specifically those relating to vegetation clearance and potential impacts to vultures. Measures have been incorporated into the EIA to replant trees on a 1:10 basis (1:25 for special status species) which, in the longer term will have positive impacts to the regional environment. NEA have also committed to collaboration with Chure Conservation Area to develop conservation measures in the Chure region and these will be further elaborated in an updated EIA as these measures are confirmed between NEA and Chure Chure Terai Madhesh Conservation Development Committee. Conservation measures for special status reptiles, including the Elongated tortoise will also be further developed between national specialists and NEA.

981. Impacts to vultures require specific attention. Detailed discussions with Bird Conservation Nepal and international vulture conservationists have indicated that additional surveys are required before the NBTL alignment is finalized. Accordingly, no works will commence on NBTL until 12 month vulture surveys have been completed to further understand the behavior of the vultures. It however, recognized that even after the surveys are completed and mitigation measures are adopted (which may include further re-alignment of NBTL) there still remains a risk of vultures colliding with NBTL. This EIA recommends specific offset measures to counter this risk. This involves retrofitting of distribution lines close to vulture nesting sites and vulture feeding stations to mitigate against electrocutions on these lines. Electrocutions on distribution lines kill substantially greater number of vultures than collisions with transmission lines and as such the proposed offsets have the opportunity to result in a net positive impact to vultures in the region.

982. The Project EMP, its mitigation and monitoring programs, will be included within the bidding documents for project works for all Project components of NEA with physical works involved. The bid documents will state that the EPC Contractor will be responsible for the implementation of the requirements of the EMP allocated to them (including specific design phase actions) and preparing their own Construction Specific EMP (C-SEMP) which will adopt all the conditions of the EMP and add in site specific elements that are not currently known, such as the EPC Contractor's storage and camp

locations. This ensures that all potential bidders are aware of the environmental requirements of the Project and its associated environmental costs. The EMP and all its requirements will then be added to the EPC Contractor's Contract, thereby making implementation of the EMP a legal requirement according to the Contract.

983. The EPC contractors will then prepare their detailed designs and C-SEMP which will be approved and their works supervised and monitored. Before the detailed designs are approved the EIA will need to be updated to reflect the final cable routes, reviewed and cleared by ADB for disclosure on the ADB website and locally. Should NEA note any non-conformance with the EMP (and C-SEMP) the EPC Contractor can be held liable for breach of the contractual obligations of the EMP. To ensure compliance with the C-SEMP the EPC Contractor is required to employ an Environmental and Social Officer and team of safeguards experts to monitor and report Project activities throughout the construction phase. Project supervision consultants will also include environment, health and safety experts to support supervision and monitoring of Project EMP implementation and to build the capacity of NEA. A team of environmental support consultants will also be engaged to further monitor works.

984. Finally, NEA will be responsible for implementing all offsets in the operational phase, including those relating to vultures and reptiles.