Initial Environmental Examination

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NEPAL: Electricity Grid Modernization Project

Part 1

Prepared by Nepal Electricity Authority, Government of Nepal for the Asian Development Bank.

CURRENCY EQUIVALENTS
(as of 12 August 2020)

Currency Unit	=	Nepali Rupee/s (Rs)
Rs1.00	=	$0.008344
$1.00	=	Rs119.8400

ABBREVIATIONS

ADB	Asian Development Bank
AIS	air insulated substation
CBS	Central Bureau of Statistics
CE	common era
CO2	carbon dioxide
COD	chemical oxygen demand
DHM	Department of Hydrology and Meteorology
DO	dissolved oxygen
EGMP	electricity grid modernization project
EHS	environment, health, and safety
EIA	environmental impact assessment
EMF	electromagnetic field
EMP	environmental management plan
EPI	environmental performance index
GIS	gas insulated substation
GRM	grievance redress mechanism
HDI	human development index
IEE	initial environmental examination
IEEE	Institute of Electrical and Electronics Engineer Inc.
ICNRP	International Commission on Non-Ionizing Radiation Protection
IUCN	International Union for Conservation of Nature
kV	kilovolt
LPG	liquefied petroleum gas
masl	meters above sea level
mm	millimeter
µg/m³	micro gram per cubic meter
NEA	Nepal Electricity Authority
PM2.5	fine particulate matter below 2.5 micrometers
PMD	project management directorate
PTDEEP	Power Transmission and Distribution Efficiency Enhancement Project
PTDSSP	Power Transmission and Distribution System Strengthening Project
ROW	right of way
SASEC	South Asia Sub-regional Economic Cooperation
SF6	sulfur hexafluoride
SNNP	Shivapuri Nagarjun National Park
SPCC	spill prevention control and countermeasures
UNESCO	United Nations Educational, Scientific and Cultural Organization

WEIGHTS AND MEASURES

amp	–	ampere
ha	–	hectare
Hz	–	hertz
km	–	kilometer (1,000 meters)
kV	–	kilovolt (1,000 volts)
kW	–	kilowatt (1,000 watts)
mG	–	milligauss

NOTES

In this report, "$" refers to US dollars unless otherwise stated.

CONTENTS

EXECUTIVE SUMMARY

1. This initial environmental examination (IEE) including an environmental management plan (EMP) for the proposed Electricity Grid Modernization Project (EGMP or the Project) by Nepal Electricity Authority (NEA) has been prepared in compliance with the Asian Development Bank's (ADB) Safeguard Policy Statement (2009) and national (Nepal) environmental assessment health, and safety requirements.

2. The project will finance high-priority transmission and distribution systems investments under three outputs. Output 1: electricity transmission capacity in project areas strengthened and modernized; Output 2: electricity distribution system in project areas modernized; and Output 3: capacity of NEA and electricity users in project areas strengthened. Only the first two outputs involve physical activities. Output 1 will involve the construction of construction of 88 km of 132 kV and 25 km of 220 kV new transmission lines. It also involves the upgrade of 144 km of existing 132 kV and 66 kV transmission lines and automation of 34 existing substations. Output 2 will involve the construction of 30km of 33 kV distribution lines and a distribution command and control center. It also involves the installation of an estimated 350,000 smart meters. Between Outputs 1 and 2, 7 new or extended transmission/distribution substations will be constructed. The project is aligned with the following impacts: Reliable and efficient electricity for all achieved by 2028 and NEA developed as modern and sustainable corporate entity providing reliable services to its customers. The project will have the following outcome: coverage, reliability, efficiency, and financial sustainability of electricity supply in Nepal improved.

3. The project is estimated to cost $195 million. ADB will finance the project through a $156 million project loan while the balance of funds will come from counterpart funding by the Government of Nepal. NEA will serve as the executing agency and will implement the EGMP through its Project Management Directorate (PMD). The EGMP will be implemented over 5 years and is expected to be completed by March 2026.

4. Under ADB's Safeguard Policy Statement (2009), the EGMP has been classified as "B" for environment requiring the preparation of an IEE. Following the requirements of ADB's Safeguard Policy Statement (2009) and national (Nepal) environmental assessment health, and safety requirements, this IEE has been prepared, covering all components of the EGMP having environmental impact.

5. The transmission line and substation work under Output 1 will be spread across various locations in Province number 1, Bagmati province, Gandaki province, province number 5, and Karnali province.

6. A total of 227.5 ha will fall under the rights of way of the 3 new overhead transmission lines, including 86.7 ha of forest land for which a compensatory reforestation program will be implemented. Compensatory reforestation at a ratio of 1:25 will be provided for the 12,950 trees to be felled on forest land (8,358 private trees will also be lost) as well as forest land replacement for 3 ha of land to be planted at 1,600 trees/ha under tower footings. In particular, 7.4 km of the new Ghorahi-Madichaur transmission line runs along a river valley that falls within the IUCN category VI Chure Conservation Area which is designated to conserve natural habitats whilst allowing sustainable use of natural resources. 400 m of this section also passes

through the outskirts of the Dang Deukhuri Foothill Forests and West Rapti Wetlands Important Bird Area. Due to the location of Ghorahi substation within the protected area, whilst alternative routings were considered to minimize forest loss, it has been unavoidable to pass through it. However, its protected area management plan specifically includes improving access to energy including through “extension of access to national electricity power transmission” as an objective. 13.32 ha of land within the Chure Conservation Area will fall under the right of way of the transmission line which is mainly agricultural land (modified habitat) with existing road access; thus no forest land is impacted with the protected area and the transmission line will not open up access to it. Dang Deukhuri Foothill Forests and West Rapti Wetlands Important Bird Area was recently extended to include the Charinge Community Forest, this forest land supports a breeding site for critically endangered vultures, located approximately 2 km distant. To ensure ADB’s Safeguard Policy Statement (2009) critical habitat requirements can be met, and there will be no reduction in their population due to electrocution or collision, “bird sensitive” design following international good practice will be adopted including installation of bird divertors along the entire transmission line to minimize collision risk. During detailed design towers will also be located as far west as is possible from Charinge Community Forest and the river. Whilst the other new transmission lines do not affect protected areas, where they cross ridge/valley crossings and waste dumps, bird divertors will be installed 500m either side. The project will also provide a biodiversity offset in the form of installing bird divertors on an additional 90km of transmission line within vulture safe zones. During construction work temporary storage areas and worker camps will be located outside of forest and protected areas and there will be strict prohibition with penalties for the construction workers on the use of fuel wood, poaching of wild animals, etc.

7. Output 1 also involves the upgrade of existing transmission lines in provinces 1 and 2 and Bagmati province. A 7.4 km section of the existing Pathlaiya to Dhalkebar transmission line falls just inside the southeastern corner of the recently extended perimeter of the IUCN category IV Parsa National Park designated for elephant, amongst other species (it and the Pathlaiya substation were constructed before extension of the protected area boundary) and two sections of the Chure Conservation Area. Although its right of way runs partly through forest land, works will be confined to the existing right of way which is already maintained by NEA and mostly follows an existing road access. The opportunity will also be taken here to retrofit “bird sensitive” design including the installation of bird diverters within the protected areas and at ridge/valley crossings, such as the Bagmati river, to provide mitigation for birdlife already at risk of collision. A 5.7 km section of the existing Duhabi to Kusaha transmission line whose right of way runs through agricultural land (modified habitat) is situated in the buffer zone of Koshi Tappu Wildlife Reserve which is for intensive use. Koshi Tappu Wildlife Reserve itself supports endangered wild water buffalo as well as migratory bird species. Flyways for migratory birds are anticipated to primarily follow the river valley but birds may also fly across the transmission line, therefore, the opportunity will be taken to retrofit “bird sensitive” design including the installation of bird diverters during reconductoring to provide mitigation for birdlife already at risk of collision from the existing line. For transmission line upgrading works all storage areas and worker camps will be located outside of forest and protected areas and there will be strict prohibition with penalties for the construction workers on the use of fuel wood, poaching of wild animals etc.

8. NEA has requested clearance from government agencies including the Department of National Park and Wildlife Conservation and the Chure Conservation Program Office for implementation of the project, and to confirm that all works within protected areas are in accordance with relevant management plan. NEA will support actions to promote and enhance their conservation aims, including vulture conservation, in conjunction with Bird Conservation Nepal or similar organization.

9. No new substations are located in protected areas, their buffer zones or key biodiversity areas. However, the 18.6km Balefi Corridor 132 kV transmission line is an associated facility of Pangtang substation. The former has similar impacts to the project components and NEA will apply the project EMP to it, including provision of bird divertors, etc.

10. Some existing substations to be automated are located in protected areas, buffer zones or important bird areas. However, as works will be undertaken within their boundaries no ecological impacts are expected from the project itself.

11. Installation of smart meters would be limited to consumers' premises and are expected to have minimal or no impacts.

12. Other than biodiversity impact, potential environmental impacts of Outputs 1 and 2 are mainly related to construction, including temporary impacts on air and water quality, noise and vibration, and occupational and community health and safety risks, in particular, related to slope stability for infrastructure on hilly terrain, seismic risk, working at height and with electricity infrastructure, and risks of communicable diseases in the context or aftermath of the COVID-19 pandemic. Specifically in relation to the upgrade of the Suichatar-Balaju 66kV transmission line under Output 1, about 150m passes over religious forest area within the current boundary of the Kathmandu Valley (Swayambu) World Heritage Site requiring prior permission from the Department of Archeology (DOA) to carry out these works, with an additional 400m passing through the proposed boundary extension which covers densely built up area. Although it is an existing transmission line and the main monument (Swayambunath Stupa) is 500m distant, there is possibility of smaller monuments within its boundary and in close proximity to the alignment being damaged during construction if works are not well managed. NEA is seeking written confirmation from the DOA (DOA is also representative of UNESCO) as to actions required to ensure these works are in accordance with the integrated management plan, and all works within the boundaries of the World Heritage Site boundaries will be supervised by an archaeologist.

13. Longer term impacts during operation and maintenance include occupational and community health and safety risks related to the presence of electricity infrastructure in communities specifically requiring any structures (e.g. houses, schools) falling in the 5-7 m horizontal safety clearance required under Nepal Electricity Rules of new or existing lines to be resettled, pollution risks related to hazardous materials and waste at substations, and climate change impacts related to use of SF6 (a potent greenhouse gas with global warming potential of 22,800 kg carbon dioxide equivalent) in the new gas insulated substations requiring leakage to be monitored. These potential environmental impacts are all well understood and can be mitigated through adherence to national requirements and international measures and standards as set out in the IFC General and Transmission and Distribution Environment, Health and Safety Guidelines.

14. Mitigation/compensation measures are defined in the project EMP whose implementation will be monitored by NEA. Environmental audits of existing substations have been carried out and a corrective action plan prepared. The EMP includes (i) corrective action for existing facilities i.e. substations; (ii) mitigation/compensation measures reflecting national requirements and international good practice for potential environmental impacts during implementation, including developing site-specific biodiversity management plans for transmission lines affecting ecologically sensitive areas and a site-specific heritage assessment and management plan for the transmission line upgrade within the Kathmandu Valley (Swayambu) World Heritage Site which will be cleared by ADB before any works can go ahead; adhering to electromagnetic field (EMF) exposure and noise guideline levels; approving contractor's pollution prevention, solid and hazardous waste management, traffic management, health and safety management plans (including COVID-19 provisions) prior to works; prohibiting PCB use in new transformers and asbestos containing materials in construction; and, community awareness raising activities on biodiversity conservation in the vicinity of ecologically sensitive areas and the health and safety risks of electrical equipment; (iii) an environmental monitoring program, including monitoring of health and safety incidents; and (iv) the responsible entities for mitigation/compensation, monitoring, and reporting (quarterly project progress reports and semi-annual safeguards monitoring reports during construction and operation) to ADB. Mitigation/compensation measures will be assured by a program of environmental supervision and monitoring to be conducted during the pre-construction, construction, and operation & maintenance stages by NEA, supported by a Project Supervision Consultant. Any unanticipated impacts or requirements for corrective action during implementation will be reported by NEA to ADB.

15. Project affected persons and other stakeholders were consulted during preparation of the IEE and invited to express any environmental and social concerns they had regarding the EGMP. In total, 50 consultation meetings (including two public hearings) involving 719 participants (535 male and 184 female) were held for the 3 new transmission lines and 1 new substation (between March 2018 to January 2020). There was generally support for the project. The main environmental and social concerns raised were community safety of electricity infrastructure, including presence of a school compound to be avoided, tree clearance and reforestation, human-wildlife conflict, timing of works to avoid crop loss, and local employment. Other stakeholders consulted included Bird Conservation Nepal who raised concerns regarding vultures in the vicinity of the new Ghorahi-Madichaur transmission line and suggested mitigation measures for the Duhabi to Kusaha transmission line upgrade. The IEE will be disclosed on the ADB website and locally by NEA with translation into local language. The meaningful consultation process will continue during project implementation to ensure that all affected persons and other stakeholders are fully engaged with the EGMP and have the opportunity to participate in its development and implementation. NEA will complete additional meaningful consultations prior to and during detailed design and update the IEE accordingly before the commencement of any work. Future consultations will be undertaken in accordance with national restrictions and international good practice guidance for managing exposure to COVID-19 risks.

16. A grievance redress mechanism (GRM) has been proposed to address the grievances of project affected persons and details of this will also be disseminated during future consultations.

17. This IEE including EMP are considered sufficient to meet the environmental assessment requirements of ADB for the project. However, it will be reviewed and updated as necessary prior to and following detailed design. In case of any unanticipated impact (including a scope or design change) occurring during project implementation, this IEE and EMP must be further updated by NEA and cleared by ADB before any related works commence or are cleared to continue.

I. INTRODUCTION

A. Project Background and Rationale

1. Nepal is a landlocked, mountainous country located between the large and fast-growing economies of the PRC to the north and India to the east, west, and south. Nepal's per capita electricity consumption of 198 kilowatt hours (kWh) per annum is just one-third of the average in South Asia and one-tenth of the world average. The share of electricity in the primary energy mix of the country is less than 10% and there is increasing dependency on biomass and fossil fuels for meeting cooking and transport needs. Only 1,320 megawatts (MW) of hydropower has been realized by the end of 2019 out of technical potential of 43,000 MW. Although 78% of Nepal's population has access to grid-supplied electricity, there is a need to increase the capacity of the power transmission and distribution systems to meet current and future demand, improve reliability and quality of supply, and eliminate bottlenecks between generation hubs and load centers. The proposed Electricity Grid Modernization Project (EGMP or the Project) by Nepal Electricity Authority (NEA) will finance high-priority transmission and distribution systems investments, under three outputs.

2. **Output 1: Electricity transmission capacity in project areas strengthened and modernized.** The project will finance (i) automation of about 34 existing grid substations throughout the country; (ii) construction of 88 km of 132 kV and 25 km of 220 kV new transmission lines (Dandakhet-Rahughat 132 kV transmission line: 25 km, Madichaur-Ghorahi 132 kV transmission line: 40 km, Borang-Lapang 132 kV transmission line: 23 km, Lapang-Ratmate 220 kV transmission line: 25 km); (iii) installation of automated 220 kV grid substations of cumulative size 400 MVA (200 MVA each in Rahughat and Lapang) and automated 132 kV grid substations of cumulative size of 361.5 MVA (30 MVA each in Rahughat, Dandakhet, Madichaur, Borang and Lapang; 63 MVA in Pangtang; and 148.5 MVA in Keraun), and (iv) upgradation of existing 102 km 132 kV transmission line from Pathlaiya to Dhalkebar in Province 2, 28 km 132 kV Duhabi to Kusaha transmission in Province 1, and 14 km 66 kV transmission line inside Kathmandu Valley in Bagmati Province with more efficient high-temperature-low-sag conductors. The Project will also provide training to at least 30 NEA staff (including at least 30% women) on automation of grid substations.

3. **Output 2: Electricity distribution system in project areas modernized**. This will include construction of a distribution command and control center in Kathmandu with at least 30% female staff; installation of smart meters for remaining 350,000 customers in Kathmandu Valley and construction of distribution system consisting of 30 km long 33 kV distribution lines in Morang district and 4 automated substations of 33/11 kV 32 MVA in various parts the country commissioned benefitting 134,000 households (33/11 kV 8 MVA each at Madichaur, Keraun, Borang, and Pangtang). About 2,000 electricity consumers including at least 30% women in project areas will benefit from knowledge on safe and efficient use of electricity.

4. **Output 3**: **Capacity of NEA and electricity users in project areas strengthened**. Considering the importance of continued support to NEA and users, the project will support increasing knowledge of at least 30 eligible NEA staff (including 30% women) on NEA's organizational development. The project will also support implementation of key actions from NEA's gender equality and social inclusion (GESI) strategy and operational guidelines in its regional offices related to human resources, to complement corporate level activities covered under a forthcoming project. The project will also support in operationalizing NEA's Nepal Power Trading Company Limited as separate entity to help sustain sector reform momentum

and overall improvement in corporate level financial reporting of NEA, through full compliance with Nepal Financial Reporting Standards.

5. The project is aligned with the following impacts: Reliable and efficient electricity for all achieved by 2028 and NEA developed as modern and sustainable corporate entity providing reliable services to its customers. The project will have the following outcome: coverage, reliability, efficiency, and financial sustainability of electricity supply in Nepal improved.

6. The project is estimated to cost $195 million. The ADB will finance the project through a $156 million project loan while remaining funds will come from counterpart funding by the Government of Nepal. NEA will serve as the executing agency and will implement all activities under the ADB loan through its Project Management Directorate (PMD). The project will be implemented over a period of 5 years after the loan effectiveness, including procurement and construction activities, and is expected to be completed by March 2026.

B. Objective and Scope of the IEE

7. This IEE report documents the environmental assessment of the proposed EGMP based on available information to date and identifies the potential adverse environmental impacts and risks to be given further attention by NEA and the engineering, procurement and construction (EPC) contractors in the detailed design phase and managed during the pre-construction, construction and operation & maintenance phases of the project. The IEE addresses, as far as required, the environmental management, health, and safety requirements of Nepal as well as those of the ADB's Safeguard Policy Statement (2009). The objectives of the IEE are to:

- identify any legislative and approval requirements under which project activities must occur;
- assess the existing environmental conditions and receptors in the project area of influence including the identification of environmentally sensitive areas such as the national protected areas network;
- assess the direct, indirect, cumulative, and induced environmental impacts of the project on and risks to physical, biological, socioeconomic, and physical cultural resources; and
- set out in an EMP the mitigation and monitoring measures that will guide environmental management during detailed design and the pre-construction, construction, operation & maintenance of the project.

8. The environmental studies have been confined to the project area of influence as defined in ADB's Safeguard Policy Statement (2009). The corridor of potential impact was generally taken as a 500 meter (m) radius around the substations and 500m corridor along the transmission line alignments (right of way [ROW] for 220 kV transmission lines is 30m, for 132 kV transmission lines is 18 m and for 66kV transmission lines is 12 m). However, the potential impact zone is considered up to a 10 kilometer (km) radius around the proposed substations and 25 km corridor along transmission line alignments in respect of indirect impacts on ecologically sensitive areas, such as, national protected areas networks and critical habitats. Assessment is carried out for various environment components including terrestrial, avian, and aquatic ecology, soil, water, air, noise, socio- economic aspects including occupational and community health and safety, and physical cultural resources.

C. Methodology of the IEE

9. The IEE report has been prepared by technical assistance consultants supported by ADB, between March to August 2020, to fulfill ADB's Safeguard Policy Statement (2009) requirements on behalf of the project's executing agency Nepal Electricity Authority. The IEE also considers the environmental, health and safety requirements of Nepal and international regulations and commitments to which Nepal is signatory.

10. The assessment was carried out based on (i) national IEEs (two) and EIA (one) for the three new transmission lines that were completed in 2018-2020 by NEA under national regulations, including primary and secondary data collection as well as public consultations; (ii) national IEE related to Pangtang substation, completed by NEA in 2018-2019 by NEA under national regulations; (iii) desk study supported by field photographs and other inputs from NEA, as the consultant could not visit the field in the context of COVID-19 pandemic and lockdown requirements; (iv) consultations with affected persons, village representatives and other concerned stakeholders (consultations were undertaken on site as well as telephonic and through e-mail using questionnaires, given the context of COVID-19 pandemic and lockdown requirements); and (v) review of existing secondary data.

11. The stepwise activities carried out include:

- review of legal requirements;
- review of technical project details;
- review of national IEE/EIA reports prepared by NEA;
- desk study supported by field photographs and inputs from NEA;
- primary and secondary data collection possible at this stage;
- consultations with affected persons, village representatives and other concerned stakeholders; and
- identification of impacts and mitigation measures.

12. The assessment is based on the locations selected for the new or extended substations and alignment of the new or existing transmission and distribution lines proposed by NEA. The detailed route survey for the three new transmission lines have been completed therefore no major changes in the route alignments are anticipated. However, it should be noted that they may alter following the completion of the detailed design process by EPC contractors and detailed route surveys during detailed design, particularly for the 33kV distribution lines. Therefore, following selection of the final line alignments and final detailed design, particularly for 33 kV distribution lines, and final locations of substations, this IEE and associated EMP will be reviewed, updated as necessary and cleared by ADB.

13. The IEE and EMP will also be updated and revised, if necessary, if any unanticipated impacts including a scope or design change occur at any stage during project design and implementation. Any changes to the IEE and EMP will be subject to ADB clearance and disclosure.

D. Structure of the IEE

14. In compliance with ADB's Safeguard Policy Statement (2009) requirements, this IEE has been structured and consists of nine sections: (i) Introduction; (ii) Policy, Legal and Administrative Framework; (iii) Description of the Project; (iv) Description of the Environment; (v) Anticipated Environmental Impacts and Mitigation Measures; (vi) Information Disclosure, Consultations, and Participation; (vii) Grievance Redressal Mechanism; (viii) Environmental

Management Plan including a Corrective Action Plan (CAP) for existing facilities (substations); and (ix) Conclusion and Recommendation. The executive summary is also provided in the beginning of the IEE report.

15. The IEE report is supported by twelve appendices (provided separately as Volume 2 of the IEE) which include (i) recommendation letters from line agencies; (ii) Nepal national standards; (iii) environmental audit report of existing facilities with CAP; (iv) report on due diligence of associated facilities; (v) alternative analysis summary; (vi) water resources capacity details; (vii) critical habitat assessment; (viii) COVID-19 guidelines; (ix) details on public and stakeholder consultations; (x) EMP mitigation and monitoring plans; (xi) template format of safeguards monitoring report; and (xii) forest land along right of way of new transmission lines.

II. POLICY, LEGAL AND ADMINSTRATIVE FRAMEWORK

16. The Project will be undertaken in accordance with ADB's Safeguard Policy Statement (2009) requirements, Government of Nepal environment, health and safety policies, laws, and regulatory requirements, including relevant international agreements, and NEA environment and social policies and procedures. Nepal has a well-defined institutional and legislative environmental, health and safety framework. The legislation covers all components of environment viz. air, water, soil, health and safety, terrestrial and aquatic flora and fauna, natural resources, and sensitive habitats. Nepal is also signatory to various international conventions and protocols. The environmental legislations in Nepal are framed to protect valued environmental components and comply with its commitment to the international community under conventions and protocols. This chapter analyses the applicability of laws and regulations, conventions, protocols, and ADB safeguards to the project. This section summaries the following:

- National (Nepal) Environmental, Health and Safety Framework;
- NEA's Environmental and Social Management Framework;
- ADB safeguard policy and categorization of the project; and
- International treaties and their applicability to the project.

A. National (Nepal) Environmental, Health and Safety Policy Framework

17. **Institutional Framework**: In Nepal, the 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. Other institutions and sector ministries coordinate with MoFE on environmental protection and biodiversity conservation while implementing their sectoral development activities.

18. The 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.

19. 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.

20. **Constitutional Provision and National Policy Framework**: Nepal's Constitution gives every citizen the right to live in a clean and healthy environment and it aspires towards the provision of the necessary balance between environment and development. In Article 30 of Part 3 of the Constitution of Nepal states the Right to Clean Environment, according to this article all citizens shall have the right to live in clean environment, and in case if there is injury caused from environmental pollution or degradation, the victim has the right to obtain compensation. In the same way, Article 51(g) explains policies relating to the Protection, Promotion and use of Natural Resources under the Policies of the State. The Constitution in Article 18 (3) 25 emphasizes on equality of the citizens and provisions for protection, empowerment of women, dalits and indigenous people. Likewise, Article 25 is related to Right to Property, Compensation to acquired property and socio-economic security to the economically as well as socially backward classes (this includes landless, bonded laborers, tillers and Harwaha/Charwaha).

21. The national policies relevant to the project are Nepal Environmental Policy and Action Plan (2050 and 2055), National Environment Policy (2076), National Biodiversity Strategy and Action Plan (2014-2020), National Forest Policy (2075), National Wetland Policy (2059), Land Use Policy (2072), National Land Policy (2075), National Policy on Land Acquisition, Compensation and Resettlement (2071), and National Climate Change Policy (2076). Summary of applicable policies along with relevance to the EGMP is presented in Table 4.

22. **Acts and Regulations:** The prevailing acts, regulations and guidelines which are related to construction and operation of the electricity transmission and distribution system, including grid expansion and improvement projects, in Nepal are broadly divided under various categories i.e. environmental protection, forests conservation, and wildlife protection, pollution control, and, health and safety. The umbrella legislations under each of above categories is as follows.

(a) Environmental protection, forests conservation, and wildlife protection

- **Environment Protection Act (EPA), 2053 (1997) Re-enacted in 2076 (2019):** Nepal has enacted a comprehensive and umbrella type act, the Environment Protection Act, 2053 (EPA) which is now enforced through appropriate regulatory measures. The EPA provides a legal basis for the concerned authorities for regulation of EIA/IEE. Section 3 of the Act requires the proponent to conduct an EIA/IEE in relation to prescribed proposals. The Act uses the word proposal instead of projects which makes its scope much broader in relation to environmental studies. Proponents include any government, semi government or non-government agency or organization applying for the approval of a proposal and possessing the responsibility to work according to such a proposal or for implementing the proposal. According to the provision in Section 7 of the Act, the relevant agency is empowered to grant approval for the EIA/IEE report, only if it finds that no significant adverse effects will be caused to the environment by the implementation of the proposal. Implementation of any proposal without the approval of the relevant agency is prohibited by the Act. The Act prohibits the implementation of any proposal without receiving environmental clearance from the relevant government agency in the form of an approved EIA/IEE report. In case of an EIA, the approval will be given by the

Ministry of Forest and Environment (MoFE); whereas, in case of an IEE the approval can be given by the Ministry of Energy, Water Resources, and Irrigation (MoEWRI) or relevant government agency.
Sections 15 to 20 are related to pollution control, import, production and management of hazardous materials, establishment of laboratory, sample collection and certification on pollution control. Sections 21 to 22 relates to inspection and monitoring, and sections 23 to 28 relate to climate change.

Sections 29 and 30 relates to National Heritage and Environmental Protection Areas. It is mentioned that Government of Nepal in consultation with Provincial Government or concerned local level can declare an Environment Protection Area for such sites that have importance in terms of environment, natural heritage, areas of natural aesthetics, historical sites, cultural sites after publishing it in Nepal Rajpatra (official gazette of government). Using this power which at the time of declaration (Rajpatra published on June 30, 2014 under section 64 number 9 part 5) was under the Environment Protection Act 1997 Section 10 the Government of Nepal declared the Chure Conservation Area (occupying 12.78% of Nepal's land area) as an Environmental Protection Area, citing its fragile geology, seismic vulnerability, important watershed function, rich biodiversity providing a habitat for threatened wildlife species and acting as a biological corridor, but also providing livelihoods to 5 million people.

- **Environment Protection Rules, 2077 (2020)**: The Environment Protection Rules (EPR) were endorsed in 1997 and were made under the provisions of the Environment Protection Act. The EPR have been amended several times since then, being re-enacted in 2020. Rules 2 and 3 of the EPR require a project developer to carry out an IEE or EIA for the type and size of projects as listed in its Schedule 2 or 3, respectively. While activities listed under Schedule 1 are required to undergo Summary Environmental Study. Transmission line projects of capacity above 132kV and outdoor substations tapping from more than a 220kV transmission line require only an IEE. However, if transmission line traverses through/located at historical, cultural, archeological (areas with such significance), national parks, wildlife reserve, wetlands, conservation area, areas that are source of public drinking water, in such case an EIA is triggered. Transmission line projects of capacity 66 kV going through forest area need Summary Environment Study. The EPR adopts the environmental assessment criteria mentioned in the EIA guidelines of the EPA. However, the EPR establishes the administrative framework for assessment, exhibition, and determination of the EIA/IEE, in terms of issues needed to be addressed and the format/layout of the EIA/IEE document.

  New transmission line components under the EGMP involve voltage level of 132 kV up to 220 kV, thus national EIA/IEE has to be carried out (based on the approved TOR) by the proponents for such components. NEA as project proponent will obtain approval from the relevant government agency prior to the implementation of these components. No other project components require EIA/IEE. Table 1 shows the list of proposed project components requiring national EIA/IEE, agency responsible for the approval of the same, and the current status.

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.

- **National EIA Guidelines, 2050 (1993):** The National EIA Guidelines, 1993 developed by the National Planning Commission in conjunction with IUCN, set out the process for the environmental review and management of infrastructure projects in all sectors and the respective roles of certain Government of Nepal agencies and project proponents. The guideline was part of a comprehensive program to develop the national and sectoral guidelines for establishing a national system for EIA, which was part of Government of Nepal's National Conservation Strategy. The schedules attached to the Guidelines include:
  - Schedule 1 Projects requiring IEE Report
  - Schedule 2 Projects requiring EIA
  - Schedule 3 EIA based on project sites
  - Schedule 4 Format for Terms of Reference
  - Schedule 4 EIA Report Format
  - Schedule 6 Format of EIA Report Annexes

It is mandatory to follow the National EIA Guidelines, 2050 (1993) during the EIA. Following the guidelines, the environmental impact prediction and evaluation of the proposed project has been done on physical, biological, and socio-economic and cultural environment of the project area. The guideline is used for analysis of significant issues.

Table 1: Assessment Requirement and Approving Agency under EPR of Nepal

Sl. No.	Project Component	Scope/Activities under Component	National EIA/IEE Required	Approving Agency	Current Status
1	Construction of Dandakhet - Rahughat 132 kV Transmission Line and associated substations	a. Construction of 25km long 132 kV overhead transmission line from Dandhakhet - Rahughat b. Construction of new 220/132 kV substation at Rahughat c. Construction of new 132/33 kV substation at Dandakhet	IEE	MoEWRI	National IEE prepared by NEA, approved by MoEWRI dated 3 October 2019 (Appendix 1a)
2	Construction of Ghorahi - Madichaur 132 kV Transmission	a. Construction of 40 km long 132 kV overhead transmission line	EIA[1]	MoFE	National EIA prepared by NEA and submitted for

[1] This transmission line requires an EIA as per national regulation because 7.4 km length of the line is located in Chure Conservation Area, a government notified protected area.

Sl. No.	Project Component	Scope/Activities under Component	National EIA/IEE Required	Approving Agency	Current Status
	Line and associated substation	from Ghorahi to Madichaur b. Construction of new 132/33 kV substation at Madichaur c. Extension of Ghorahi substation			approval by MoFE (expected by 30 September 2020)
3	Construction of Borang - Lapang - Ratmate (132/220kV) Transmission Line and associated substations	a. Construction of 25 km long 220 kV overhead transmission line from Ratmate to Lapang b. Construction of 23 km long 132 kV overhead transmission line from Lapang to Borang c. Construction of new 220/132/33 kV substation at Lapang d. Construction of new 132/33 kV substation at Borang	IEE	MoEWRI	National IEE prepared by NEA and submitted for approval to MoEWRI (expected by 15 August 2020)
4	Construction of 132/33/11 kV substation at Pangtang	a. Construction of new 132/33 kV substation at Pangtang and extension of Barhabise Substation	Not required.	Not required.	Not required for substation, but national IEE for associated facility of Balefi Corridor Transmission Line prepared by NEA with approval by MoFE, *vide* its letter dated September 9, 2019 (Appendix 4)

Sl. No.	Project Component	Scope/Activities under Component	National EIA/IEE Required	Approving Agency	Current Status
5	Construction of 132/33/11 kV substation at Keraun (Morang)	a. Construction of new 132/33 kV substation at Keraun. b. Construction of 30 km associated 33 kV distribution lines.	Not required.	Not required.	Not required.
6	Grid Substation Automation (Outside Kathmandu Valley)	a. Installation of substation automation system at around 34 nos. of 400/220/132/66/33/11 kV existing substations outside of the Kathmandu Valley	Not required.	Not required.	Not required.
7	Construction of Distribution Command and Control Centre	a. Construction of Distribution Command and Control Centre Building and associated infrastructure, hardware, and software	Not required.	Not required.	Not required.
8	Smart Metering in Kathmandu Valley (2nd Phase)	a. Installation of 350,000 smart meters and associated facilities in 9 distribution centers of NEA.	Not required.	Not required.	Not required.
9	132 kV/66 kV Transmission Line Conductor Upgradation	a. Upgrading conductor (DC) on 102km 132kV Pathlaiya-Dhalkebar transmission line b. Upgrading conductor (DC) on 28 km 132kV SC Duhabi-Kusaha transmission line c. Upgrading conductors (DC) on 14 km 66kV transmission lines inside Kathmandu valley	Not required.	Not required.	Not required.

- **Forest Act, 2049 (1992):** The Forest Act, 2049 recognizes the importance of conservation, management and utilization of wildlife, environment, watershed, and biodiversity for national prosperity. According to this Act, ownership of the national forest is vested to Government of Nepal and no national forest land is to be utilized for any settlement or resettlement. As per this Act, the MoFE in consultation with Provincial Government can declare some parts of national forest as forest conservation area when forest areas have environmental, ecological, cultural and scientific importance. It emphasizes the development and implementation of an approved work plan for different categories of forest, i.e. Community Forests, Leasehold Forests, Private Forests, Collaborative Forest and Religious Forests. The Act requires decision-makers to take account of all forest values, including environmental services and biodiversity. Article 68 gives authority to the government to allow the use of any part of the government-managed, community, leasehold, and religious forests if there are no alternatives for the implementation of national priority plans/projects.

- **Forest Rules, 2051 (1995):** Rule 7 prohibits cutting of forest without obtaining a license. Rule 65 of the Forest Rules stipulates that if the execution of any project having national priority in any forest area causes any loss or harm to any local individuals or community, the proponent of the project itself will bear the amount of compensation to be paid. Similarly, the entire expenses required for the cutting and transporting of forest products in a forest area should be borne by the proponent of the project.

  As some of the EGMP components (Table 2) are located in or passing through forest areas, Forest clearance will be sought through correspondence by NEA with MOFE for official permission prior to the implementation of these project components. Following this, in coordination with the Division Forest Offices (DFOs) and concerned Community Forest User Groups the selection, counting and marking of trees in the forest will be carried out. On completion, the timber volume is estimated. This will be followed by felling, transportation, and stockpiling of logs. Reforestation activities are carried out in coordination with concerned Division Forest Offices and any conservation non-governmental organizations (NGOs) working in the project area.

Table 2: Project Components Requiring Forest Clearance and DNPWC Permission Approval

Sl. No.	Project Component	Scope/Activities under Component	Forest Area (ha)	Protected Area	Clearance and Permissions Required	Current Status
1	Construction of Dandakhet - Rahughat 132 kV Transmission Line and associated Substations	a. Construction of 25km long 132 kV overhead transmission line from Dandhakhet - Rahughat	23.17	Nil	Forest clearance required from DFO/ MoFE	Not yet initiated.

Sl. No.	Project Component	Scope/Activities under Component	Forest Area (ha)	Protected Area	Clearance and Permissions Required	Current Status
		b. Construction of new 220/132 kV substation at Rahughat				
		c. Construction of new 132/33 kV substation at Dandakhet				
2	Construction of Ghorahi - Madichaur 132 kV Transmission Line and associated substation	a. Construction of 40 km long 132 kV overhead transmission line from Ghorahi to Madichaur	33.81	Chure Conservation Area	Forest clearance required from DFO/ MoFE Presidents Chure Terai Madesh Conservation Development Committee (CDC) Permission	Forest clearance not yet initiated. Recommendation letter received from CDC (Appendix 1b).
		b. Construction of new 132/33 kV substation at Madichaur				
		c. Extension of Ghorahi substation				
3	Construction of Borang - Lapang - Ratmate (132/220kV) Transmission Line and associated substations	a. Construction of 25 km long 220 kV overhead transmission line from Ratmate to Lapang	29.70	Nil	Forest clearance required from DFO/ MoFE	Not yet initiated.
		b. Construction of 23 km long 132 kV overhead transmission line from Lapang to Borang				
		c. Construction of new 220/132/33 kV substation at Lapang				
		d. Construction of new 132/33 kV substation at Borang				
4	Construction of 132/33/11 kV Substation at Pangtang	a. Construction of new 132/33 kV substation at Pangtang and	Nil	Nil	Not required.	Not required.

Sl. No.	Project Component	Scope/Activities under Component	Forest Area (ha)	Protected Area	Clearance and Permissions Required	Current Status
		extension of Barhabise Substation				
5	Construction of 132/33/11 kV substation at Keraun (Morang)	a. Construction of new 132/33 kV substation at Keraun.	Nil	Nil	Not required.	Not required.
		b. Construction of 30 km associated 33 kV distribution lines.	Not anticipated[2]	Nil		
6	Grid Substation Automation (Outside Kathmandu Valley)	a. Installation of substation automation system at around 34 nos. of 400/220/132/66/33/11 kV existing substations outside of the Kathmandu Valley	Nil	12 existing substations are within the boundary of protected areas or their buffer zones, or important biodiversity areas [3]	Not required.	Not required.
7	Construction of Distribution Command and Control Centre	a. Construction of Distribution Command and Control Centre Building and associated infrastructure, hardware, and software	Nil	Nil	Not required.	Not required.
8	Smart Metering in Kathmandu Valley (2nd Phase)	a. Installation of 350,000 smart meters and associated facilities in 9 distribution centers of NEA.	Nil	Nil	Not required.	Not required.
9	132 kV/66 kV Transmission	a. Upgrading conductor (DC)	Part of the line is in	Parsa National Park	Local level agreement	Not yet initiated.

[2] Detailed route survey is still to be undertaken but it is anticipated forest areas will be avoided

[3] Since all works will be carried out within the boundaries of the existing substations clearance/permission is not required.

Sl. No.	Project Component	Scope/Activities under Component	Forest Area (ha)	Protected Area	Clearance and Permissions Required	Current Status
	Line Conductor Upgradation	on 102km 132kV Pathlaiya-Dhalkebar transmission line	forest area. However, works will be carried out within existing ROW already maintained by NEA.	Chure Conservation Area	required for brush cutting in existing RoW with no compensatory reforestation legally mandated. DNPWC Permission. Presidents Chure Terai Madesh Conservation Development Committee (CDC) Permission	
		b. Upgrading conductor (DC) on 28 km 132kV SC Duhabi-Kusaha transmission line	Nil	Koshi Tappu Wildlife Reserve Buffer Zone	DNPWC Permission.	Not yet initiated
		c. Upgrading conductors (DC) on 14 km 66kV transmission lines inside Kathmandu valley	Part of the line is in religious forest area. However, works will be carried out within existing ROW already maintained by NEA.	Kathmandu Valley World Heritage Site	Local level agreement required for brush cutting in existing RoW with no compensatory reforestation legally mandated. Department of Archaeology permission.	Not yet initiated

- **National Parks and Wildlife Conservation Act, 2029 (1973) Amended 2073 (2016):** The National Parks and Wildlife Conservation Act, 2029 is enacted to make arrangements for the management of national parks, conservation of

wildlife and their habitat and regulation of hunting. It also conserves, promotes, develops, and makes appropriate arrangements for the use of places which are of special importance from the point of view of natural beauty and to maintain good manners and welfare of the general public. Government of Nepal declares an area as a national park or wildlife reserve or conservation area by publishing a notice in the Nepal Gazette and by indicating its boundary. According to this Act, these areas are to be managed according to an integrated plan for the conservation of their natural environment and balanced utilization of the natural resources.

Government of Nepal can also abandon or transfer the ownership or alter the boundaries of an area by publishing a notification in the Nepal Gazette. Within the national park, wildlife reserve or conservation area, Government of Nepal makes arrangements for operating hotels, lodges, public transport services or other similar services or facilities by itself or through other parties by entering into a contract. Government of Nepal entrusts the management of any national park, wildlife reserve or conservation area to any institution established with the objective of conserving nature and natural resources for a particular period by notifying in the Nepal Gazette. As per Article 5 certain activities are restricted (Hunting, Construction Work, Clearance, Cultivation, Settlement, Livestock/Poultry Herding, Clearance of Vegetation, Mining, Removal of Construction Materials, Property Damage, Carrying Ammunition and blocking river/streams) without written permission. According to Article 7 damage to forest product, blockage or diversion of river/stream flowing through a national park, wildlife reserve or conservation area or any other source of water, as well as use of explosive materials with no written permission are prohibited.

According to Article 10, 26 mammal species, 9 bird species and 3 reptile species[4] of Nepal have been enlisted into the protected categories. Similarly, Article 13 prohibits collection of samples from national parks and reserve forests without prior obtention of license.

- **National Parks and Wildlife Conservation Rules, 2030 (1974):** To implement Section 33 of the National Parks and Wildlife Conservation Act, 2029 (1973), the National Parks and Wildlife Conservation Rules, 2030 (1974) were prepared. Chapter 2, Section 3 of this rule focused on publishing a notice at least 35 days prior to submitting a tender in the major newspapers for the operation of any service from any bodies of the Government of Nepal inside national parks and reserves. To operate any services or facilities related to construction work within

[4] **Mammals:** Assamese Monkey - *Macaca assamensis*, Pangolin - *Manis crasscaudata* and *Manis pentadactyla*, Hispid Hare - *Caprolagus hispidus*, Gangetica Dolphin - *Platanista gangetica,* Grey Wolf - *Canis lupus,* Himalayan Brown Beer - *Ursus arctos*, Red Panda - *Ailurus fulgens,* Lingsang - *Prionodon pardicolor*, Striped Hyena - *hyaena hyaena*, Leopard Cat - *Felis (Prionailurus) bengalensis*, Lynx - *Lynx lynx*, Clouded Leopard - *Neofelis nebulosa,* Tiger - *Panthera tigris tigris*, Snow Leopard -*Uncia uncia,* Asian Elephant - *Elephas maximus,* One-horned rhinoceros - *Rhinoceros unicornis*, Pygmy Hog - *Sus salvanius*, Musk Deer - *Moschus chrysogaster,* Swamp Deer - *Cervus duvaucelii,* Gaur - *Bos gaurus*, Wild Yak - *Bos grunniens (mutus),* Wild Buffalo - *Bubalus arnee,* Great Tibetan Sheep - *Ammon hodgsonil,* Tibetan Antelope - *Pantholops hodgsoni,* Black buck - *Antilope cervicapra,* Four-horned Antelope - *Tetracerus quadricornis*. **Birds:** Black Stork - *Ciconia nigra,* White Stork - *Ciconia Ciconia*, Sarus Crane - *Grus Antigone*, Cheer Pheasant - *Catreus wallichii*, Impeyon pheasant - *Lophophorus impejanus*, Crimson-horned Pheasant - *Tragopan satyra,* Bengal Florican - *Houbaropsis bengalensis*, Lesser Florican - *Eupodotis indica*, Giant Hornbill - *Buceros bicomis*. **Reptiles:** Python - *Python molurus*, Gharial Crocodile - *Gavialis gangeticus*, Golden Monitor Lizard - *Varanus flavescens.*

a national park, wildlife reserve or conservation area, the person or entity shall seek prior approval from the Government of Nepal. Except for Government employees deputed for the duty, no other person shall be allowed to enter into the protected area without receiving the written permission from the chief. The permission shall be provided only for scientific research.

Since the 132 kV Ghorahi-Madichaur DC transmission line of the EGMP passes through the Chure Conservation Area (in Dang District) approval from the Presidents Chure Terai Madesh Conservation Development Committee (CDC) of Nepal is required for implementation of this transmission line. Note: the Department of National Parks and Wildlife Conservation is a partner organization to this Committee. NEA has received recommendation letter from the CDC for Ghorahi-Madichaur Line (Appendix 1b).

Reconductoring work will be carried out on two transmission lines under the Project, namely the 132kV Pathlaiya- Dhalkebar transmission line (which partially falls within the perimeter of the newly extended Parsa National Park and within Chure Conservation Area) and the 132kV SC Duhabi-Kusaha transmission line (which includes work within buffer zone of Koshi Tappu Wildlife Reserve). To execute work under these areas prior permission will be required from the Department of National Parks and Wildlife Conservation. Since work will be carried out on existing towers, no national EIA/IEE is required.

- **Wildlife Reserve Rules, 2049 (1977):** Rule 4 makes the provision for the need to obtain an “entry permission” to enter into any Wildlife Reserve. Rule 6 stipulates activities prohibited within the reserve without a written permission (these include construction works, vegetation clearance, fire, damage, spending night/construction of camps and removal of construction materials). Rule 14 prohibits throwing wastes and Rule 15 prohibits the disposal of hazardous wastes in the Wildlife Reserve. Rule 16 stipulates the rules for driving inside the Wildlife Reserve.

- **Buffer Zone Rules, 2052 (1996):** Rules described demarcation and management of buffer zones within forest areas and protected area buffer zones.

- **Working Policy for Construction and Operation of Physical Infrastructure within Protected Area, 2065 (2009):** This policy describes the terms and conditions required for implementing projects inside the National Park, Wildlife Reserves and Conservation Areas. This policy states that no land will be made available for construction of any development work except of national priority within the protected area. It further states that for a hydropower project utilizing the water flowing inside the National Park or along the boundary of the National Park, all the hydropower components should be constructed outside the National Park, and a minimum of 10% of the monthly discharge as well as the discharge quantified by the EIA report should be released. Implementation of mitigation measures, allocation of royalty for the protection of the National Park, payment for the use of natural resources and monitoring are some of the conditions mentioned in this policy. Similarly, for any water diversion project within the National Park or Wildlife Reserves, a minimum of 50% of the monthly discharge should be released. This policy has made the provision of

compensatory plantation of 25 seedlings for every tree or pole loss from the protected areas.

- **Kathmandu Valley Development Authority (KVDA) Act 2045 (1988):** It is considered as sole government authority, directly under the central government, to undertake and execute Integrated Development of Kathmandu Valley. Constitution of Nepal 2015, has made various provisions and guidelines, which unequivocally authorize KVDA, as an apex planning body for KVDA, to execute Sustainable Development Master Plan (SDMP 2015-35) programs avoiding any legal contentions. The components in Kathmandu Valley will be implemented in accordance with this Act.

- **Ancient Monument Preservation Act, 2013 (1956):** It was enacted to integrate the conservation and protection of ancient monuments and archeological properties. The act mentions any ancient monuments and artistic objects of hundred years old shall be regarded archeologically important objects and Department of Archeology (DOA) shall preserve such objects. The components in Kathmandu Valley will be implemented in componence with this Act.

  About 150m length of the Suichatar-Balaju 66kV line in Kathmandu Valley proposed for reconductoring under the project, passes through the current boundary of the UNESCO World Heritage Site of Kathmandu Valley named Swayambhunath. To execute work under this area prior permission will be required from the Department of Archeology.

- **Forest Production, Collection and Sales Distribution Guidelines, 2057**: The Clauses 3 to 10 of the Guidelines have specified various procedure and formats for getting approval for vegetation clearance, delineation of lands for vegetation clearance, evaluation of wood volume etc. and government offices and officials responsible for the approval, delineation and evaluation. These provisions have a direct relevance to the development of the project and need compliance to these provisions. These provisions have a direct relevance to the development of the project and need compliance to these provisions. It is obligation to the project for getting approval in view of vegetation clearance and evaluation of wood volume from division forest office prior to the construction phase.

(b) Pollution control

- **Solid Waste Management Act, 2068 (2011):** Article 4 lays the responsibility of the solid waste management on the persons or institution that has generated the waste whereas Article 5 mandates reduction of the waste at source. Article 9 makes the institution responsible for transporting the solid waste to the waste disposal facility. The local body (municipality, sub-municipality, city and Village Development Committee) is made responsible for the monitoring of solid waste management as per Article 21. Article 38 stipulates that the discharge of solid waste without the consent of the local body is an offence under this legislation and Article 39 details the provisions for punishment/penalty in case of offense.

- **Solid Waste Management Rules 2070 (2013):** Rule 5 elaborates on the disposal and management of harmful and chemical waste. According to sub-rule 1 and 2, disposal by mixing of such waste with other waste is prohibited as

such waste requires prior processing. Sub-rule 3 instructs that a permit is required by the individual, agency or organization from the local body for managing such waste. Sub-rule 5 states that the local body will follow-up with the permitted entity as to the appropriate standards and technology for processing. Sub-rule 7 directs that harmful and chemical waste collection, transportation and storage must be done in a safe manner. Sub-rule 8 states that disposal of such harmful waste can be done only after the harmful elements have been normalized. Sub-rule 9 makes it mandatory for agencies producing harmful waste to abide by prevailing Government of Nepal environmental laws.

- **Policies in Nepal for Harmful Chemicals and Toxic Wastes**: Laws governing chemical substances that can cause harm include Biocidal Poison Act 1991, Biocidal Poison Management Act 2019, Biocidal Poison Rule 1993 (these are related to the regulation of Biocidal Poisons production, synthesis, export, import, storage, sales, distribution and disposal to ensure control of adverse effects to health – both human and animal – and environment). Likewise, the Environment Protection Act and Rules regulate hazardous waste and set thresholds triggering the requirement for an EIA/IEE for waste management activities. Other acts that regulate effects of hazardous chemicals include the Consumer Protection Act 2018 (it sets out provisions relating to consumer protection, including a right to obtain quality goods and services and seek compensation against harm and injury caused from the use of goods and services). Another relevant act is the Industrial Enterprises Act 2016 whose clause 5 makes it mandatory that any EIA/IEE required by law must be carried out prior to the establishment of an industrial enterprise. Clause 6 stipulates corrective actions to be taken for industries causing adverse impact to the environment. Clause 7 makes it mandatory to seek permissions for the establishment, expansion and diversification of industries related to Foreign Investment Companies and companies related to Explosives, Arms and Ammunitions and Substances requiring permission by law. Clause 41 is related to punitive actions if the act is not followed. Other relevant acts include the Pesticide Act 1991 and the Pesticide Rules 1994.

  Polychlorinated biphenyl (PCB), a persistent organic pollutant (POP), is a compound that was commonly used in transformer oil, capacitor, circuit breaker, industrial equipment, hydraulic fluid, voltage regulator, vacuum pump, turbine, paint, lubricating oil, fire controlling material etc. until it was phased out internationally in the 1980s. This compound was banned for its excessively harmful effects to human health and the environment and categorized as a POP by the Stockholm Convention, of which Nepal became a signatory on 5 April 2002 and a party to since 2007. The Stockholm Convention demands the phase out of PCB-containing equipment from its signatory nations by 2025. Nepal banned its import since 1990 (The Treaty Act 1990 of Nepal mentions that the provision of convention to which Nepal is a party are as good as domestic law and case there is any contradiction with the domestic law, the provision of the convention will prevail).

- **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 m^2 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.

(c) Health and Safety

- **Electricity Act, 2049 (1992):** The Electricity Act, 2049 is related to the survey, generation, transmission, and distribution of electricity. Electricity is hereby defined as electric power generated from water, mineral oil, coal, gas, solar energy, wind energy, etc. Under Section 3 of the Act, it is stated that the survey, generation, transmission, or distribution of electricity without prior obtention of a license is prohibited. The Electricity Act, 2049 also contains provisions to minimize soil erosion, flood, air pollution and damage on the environment during activities of electricity production and power transmission (Article 24). NEA is responsible for electricity generation, transmission, and distribution. Article 39 describes the rights to appeal of affected people to the concerned Appellate Court against the decision of a concerned authority.

- **Electricity Rules, 2050 (1993):** Rules on electricity sectors have been formulated for the implementation of the provisions made in the Electricity Act, 2049. The Electricity Rules, 2050 emphasize environmental analysis, which should include environmental mitigation measures to minimize adverse impacts likely to occur while developing hydroelectricity (Rule 12 and 13).

  Rule 12 (f) and Rule (g) are related to the EIA/IEE process which emphasize that the EIA report should include measures to be taken to minimize the adverse effects of a project on social, biological and physical environment and should also elaborate on the utilization of local labor, source of materials, benefits to the local people after the completion of the project, training to local people in relation to construction, maintenance and operation, facilities required for construction site and safety arrangements.

  Rule 50 and Schedule-13 of the Rule, 2050 defines the minimum distance to be maintained on either side of the electric wire, which in fact defines the RoW for transmission and distribution lines and associated safety clearance corridors (Table 3). Rule 66 is regarding restrictions on the utilization of buildings and land under power lines (transmission as well as distribution lines). Rule 68 to 74 are related to safety measures relating to electrical works. Rule 87 is related to compensation for the affected property and Rule 88 is related to the compensation fixation committee.

Table 3: Right of Way (ROW) and Safety Clearances as per Electricity Rules

Parameter	33 kV line	66 kV Line	132 kV Line	220 kV Line
Right of Way (ROW)	7m (3.5m either side)	12m (6m either side)	18m (9m either side)	30m (15 m either side)
Ground Clearances	Minimum 6.1m at the maximum sag condition. • Road - 7m • Power cable with voltage - 3.5m • Communication line crossing - 3.5m • Residential area - 7m • Power line above/ below - 3.5m • Phase to phase - 3.75 m			
Horizontal Clearance	Minimum distance from a tree or a house. • For 230/400 to 11,000 V - 1.25 m • For 11,000 to 33,000 V - 2 m • For >more than 33,000 V - add 0.305m for each 33,000 V on the above distance			

Source: Nepal Electricity Rules, 2050.

23. **Labor Act, 2049 (1993):** The Act clearly mentions that the appointment letter should be issued for all the employees which include their working hours, working time, wages, and other benefits. The Act allows for the time bond contract for the manpower required for development work. The Act specifies that working hours for the Anabolic and women must be within 6 AM to 6 PM which clearly restrict to deploy women in night works. The Act also state that equal opportunity shall be given to women as men. Similarly Working Hours continue to be 8 hours a day and 48 hours a week, overtime has been increased to 24 hours per week from 20 hours a week. New Labor Act provides that the minimum remuneration of workers, public and weekly holidays should be as prescribed. The employer can deduct the expenses incurred in providing food and lodging from remuneration if such is provided. Domestic workers should be allowed to celebrate festivals as per their culture, religion, tradition.

24. Other national relevant regulations and guidelines include Irrigation Rules, 2056 (1999/2000); National Health Care and Waste Management Guidelines, 2002; and Infectious Disease Act 1964 are presented in Table 4.

25. The Government of Nepal also prescribed standards such as National Ambient Air Quality Standards 2012, National Standards for Sound Pressure Levels, 2012, Emission Standards for Diesel Generators, 2012, Drinking Water Quality Standards, 2006, Nepal Vehicle Mass Emission Standards, 2012, Vehicle Emission Standards, 2012 for in use vehicles, Generic Standard I: Tolerance Limits for Industrial Effluents to be discharged into Inland Surface Waters, 2001. The relevance of these standards are presented in Table 4.

26. Table 4 below presents the summary of the above national regulatory framework as well as other relevant acts/regulations and their applicability to the proposed EGMP project.

Table 4: Summary of Relevant National Policies and Regulatory Framework

Policies, Acts, Regulations and Guidelines	Applicable to EGMP	Relevance
A. Policies		
Nepal Environmental Policy and Action Plan (NEPAP), 2050 (1993) and 2055 (1998)	All project components and particularly component no. 2	Emphasis on environment conservation, incorporation into development projects.
National Wetlands Policy of Nepal 2059 and 2069 (2003 and 2012)	Component 9(b)	Duhabi – Kusaha Line is partially in buffer zone of Koshi Tappu Wildlife Reserve (KTWR) which is also designated Ramsar wetland.
National Environmental Impact Assessment Guidelines, 2050 (1993)	Components 1, 2, and 3	New lines of 132 kV capacity need IEE. Ghorahi-Madichaur line traverses / located in Chure Conservation Area so requires EIA.
Working Policy for Construction and Operation of Physical Infrastructure within Protected Area, 2065 (2009)	Components 2, 6, Components 9(a) and 9(b)	In relation to Chure Conservation Area, KTWR, and, Parsa National Park and existing substations in boundary of protected areas or their buffer zones.
National Environment Policy (2076)	All project components and particularly component no. 2	Emphasis on environment conservation, incorporation into development projects.
National Biodiversity Strategy and Action Plan (2014-2020)	All project components and particularly components 1, 2, 3, 9(a) and 9(b)	Emphasis on biodiversity conservation, incorporation into development projects.
National Forest Policy (2075)	Components 1, 2, 3, 9(a) and 9(c)	Project components traversing Forest Areas.
Land Use Policy (2072)	All project components	Project components require land acquisition and change in land use.
National Land Policy (2075)	All project components	Project components require land acquisition and change in land use.
National Policy on Land Acquisition, Compensation and Resettlement (2071)	All project components	Project components require land acquisition and change in land use.
National Climate Change Policy (2076)	All project components	Project components vulnerable to climate risks.
B. Statutes and Legislation		
National Park and Wildlife Conservation Act, 2029 (1973)	All project components and particularly	Observation of protected species listed in Act particularly in forest

Policies, Acts, Regulations and Guidelines	Applicable to EGMP	Relevance
Amended 2073 (2016), Government of Nepal	components 1, 2, 3, 9(a) and 9(b)	traversed by three new transmission lines. Component 2 passes through Chure Conservation Area. Components 9a and 9b pass through Buffer Zone of KTWR, Parsa National Park and Chure Conservation Area.
National Park and Wildlife Conservation Rule, 2030 (1974),	All project components and particularly components 1, 2, 3, 9(a) and 9(b)	Observation of protected species listed in Act particularly in forest traversed by three new transmission lines. Component 2 passes through Chure Conservation Area. Components 9a and 9b pass through Buffer Zone of KTWR, Parsa National Park and Chure Conservation Area.
Wildlife Reserve Rules, 2049 (1977)	Component 1, 2, 3, 6, 9(a) and 9(b)	Components in forests and protected areas.
National Implementation Plan (NIP) for Stockholm Convention on Persistent Organic Pollutants in Nepal 2017	All project components	NIP mentions the dechlorination of industrial chemical (PCBs), Nepal has no stock of intentionally produced POPs chemicals.
Buffer Zone Management Rules, 2052 (1996)	Components 6 and 9(b)	Component 9(b) in KTWR Buffer Zone and existing substations located in buffer zone of protected areas.
Kathmandu Valley Development Authority Act 2045 (1988)	Components 7 and 9(c)	Project components are inside Kathmandu Valley and works will be carried out in public places.
Environment Protection Act (EPA), 2053 (1997) Re-enacted in 2076 (2019) and Environment Protection Rules, 2077 (2020)	All project components	All development projects require to be screened in relation to this Act and Rules as even upgrade work causes wastes. Management of wastes, type and quantity of waste generated becomes relevant.
Forest Act, 2049 (1992) and Forest Rules, 2051 (1995)	Components 1, 2, 3, 9(a) and 9(c)	Project components traverse Forest Areas
Ancient Monument Preservation Act, 2013 (1956)	Components 7 and 9(c)	Project components are inside Kathmandu Valley and works will be carried out in public places. Kathmandu Valley has numerous

Policies, Acts, Regulations and Guidelines	Applicable to EGMP	Relevance
		historically important temples, stupas, underground water channels, traditional waterspouts spread throughout the urban area. Suichatar-Balaju 66kV line in Kathmandu Valley passes through the boundary of the UNESCO Kathmandu Valley World Heritage Site: Swayambhunath.
Irrigation Rules, 2056 (1999/2000)	Component 2, 5, and 9(b).	Of concern where transmission lines cross irrigation canals or channels
Electricity Act, 2049 (1992) and Electricity Rules, 2050 (1993)	All project components	Standards, security, and safety related measures for electrical works are elaborated
Labor Act, 2049 (1993)	All Project Components	Elaborates on occupational health and safety for workers, welfare, conduct, penalties, and dispute settlements
Solid Waste Management Act (SWMA) 2068 (2011) and Solid Waste Management Rules 2070 (2013)	All project components	Construction sites and construction camps generate wastes, replacement of old equipment for upgradation work also generates electrical wastes.
Biocidal Poison Act 1991, Biocidal Poison Management Act 2019, Biocidal Poison Rule 1993	All project components	Project components involving chemical substances including PCBs.
Forest Produces Collection, Sale and Distribution Guidelines 2000	Components 1, 2, 3 and 9a.	Requires clearing of vegetation in forest land.
Nepal Vehicle Mass Emission Standards, 2012	All project components	Petrol and diesel vehicles used for the project to comply with national standards while importing. (Appendix 2)
Vehicle Emission Standards, 2012 for in use vehicles	All project components	Specifies tolerance limits for project vehicular emissions. (Appendix 2)
Generic Standard I: Tolerance Limits for Industrial Effluents to be discharged into Inland Surface Waters, 2001	All project components except component 8.	Project facilities and construction camps discharge of effluent
National Health Care and Waste Management Guidelines, 2002	All project components	Waste generated during construction and from substations

Policies, Acts, Regulations and Guidelines	Applicable to EGMP	Relevance
National Ambient Air Quality Standards 2012	All project components	Limits of the ambient air quality parameters (Appendix 2)
National Standards for Sound Pressure Levels, 2012	All project components	Limits of the sound pressure level Leq (dBA) for different areas (Appendix 2)
Emission Standards for Diesel Generators, 2012	All components except component 8.	Construction work requiring usage of generator. Emission standards for the Generators to be followed (Appendix 2)
Drinking Water Quality Standards, 2006	All components except component 8.	Construction camps and substations to follow drinking water standards (Appendix 2)
Infectious Disease Act 1964	All project components	Health and safety measures for workers and community with labor involved from outside project area.

B. NEA's Environmental and Social Management Framework

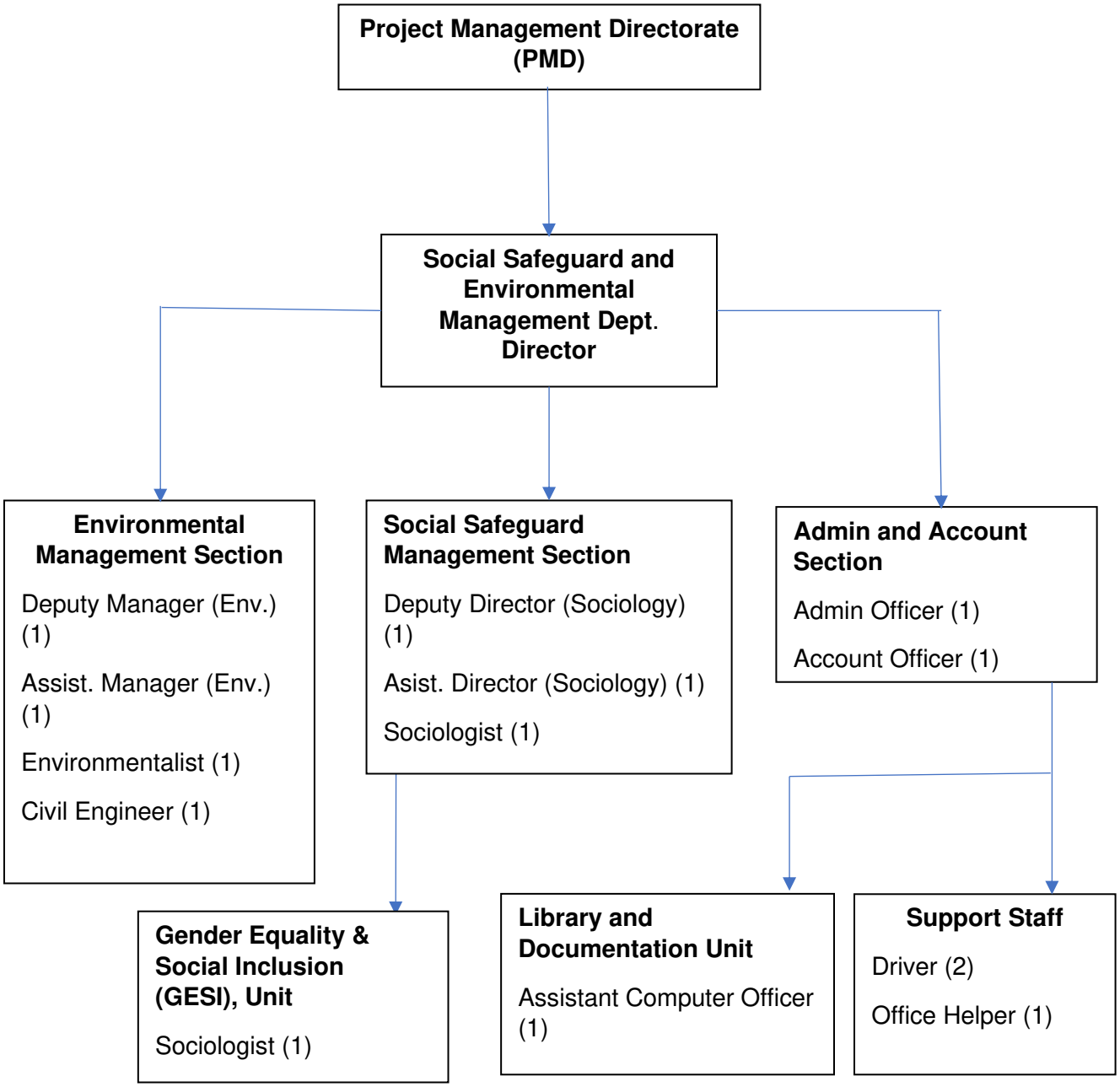
27. Currently, NEA has no internal environmental and social management system, guidelines, or standards for managing environmental and social impacts of its projects. In case of projects funded by international financial institutions (IFIs), NEA primarily applies the relevant standards of the institutions to guide its approach to managing project safeguards risks. This approach varies from project-to-project based on the requirements of the lending agencies. The NEA projects funded through domestic resources primarily rely on the country's laws. In the absence of standard procedures, NEA's social and environmental impact management practices across the organizational structure tend to be inconsistent and differ from one project to another.

28. Current capacity of PMD who are dedicated to managing ADB projects of NEA is insufficient to deal with the environmental and social risks associated with NEA operations. PMD therefore needs to enhance its institutional arrangement and capacity for environmental and social risks management.

29. PMD normally sign an MOU with the environment and social studies department (ESSD) of NEA to implement field level environmental and social safeguard monitoring and community development programs. PMD has also informally established a Social Safeguard and Environmental Management Department (SSEMD) (Figure 1) headed by director level with a few safeguards staff to support PMD in safeguard compliance and periodic reporting to ADB. However, this is an ad hoc unit and not yet formalized. PMD plans to establish a formal safeguards unit under its organogram.

Figure 1: Structure of Informal PMD

Social Safeguards and Environmental Management Department (SSEMD)



C. ADB's Safeguard Policy Statement (2009) Requirements

30. Specific to environmental aspects, the objective of the ADB's Safeguard Policy Statement (2009) is to "ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process."

31. ADB's Safeguard Policy Statement (2009) defines the requirements to be followed with regards to project screening and classification, information disclosure, consultation and participation, due diligence, monitoring and reporting, local grievance redress mechanisms, and ADB's Accountability Mechanism.

32. **Project screening and classification**. ADB's Safeguard Policy Statement (2009) requires screening as early as possible to (i) determine the significance of adverse impacts; and (ii) identify the level of assessment and institutional resources required; and (iii) determine disclosure requirements. A project's category is determined by its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Projects are then assigned to one of the following three categories:

- **Category A**. A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.

- **Category B**. A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.

- **Category C**. A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.

33. **Category of the project**: The project has been evaluated considering the outcome of the environmental assessment. The magnitude of potential impacts and the presence of environmentally sensitive areas in the project influence areas of all project components have been critically analyzed (iBAT tool used to screen and critical habitat analysis) to determine likely significance. Potential environmental impacts of project components are not diverse, mainly relating to construction, and are all site-specific being confined to the ROW in which the lines will be installed and substation sites. The potential environmental impacts are all well understood and can be mitigated through adherence to national requirements and international measures and standards as set out in the IFC General and Electric Power Transmission and Distribution Environment, Health and Safety Guidelines. Considering this under ADB's Safeguard Policy Statement (2009), the project is classified as category B on environment requiring the preparation of an IEE. Accordingly, this IEE has been prepared covering all components of the project.

34. **Information disclosure**. ADB's Safeguard Policy Statement (2009) requires information about environmental safeguard issues to be made available in a timely manner, in an accessible place, and in a form and language(s) understandable to affected people and to other stakeholders, including the general public, so they can provide meaningful inputs into project design and implementation. For illiterate people, suitable communication methods will be used. During project implementation NEA will need to submit the following for posting on ADB's website: (i) final and updated IEE and corrective action plans upon receipt by ADB; and (ii) environment monitoring reports submitted by NEA during project implementation upon receipt by ADB.

35. **Consultation and participation**. ADB's Safeguard Policy Statement (2009) requires communities, groups, or people affected by proposed projects, and civil society to be engaged by NEA through information disclosure, consultation, and informed participation in a manner commensurate with the risks to and impacts on affected communities. Meaningful consultation processes are defined as those that, (i) beginning early in the project preparation stage and being carried out on an ongoing basis throughout the project cycle; (ii) providing timely disclosure of relevant and adequate information that is accessible to affected people; (iii) being free of intimidation and coercion; (iv) being gender inclusive and responsive; and (v) enabling the incorporation of all relevant views of affected people and other stakeholders in decision-making. The consultation process and its results are to be documented and reflected in the IEE report.

36. **Monitoring and reporting**. ADB's Safeguard Policy Statement (2009) requires that NEA implement the safeguard measures and relevant safeguard plans, as provided in the legal agreements, and submit periodic monitoring reports on their implementation performance. Given the Project is category B for environment, NEA is required to (i) establish and maintain procedures to monitor the progress of implementation of safeguard plans; (ii) verify the compliance with safeguard measures and their progress toward intended outcomes; (iii) document and disclose monitoring results and identify necessary corrective and preventive actions in the periodic monitoring reports; (iv) follow up on these actions to ensure progress toward the desired outcomes; and (v) submit periodic monitoring reports on safeguard measures as agreed with ADB, in this case given environmental sensitivities semi-annual safeguards monitoring reports are required to be submitted up until the completion of construction and throughout the operation period until project closure. In addition to recording information to track environmental performance, NEA will need to undertake inspections to verify compliance with the EMP and progress toward the expected outcomes. Environmental monitoring reports should describe progress with implementation of the EMP and compliance issues and corrective actions, if any, and the findings disclosed locally in a location accessible to the public. ADB will also monitor projects on an ongoing basis until a project completion report is issued.

37. **Local grievance redress mechanisms (GRM) and ADB's Accountability Mechanism**. ADB's Safeguard Policy Statement (2009) requires that NEA set up and maintain a GRM to receive and facilitate resolution of affected peoples' concerns and grievances about their environmental performance at project level. It should address affected people's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people. Affected people can also take complaints to ADB's Accountability Mechanism although they should approach the local GRM in the first instance; but the GRM should not impede access to the country's judicial or administrative remedies.

D. Other Applied Standards

38. The project will follow national (Nepal) as well as international good practices related to environment, health and safety including those set out in the IFC EHS General Guidelines 30 (30 April 2007). The IFC EHS Guidelines for Electric Power Transmission and Distribution (30 April 2007) also need to be considered while designing the power transmission lines and substations components and undertaking the environmental assessment. 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. As a project proponent, NEA shall follow the IFC EHS Guidelines for this project and shall also ensure that all appointed contractors and their subcontractors follow these guidelines.

E. International and Regional Treaties, Agreements and Conventions

39. Nepal is a party and signatory to several international and regional environmental treaties, agreements, and conventions, to which the Ministry of Forests and Environment is the national focal point. A screening was carried out of these treaties regarding their applicability to this project. Key international/regional conventions and declarations agreements that Nepal is signatory to and relevant for the project are provided below:

- Convention Relative to the Preservation of Fauna and Flora in the Natural State (1933) – three news lines under project requires clearing of vegetation from forests.
- International Plant Protection Convention (1951) – no direct relevance.
- Convention on Wetlands of International Importance, Especially as Waterfowl Habitat (Ramsar, 1971) – one of the project components is immediately adjacent a Ramsar designated site.
- Convention concerning the Protection of World Cultural and Natural Heritage (Paris, 1972) – ensure potential impacts on world cultural and natural heritage designated sites avoided. One of the components in Kathmandu Valley is passes through the boundary of the UNESCO Kathmandu Valley World Heritage Site.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington, 1973) – no direct relevance, but seek to avoid poaching by construction workers especially in environmentally sensitive areas
- Convention on Migratory Species of Wild Animals (Bonn, 1979) – ensure potential impacts on any migratory species supported by the project area of influence assessed and managed
- Convention on the Prior Informed (Consent) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (PIC or Rotterdam, 1990) – management of PCBs from project components.
- United Nations Framework Convention on Climate Change (Rio De Janeiro, 1992) – GHG emissions from project components particularly from GIS substations.
- Convention on Biological Diversity (Rio De Janeiro, 1992) – project components are in protected areas.
- Protocol to the United Nations Framework Convention on Climate Change (Kyoto, 1997) - 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 gas insulated switchgear.

- Stockholm Convention of Persistent Organic Pollutants (POPs) (1972) - ensures the environmentally sound management and the disposal of POPs including PCBs. Nepal has started using PCB-free equipment, but not yet legislated.
- Basel Convention - this convention came into force on 5 May 1992 and 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.
- International Labour Organization (ILO) conventions and protocol ratified by Nepal (Nepal has ratified 11 ILO conventions and 2 optional ILO protocols) relate to the core labor standards.
- ILO Asbestos Convention, 1986 (Convention No. C 162) – yet to be ratified by Nepal but will be applied to project as measure to avoid use of asbestos in substations. This convention applies to all activities involving exposure of workers to asbestos in the course of work.

40. The interventions proposed under the project shall be implemented in compliance with applicable international and regional conventions and declarations (particularly those related to World Heritage Sites, Ramsar sites, PCBs and SF6 as listed above) to which Nepal is a party.

III. DESCRIPTION OF THE PROJECT

A. Project Components and Locations

41. **Project Components:** As introduced in section I, the project will strengthen and modernize electricity transmission and distribution system of Nepal by (i) the construction and installation of new transmission and distribution; (ii) of new substations; (iii) augmentation of capacity of existing substations; (iv) upgrading/reconductoring of existing transmission lines; (vi) automation of existing substations; (vii) construction of distribution control center in Kathmandu; (viii) installation of smart meters; and (ix) capacity building of NEA staff. Table 5 presents each project component in further details.

TABLE 5: DETAILS OF PROJECT COMPONENTS

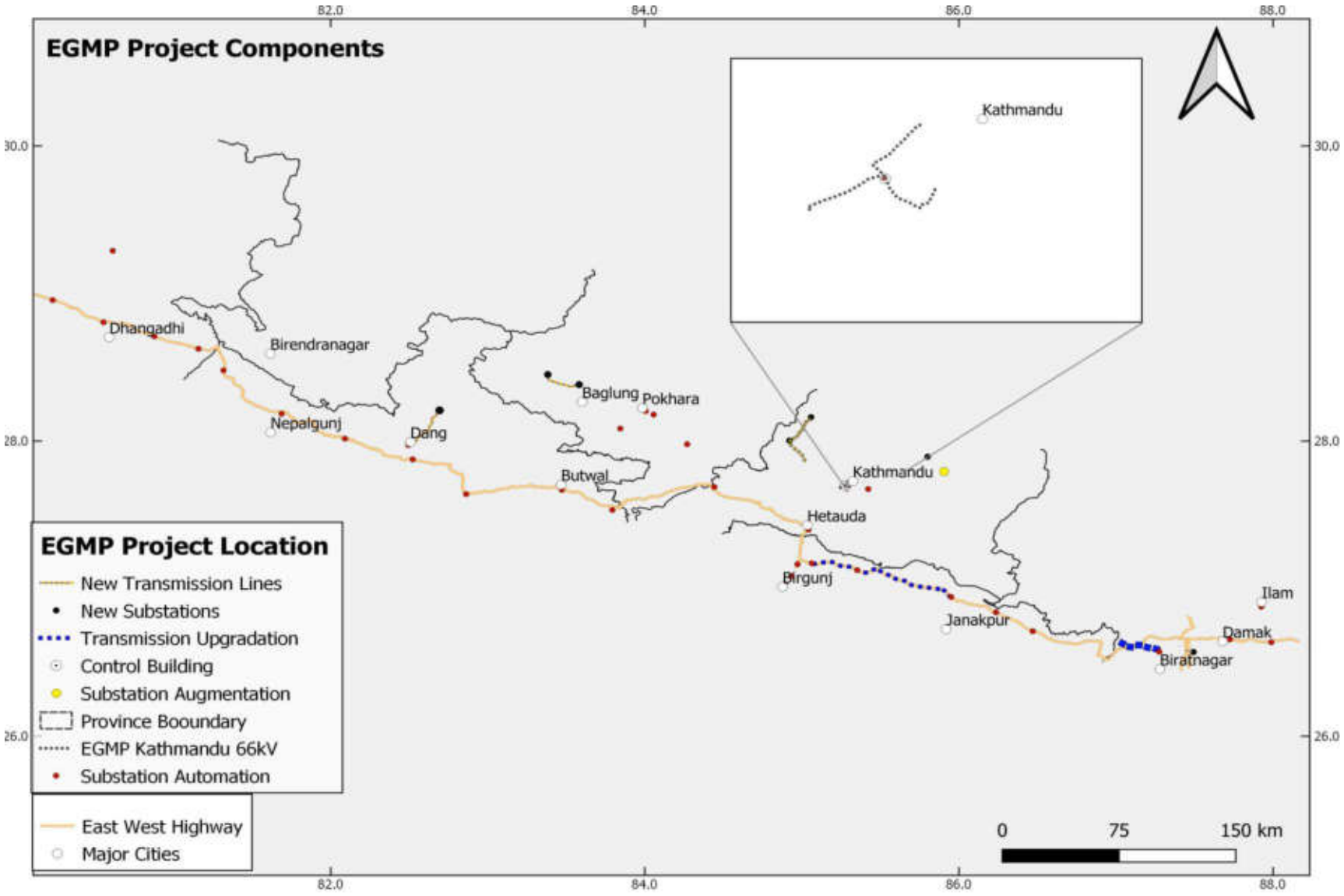
Sl. No.	Project Component	Scope/Activities under Component
1	Construction of Dandakhet - Rahughat 132 kV Transmission Line and associated Substations	a. Construction of 25km long 132 kV overhead transmission line from Dandhakhet - Rahughat
		b. Construction of new 220/132 kV substation at Rahughat
		c. Construction of new 132/33 kV substation at Dandakhet
2	Construction of Ghorahi - Madichaur 132 kV Transmission Line and associated substation	a. Construction of 40 km long 132 kV overhead transmission line from Ghorahi to Madichaur
		b. Construction of new 132/33 kV substation at Madichaur
		c. Extension of Gharohi substation
3	Construction of Borang - Lapang - Ratmate (132/220kV) Transmission Line and associated substations	a. Construction of 25 km long 220 kV overhead transmission line from Ratmate to Lapang
		b. Construction of 23 km long 132 kV overhead transmission line from Lapang to Borang
		c. Construction of new 220/132/33 kV substation at Lapang
		d. Construction of new 132/33 kV substation at Borang
4	Construction of 132/33/11 kV Substation at Pangtang	Construction of new 132/33 kV substation at Pangtang and extension of Barhabise Substation
5	Construction of 132/33/11 kV substation at Keraun (Morang)	Construction of new 132/33 kV substation at Keraun.
		Construction of 30 km associated 33 kV distribution lines.
6	Grid Substation Automation (Outside Kathmandu Valley)	Installation of substation automation system at 34 nos. of 400/220/132/66/33/11 kV existing substations outside of the Kathmandu Valley

Sl. No.	Project Component	Scope/Activities under Component
7	Construction of Distribution Command and Control Centre	Construction of Distribution Command and Control Centre Building and associated infrastructure, hardware, and software
8	Smart Metering in Kathmandu Valley (2nd Phase)	Installation of 350,000 smart meters and associated facilities in 9 distribution centers of NEA.
9	132 kV/66 kV Transmission Line Conductor Upgradation	a. Upgrading conductor (DC) on 102km 132kV Pathlaiya-Dhalkebar transmission line
		b. Upgrading conductor (DC) on 28 km 132kV SC Duhabi-Kusaha transmission line
		c. Upgrading conductors (DC) on 14 km 66kV transmission lines inside Kathmandu valley

42. These components are prioritized by NEA for implementation based on system assessment, national priority, and readiness of the components.

43. **Location of Project Components:** The EGMP components (including substation automation) are located in seven provinces of Nepal, without substation automation this is five provinces namely, province number 1, Bagmati, Gandaki, province number 5, province number 2, and Karnali province. Figure 2 presents the location map of project components. The exact location of individual components is discussed in subsequent sections.

FIGURE 2: PROJECT LOCATION MAP (GOOGLE GEOGRAPHICAL MAP)



B. Nature, Size and Location of Project Facilities under each Component

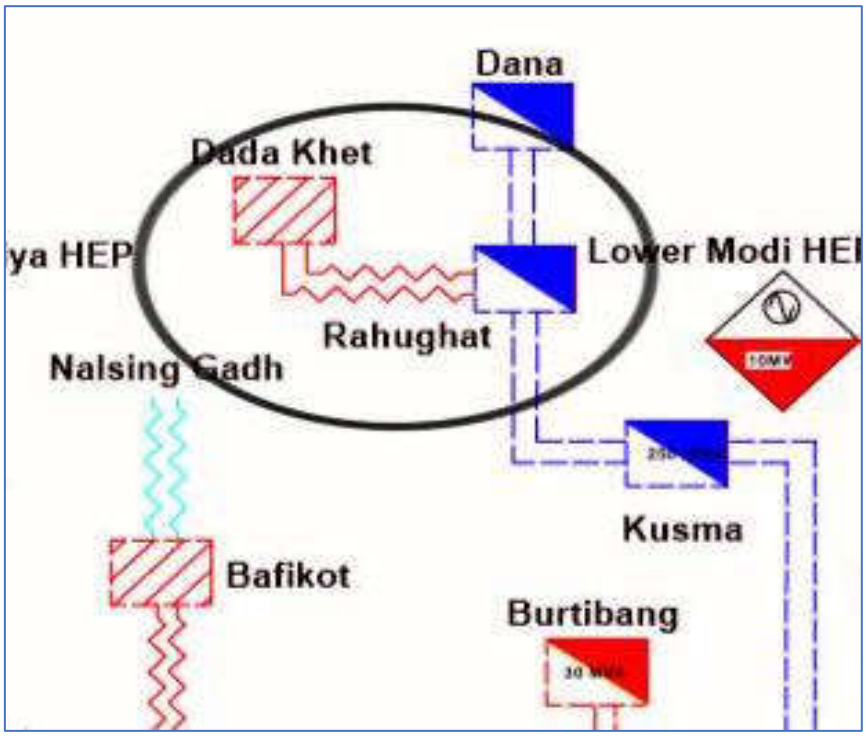
44. The scope under each component of the project is described in the following sections. These components of the project will be implemented under 9 different contract packages. Each component is packaged as separate procurement package except components 4 and 5, which are packaged in a single procurement package but with two lots. The components of the project covered by the IEE are mentioned in this section – if there is any change to the components including new components added at a later date the IEE will need to be updated and cleared by ADB before any works take place.

45. **Component 1. Dandakhet - Rahughat 132 kV Transmission Line and associated Substations**: This component includes construction of a 25km long 132 kV double circuit transmission line from Dandhakhet - Rahughat; construction of a new 220/132 kV GIS substation at Rahughat; and construction of a new 132/33 kV substation at Dandakhet. All facilities under this component are located in Myadgi district of Gandaki province of Central Nepal. It traverses through 5 municipalities (namely Bani municipality, Rahuganga RM-3, Mangala RM, Malika RM, and Dhaulagiri RM) of Myadgi district The transmission line starts from the proposed Rahughat substation of Rahuganga RM-3 and end at the proposed Dandakhet substation of Malika RM-7. It will connect to the Integrated Nepal Power System (INPS) and strengthen the existing transmission network to improve power supply in Dhaulagiri zone as well as providing a means to evacuate power from any future hydropower plants of the Myadgi and Kaligandaki river basins of Myadgi district through the national grid. It will have a capacity to carry 200 MW of power. Figure 3 show the position of the transmission line and substation in the overall integrated Nepal power system map. It can be seen from Figure 3 that it is extending the national grid, connected to it through Rahughat substation. It will have a line-in-line-out (LILO) with the currently under construction 220kV Kaligandaki transmission line from New Butwal - Kusma – Dana (ADB financed).

46. There is hydropower under construction in the subject river basins having received generation license from DOED, but the agreement is for the grid connection to be via LILO to the soon to be completed 220kV Kaligandaki transmission line. Other approved hydropower in advance stages of preparation in the Myadgi and Kaligandaki river basins including those that have already secured generation licenses[5] have connection point at Dana substation in their agreement with NEA. No approved hydropower project has currently received agreement from NEA to connect into the Dandhakhet - Rahughat transmission line. Whilst future hydropower in the Myadgi and Kaligandaki river basins may be induced as a result of the grid extension, and hydropower evacuated to the national grid through it, this project component is not dependent on any individual hydropower projects being permitted and constructed. Therefore, no associated facilities of this project component are identified.

[5] https://doed.gov.np/license/66

FIGURE 3: LOCATION OF PROJECT COMPONENT ON NEPAL INTEGRATED POWER SYSTEM NETWORK



47. The 132 kV line will be a double circuit line with aluminum-conductor steel-reinforced (ACSR) Cardinal conductor. In total 68 towers (35 Angle Points and 33 suspension towers) will be necessary. Each tower will require a 12m x 12m footing. The ROW will be 9m on each side. It will have one 132/33kV substation at Dandakhet, Malika Rural Municipality Ward No. 7 (occupying 2.60 ha area) at geographical coordinates 439709.10E and 3147925.50N and another 220/132 kV substation at Rahughat (Ambawang) of Rahuganga Rural Municipality Ward No. 3 (occupying 4.61 ha area) at geographical coordinates 459231.23E and 3140299.93N. Substations will require 7.22 ha. The land acquisition for the substations has been completed.

48. 51.52 ha of land will be permanently affected, and an estimated 0.3 ha of land will be temporarily required during construction for storage areas, mobile camps etc. Therefore, in total the project footprint will be 51.82 ha (23.17ha or 23.17% in forest land, substation and temporary uses will be outside forest area). Figure 4 show the alignment of the transmission line and location of substations, and Tables 6 to 8 provide the physical and technical parameters of project facilities under this component.

FIGURE 4: ALIGNMENT OF DANDAKHET - RAHUGHAT 132 KV TRANSMISSION LINE

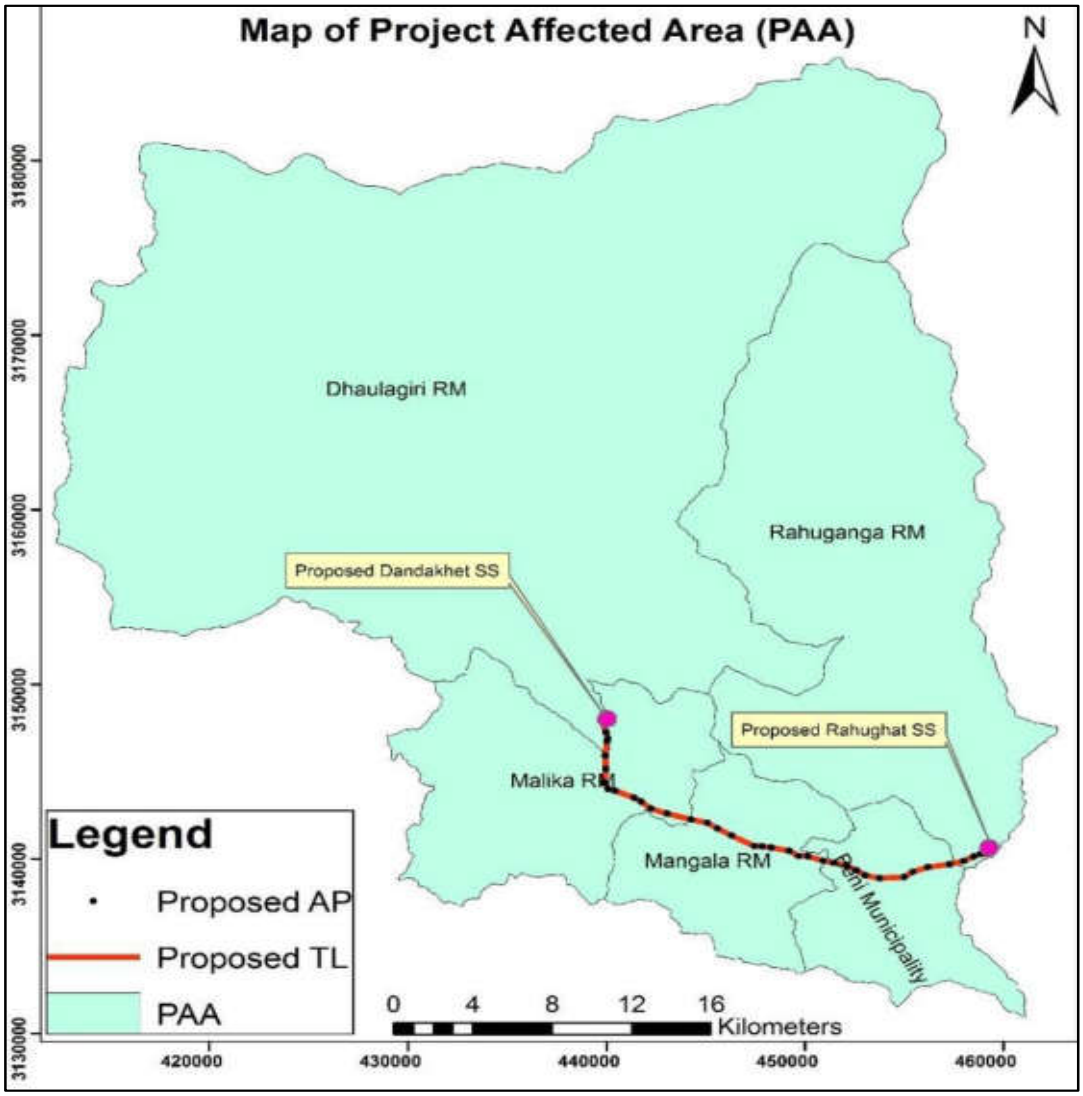


Table 6: Physical and Technical Parameters of 132kV Transmission Line

General	
Project	Dandakhet - Rahughat 132kV Transmission Line Project
Affected Province	Gandaki province
Affected Districts	Myadgi district
RM/Municipality	Rahuganga Rural Municipality Malika Rural Municipality
Terrain/Land use	Hilly and Undulating / Agriculture and Forests

Technical	
Total length	25km
Right of way	18m
Number of angle points	35
Basic span	350m in plains
Number of towers	68 towers (35 Angle Points and 33 suspension towers)
Area required for one tower	0.0144 ha (12m x 12m)
Height of tower	Average 32m
Ground clearance of conductor	Minimum 6.1 m at the maximum sag condition Road 7m Communication line crossing 3.5 m Power line above/below - 3.5m Phase to phase - 3.75 m
Horizontal Clearances from Houses and Trees	2.915 m (min.)
Voltage level	132kV
No. of circuits	Double circuit
Tower type	Lattice
Conductor	ACSR Cardinal "Bear"
Foundation type	Concrete pier and pad type

Table 7: Physical and Technical Parameters of 220/132 kV Rahughat Substation

Parameter	**Qty**	**Unit**
Substation Type	GIS	
Capacity/Voltage Level	220/132	kV
220 kV Line bay	2	no.
220/132 kV Transformer Bay	1	no.
220/132 kV 200 MVA Transformer	1	no.
132 kV Line Bays	2	no.
132/33 kV Transformer Bay with buscoupler	1	no.

132/33 kV 30 MVA Transformer	1	no.
Substation Area	New 4.6097	ha
Land use/Terrain	Agriculture/ Flat	

Table 8: Physical and Technical Parameters of 132/33 kV Dandakhet Substation

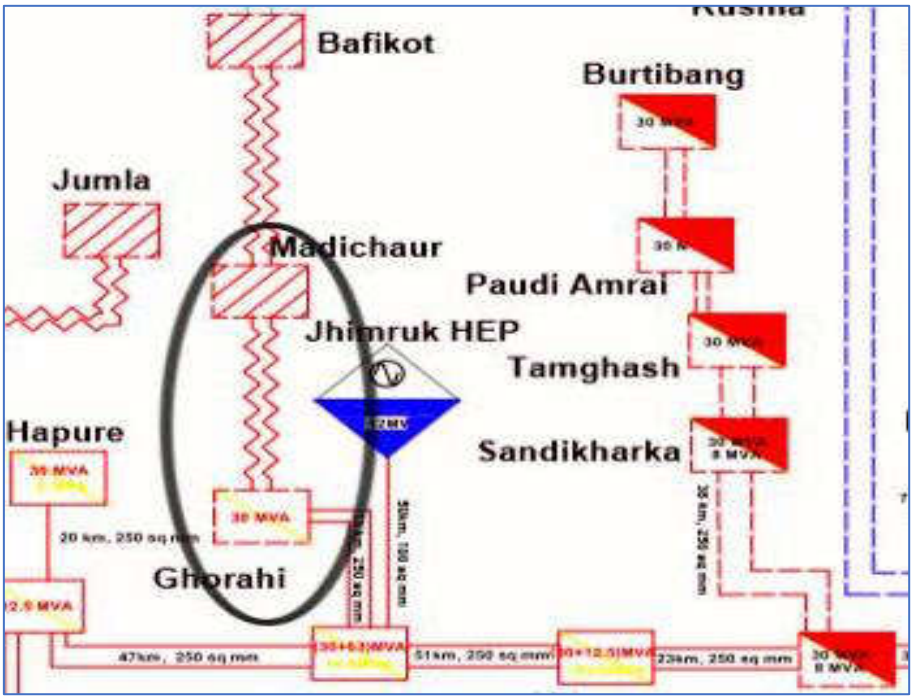
Parameter	**Qty**	**Unit**
Substation Type	AIS[6]	no.
Capacity/Voltage Level	132/33	kV
132 kV Line bay	2	no.
132/33 kV Transformer Bay with buscoupler	2	no.
132/33 kV 30 MVA Transformer	1	no.
33 kV Line Bay	4	no.
33/11 kV 8 MVA Transformer	1	no.
Substation Area	New 2.6045	ha
Land use/Terrain	Agriculture/ Flat	

49. **Component 2. Ghorahi - Madichaur 132 kV Transmission Line and associated Substation:** This component includes construction of 40 km of 132 kV double circuit transmission line from Ghorahi to Madichaur, and construction of a new 132/33 kV substation at Madichaur and installation of 2 bays at the existing Ghorahi substation. All facilities under this component are located in Rolpa, Pyuthan and Dang district of Province 5 of Nepal. The transmission line starts from the existing Ghorahi substation at Jhingani of Ghorahi SMC-3 and ends at the proposed Madichaur substation at Dharampani of Sunil smriti RM-2. It traverses one sub-metropolitan city (Ghorahi of Dang district), one municipality (Sworgadwary of Pyuthan District) and two rural municipalities (Sunil Smriti of Rolpa district and Banglachuli of Dang district). It will connect to the INPS and strengthen the existing transmission network to improve power supply in the Rolpa district region as well as providing a means to evacuate power from any future hydropower plants of the Madi and Lungri river basins through the national grid. It will have a capacity to carry 150 MW of power. Figure 5 shows the position of the proposed line and substations in the overall integrated Nepal power system map. It can be seen from Figure 5 that it is extending the national grid, connected to it through the existing Ghorahi substation.

[6] Air-insulated switchgear (AIS)

50. No approved hydropower has currently received agreement from NEA to connect to the Ghorahi - Madichaur transmission line. Whilst future hydropower in the Madi and Lungri river basins may be induced as a result of grid extension, and hydropower evacuated to the national grid through it, this project component is not dependent on any individual hydropower projects being permitted and constructed. There may be a future extension to Bafikot, but the project is not dependent on it. Therefore, no associated facilities of this project component are identified.

FIGURE 5: LOCATION OF PROJECT COMPONENT ON NEPAL INTEGRATED POWER SYSTEM NETWORK



51. The 132 kV line will be a double circuit line with ACSR Cardinal conductor. In total 122 towers (53 Angle Points and 69 suspension towers) will be necessary. Each tower will require a 15mx15m footing. The ROW will be 9 m on each side. About 7.4 km of this transmission line starting from Ghorahi substation is located on non-forest land within the Chure Conservation Area (Figure 7). It will have one 132/33kV substation at Madichaur (Dharampani village) of Sunilsmriti/Sunarwati Rural Municipality Ward No. 2 in Rolpa District (occupying 2.407 ha). The geographical coordinates of the land are 28°12'20"N and 82°41'35"E. The substation requires 2.40ha of land. The project will also install 2 132 kV bays within the existing Ghorahi substation. The land acquisition for the substations has been completed.

52. 68.33 ha of land will be permanently affected, and an estimated 0.5 ha of land will be temporarily required during construction for storage areas, mobile camps etc. Therefore, in total the project footprint will be 68.83 ha (33.81ha or 49.12% in forest land, substation and temporary uses will be outside forest area). Figure 6 show the alignment of line and location of the substations, and Tables 9 and 10 provide physical and technical parameters of project facilities under this component.

FIGURE 6: ALIGNMENT OF GHORAHI - MADICHAUR 132 KV TRANSMISSION LINE

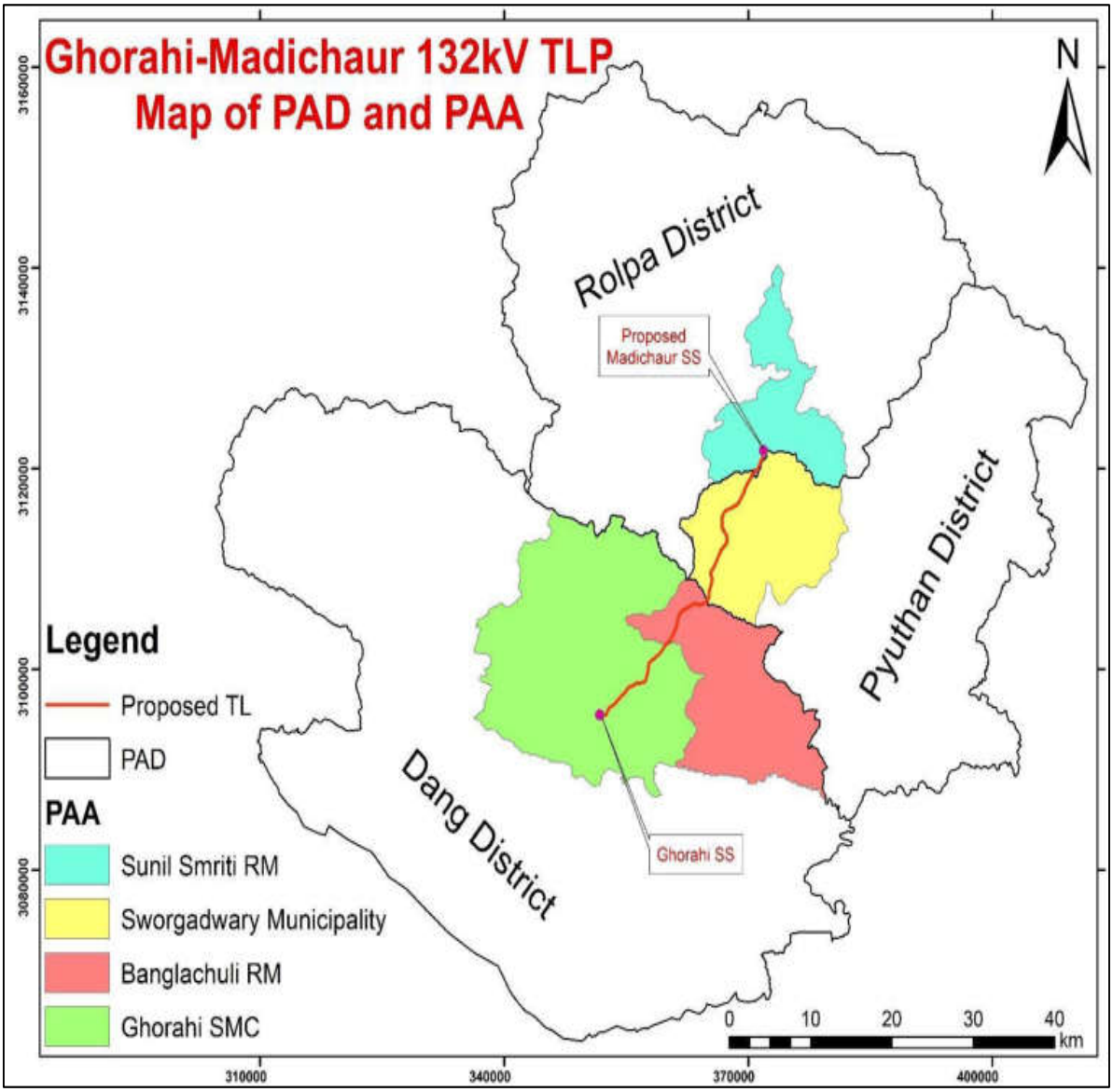


FIGURE 7: ALIGNMENT OF GHORAHI - MADICHAUR 132 KV TRANSMISSION LINE IN CHURE CONSERVATION AREA

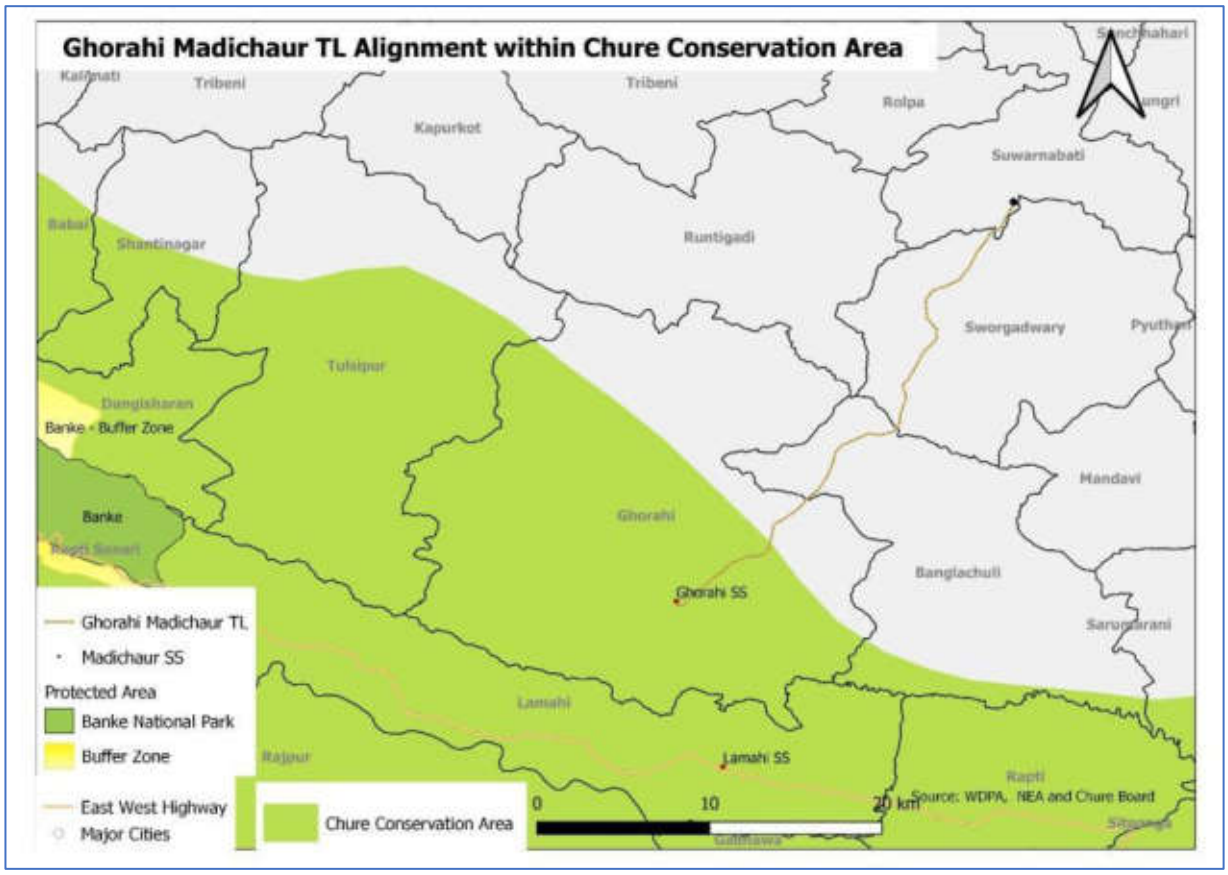


Table 9: Physical and Technical Parameters of 132kV Transmission Line

General	
Project	Ghorahi - Madichaur 132kV Transmission Line Project
Affected Province	Province 5
Affected Districts	Rolpa, Pyuthan and Dang
RM/Municipality	Sunilsmriti/Sunarwati Rural Municipality
Terrain/Land use	Hilly and Undulating / Agriculture and Forests
Technical	
Total length	40km
Right of way	18m
Number of angle points	53
Basic span	350m in plains, 100 to 900m in hills (approximate)

Number of towers	122 towers (53 Angle Points and 69 suspension towers)
Area required for one tower	0.0225 ha (15m x 15m)
Height of tower	Average 32m
Ground clearance of conductor	Minimum 6.1 m at the maximum sag condition Road 7m Communication line crossing 3.5 m Power line above/below - 3.5m Phase to phase -3.75 m
Horizontal Clearances from Houses and Trees	2.915 m (min.)
Voltage level	132kV
No. of circuits	Double circuit
Tower type	Lattice
Conductor	ACSR Cardinal "Bear"
Foundation type	Concrete pier and pad type

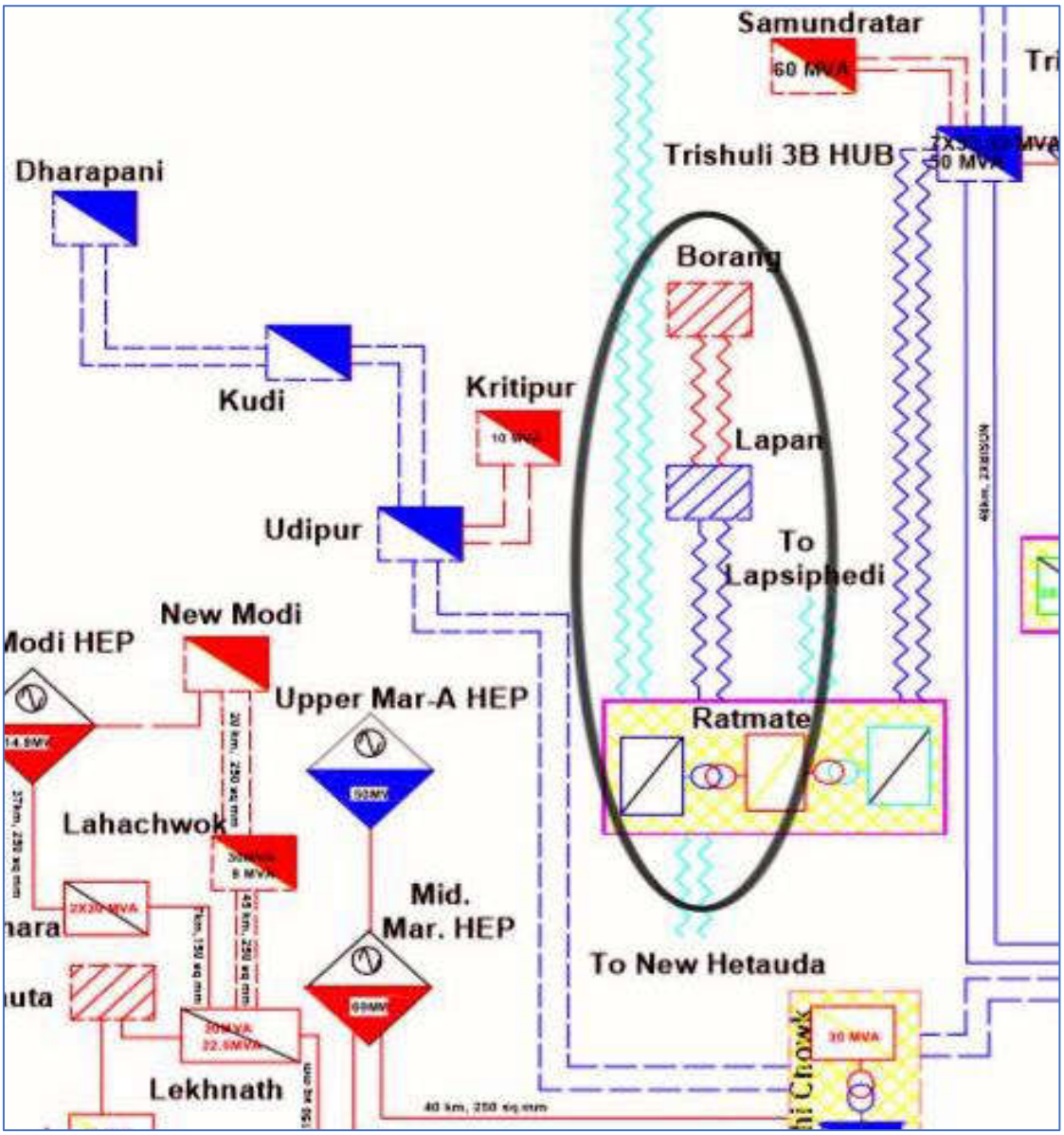
Table 10: Physical and Technical Parameters of 132/33 kV Madichaur Substation

Parameter	**Qty**	**Unit**
Substation Type	AIS	
Capacity/Voltage Level	132/33	kV
132 kV Line bay	2	no.
132/33 kV Transformer Bay	2	no.
132/33 kV 30 MVA Transformer	1	no.
33 kV Line Bay	4	no.
33/11 kV 8 MVA Transformer	1	no.
Substation Area	New 2.407	ha
Land use/Terrain	Agriculture/Flat	

53. **Component 3. Borang - Lapang - Ratmate Transmission Line and associated Substations:** This component includes construction of 25 km of 220 kV transmission line from Ratmate to Lapang, construction of 23 km of 132 kV transmission line from Lapang to Borang, construction of a new 220/132/33 kV substation at Lapang, and construction of a new 132/33 kV substation at Borang. All facilities under this component are located in the middle mountain and hill of the central region in Bagmati Province (Dhading and Nuwakot districts) of Nepal. The transmission line starts from the proposed Borang Substation at Ruby Valley RM-4 in Dhading district and ends at the existing Ratmate Substation at Belkotgadhi Municipality- 7 in Nuwakot district. Its total length is about 48km and it traverses two municipalities (Neelakantha of Dhading District and Belkotgadhi of Nuwakot District) and five rural municipalities (Ruby Valley, Khaniyabas, Tripurasundari, Netrawati Dabjong of Dhading district and Tarkeshwar of Nuwakot district). The Lapang to Borang 132 kV line will have a capacity to carry 250 MW of power whereas Ratmate to Lapang 220 kV line will have capacity to carry 1,936 MW of power. The transmission line will strengthen the ability of the existing transmission network to evacuate power generated by future independent power producers (IPPs) in the Aankhu Khola Corridor to the INPS and augment the same. Figure 8 show the position of the transmission line and substations in the overall integrated Nepal power system map. It can be seen from Figure 8 that it is strengthening the national grid, connected to it through the existing Ratmate substation.

54. No approved hydropower has currently received agreement from NEA to connect into the Borang - Lapang - Ratmate transmission line. Whilst future hydropower in the Aankhu Khola Corridor may be induced as a result of the grid extension, and hydropower evacuated to the national grid through it, this project component is not dependent on any individual hydropower projects being permitted and constructed. Therefore, no associated facilities of this project component are identified.

FIGURE 8: LOCATION OF PROJECT COMPONENT ON NEPAL INTEGRATED POWER SYSTEM NETWORK



55. The Lapang to Borang 132kV line will be double circuit (DC) line using ACSR Bear conductor whereas Ratmate to Lapang 220kV line will be DC line using ACSR twin Moose conductor. In total 157 towers (36 angle points (AP) for the 132 kV line and 33 AP for the 220 kV line; 40 suspension towers (ST) for the 132kV line and 48 ST for the 220 kV line) will be necessary; of these towers 4 towers will be within substation premises. Each tower will require 12x12m footing for the 132kV and 20x20m footing for the 220 kV. The ROW will be 9 m on each side for 132kV while for 220kV line will be 15m on each side. There will be two substations. Borang 132/33/11kV substation at Borang Village of Ruby Valley Rural Municipality Ward No. 4 in Dhading district (occupying 7.702 ha) at geographical coordinates of the land are 28°09'31"N and 85°02'54"E and 220/132/33kV substation at Lapang of Tripurasundari Rural Municipality Ward No. 7 in Nuwakot district (occupying 5.689 ha) at geographical coordinates

27°51'06"N and 85°02'27”E. The substations require 13.39ha of land. The land acquisition for the substations is under progress.

56. 128.39 ha of land will be permanently affected, and an estimated 1.5 ha of land will be temporarily required for storage areas, mobile camps etc. Therefore, in total the project footprint will be 129.89 ha (29.67ha or 22.86% in forest land, substation and temporary uses will be outside forest area). Figure 9 shows the alignment of line and location of the substations, and Tables 11 to 14 provide physical and technical parameters of the facilities under this component.

FIGURE 9: ALIGNMENT OF BORANG - LAPANG - RATMATE TRANSMISSION LINE

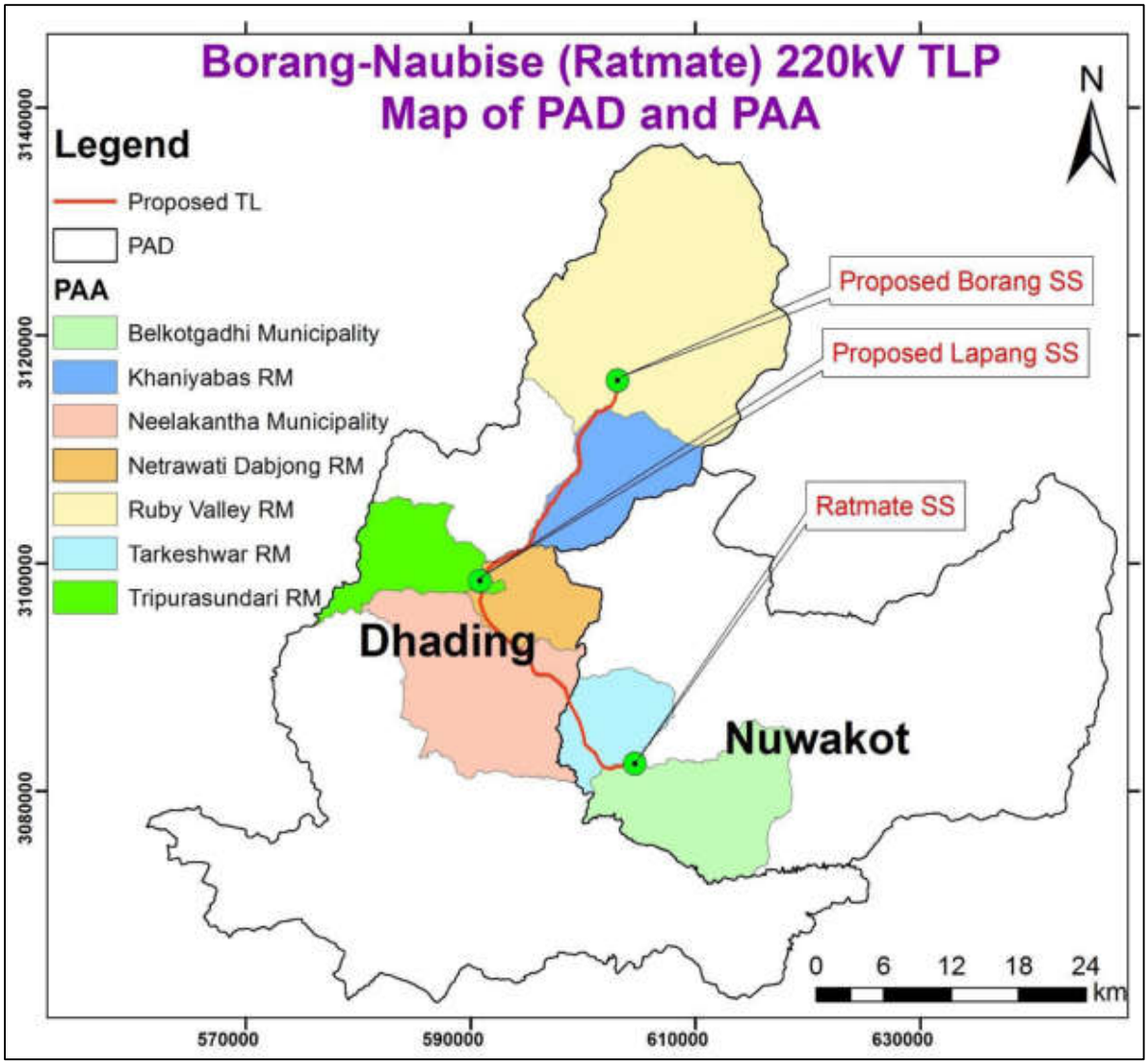


Table 11: Physical and Technical Parameters of 220kV Transmission Line

General	
Project	Ratmate to Lapang 220kV Transmission Line Project
Affected Province	Bagmati Province
Affected Districts	Dhading and Nuwakot
RM/Municipality	Ruby Valley Rural Municipality Tripurasundari Rural Municipality
Terrain/Land use	Hilly and Undulating / Agriculture and Forests

Technical	
Total length	25km
Right of way	30m
Number of angle points	33
Basic span	350m in plains, 100 to 900m in hills (approximate)
Number of towers	81 towers (33 Angle Points and 48 suspension towers)
Area required for one tower	0.0400 ha (20m x 20m)
Height of tower	Average 32m
Ground clearance of conductor	Minimum 6.1 m at the maximum sag condition Road 7m Communication line crossing 3.5 m Power line above/below - 3.5m Phase to phase -3.75 m
Horizontal Clearances from Houses and Trees	3.83 m (min.)
Voltage level	220kV
No. of circuits	Double circuit
Tower type	Lattice
Conductor	ASCR Twin Moose
Foundation type	Concrete pier and pad type

Table 12: Physical and Technical Parameters of 132kV Transmission Line

General	
Project	Lapang - Borang 132kV Transmission Line Project
Affected Province	Bagmati Province
Affected Districts	Dhading and Nuwakot
RM/Municipality	Ruby Valley Rural Municipality Tripurasundari Rural Municipality
Terrain/Land use	Hilly and Undulating / Agriculture and Forests
Technical	
Total length	23km

Right of way	18m
Number of angle points	36
Basic span	350m in plains, 100 to 900m in hills (approximate)
Number of towers	76 towers (36 Angle Points and 40 suspension towers)
Area required for one tower	0.0144 ha (12m x 12m)
Height of tower	Average 32m
Ground clearance of conductor	Minimum 6.1 m at the maximum sag condition Road - 7m Communication line crossing - 3.5 m Power line above/below - 3.5m Phase to phase - 3.75 m
Horizontal Clearances from Houses and Trees	2.915 m (min.)
Voltage level	132kV
No. of circuits	Double circuit
Tower type	Lattice
Conductor	ASCR Cardinal "Bear"
Foundation type	Concrete pier and pad type

Table 13: Physical and Technical Parameters of 220/132/33 kV Lapang Substation

Parameter	**Qty**	**Unit**
Substation Type	AIS	
Capacity/Voltage Level	220/132/33	kV
220 kV Line bay	3	no.
220/132 kV Transformer Bay	2	no.
220/132 kV 200 MVA Transformer	1	no.
132 kV Line bay	3	no.
132/33 kV Transformer Bay	2	no.
132/33 kV 30 MVA Transformer	1	no.
33 kV Line Bay	4	no.
33/11 kV 8 MVA Transformer	1	no.

Substation Area	New 7.702	ha
Land use/Terrain	Agriculture/Flat	

Table 14: Physical and Technical Parameters of 132/33 kV Borang Substation

Parameter	Qty	Unit
Substation Type	AIS	
Capacity/Voltage Level	132/33	kV
132 kV Line bay	3	no.
132/33 kV Transformer Bay	1	no.
132/33 kV 30 MVA Transformer	1	no.
33 kV Line Bay	1	no.
33/11 kV 8 MVA Transformer	1	no.
Substation Area	New 5.689	ha
Land use/Terrain	Agriculture/Flat	

57. **Component 4. New 132/33/11 kV Substation at Pangtang:** This component includes the construction of new 132/33 kV substation at Pangtang and the extension of the existing Barhabise Substation. The selected Pangtang substation site is located in Jugal RM Ward No. 4 (2.65 ha of land) of Sindupalchowk District of Bagmati Province. The geographical coordinates of the land are 27053'35''N and 85047'53''E. At Barhabise Substation 2 132kV Bays will be installed.

58. Pangtang substation is proposed to be connected to the grid at the Barhabise GIS 220/132/11 kV substation through an 18.16 km long 132 kV transmission line from Jugal Rural Municipality (RM) to Barhabise Municipality, known as Balefi Corridor. This new transmission line is being developed by the Transmission Directorate of NEA under government financing. The new transmission line and substations will improve power supply in the Sindupalchowk District of Bagmati Province as well as providing a means to evacuate power from future IPPs in the Balefi Corridor. Since the project facilities are dependent on the Balefi Corridor transmission line being constructed and vice versa, it is considered an associated facility of the project.

59. The land acquisition (cultivated land) for Pangtang substation has been completed. Bay extension work at Barhabise substation will be carried out within the premises of the existing substation (ADB financed) which is currently under construction. Figure 10 shows the location of the project facilities and the routing of the associated Balefi Corridor transmission line. Table 15 and 16 provide the physical and technical parameters of project facilities under this component.

FIGURE 10: LOCATION OF THE PANGTANG SUBSTATION AND BARHABISE SUBSTATION, CONNECTED BY THE BALEFI CORRIDOR 132KV TRANSMISSION LINE

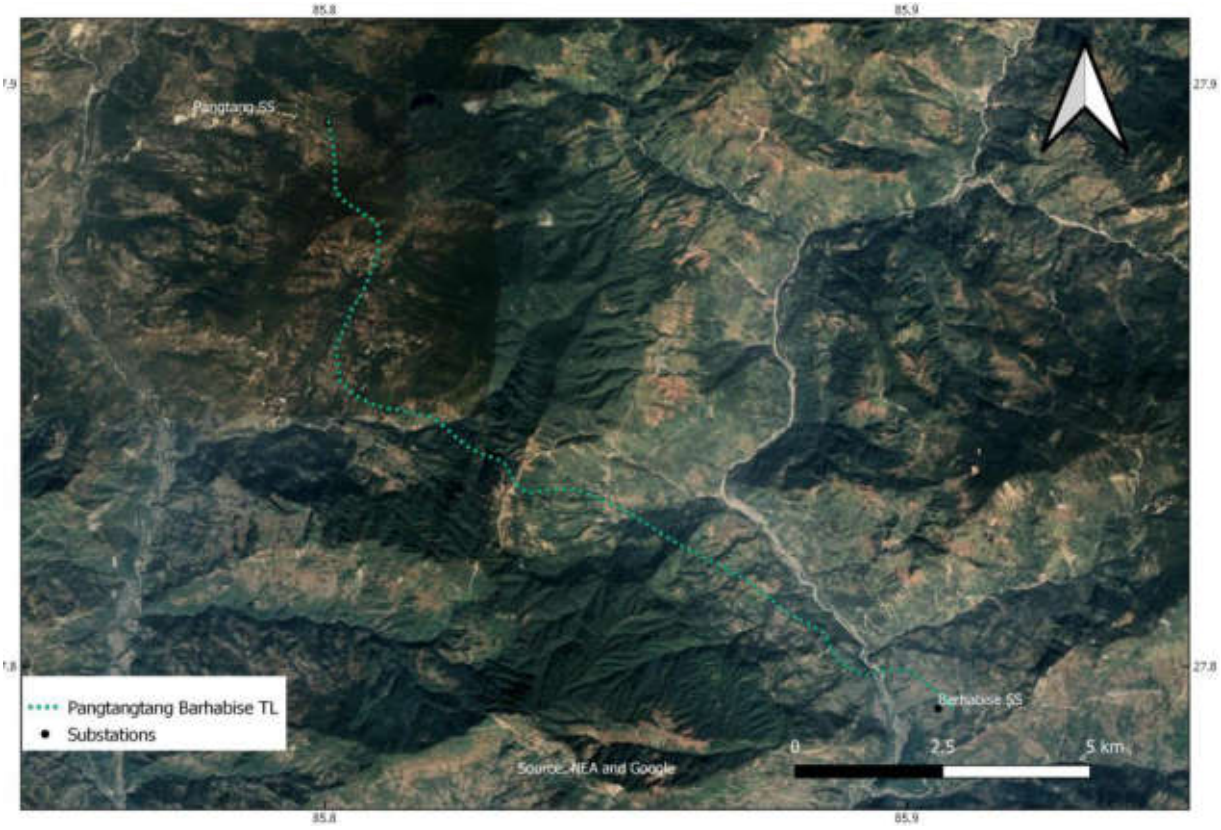


Table 15: Physical and Technical Parameters of 132/33 kV Pangtang Substation

Parameter	Qty	Unit
Substation Type	AIS	
Capacity/Voltage Level	132/33	kV
132 kV Line bay	2	no.
132/33 kV Transformer Bay	1	no.
132/33 kV 63 MVA Transformer	1	no.
33 kV Line Bay	4	no.
33/11 kV 8 MVA Transformer	1	no.
Substation Area	New 2.65	ha
Land use/Terrain	Agriculture/Flat	

Table 16: Physical and Technical Parameters of 132/33 kV Barhabise Substation

Parameter	Qty	Unit
Substation Type	GIS	
Capacity/Voltage Level	220/132	kV
132 kV Line bay	2	no.
220/132 kV Single Phase Auto Transformer	4	no.
132/11 kV Three Phase Transformer	1	no.
Substation Area	Under Construction 7.064744	ha
Land use/Terrain	Agriculture/ Slope	

60. **Component 5. New 132/33/11 kV substation at Keraun:** This component includes the construction of a new 132/33 kV substation at Keraun and the construction of about 30 km of associated 33 kV distribution lines. The selected substation site is located in Keraun of Kanepokhari RM Ward No. 2 (3.52 ha land) of Morang District in Province 1. The geographical coordinates of the land are $26^0$34'12''N and $87^0$29'36''E. It will be connected to the existing 132 kV grid through a LILO arrangement from the existing Duhabi-Anarmani 132 kV transmission line as part of the project, no associated facilities are identified. The existing line is 30 m away from the substation site and it will be connected through a line with one tower in between. The construction of the new substation will reduce the overloading capacity of Duhabi 132/33 kV substation, to help meet increased power demand, reduce frequent tripping and outage, and cater for the 33 kV load of different 33 kV substations of Morang district by constructing about 30 km length of 33 kV distribution lines.

61. The 33kV lines will be double circuit. Two 33kV lines are proposed, namely Keraun-Rangeli 33 kV line mostly running along the Sunsari Morang Sichai Aayojana Nahar (Chatara Canal) and Keraun-Biratchok 33kV line lying partly along the canal and partly along road. The final length of the 33kV distribution line and route alignment will be finalized following detailed route surveys and this IEE will be updated accordingly. The land acquisition (cultivated land) for the substation has been completed. Figure 11 shows the location of proposed substation and 33kV lines and Table 17 provides the physical and technical parameters for the project facilities under this component.

FIGURE 11: LOCATION OF THE PROPOSED KERAUN SUBSTATION AND 33KV LINES

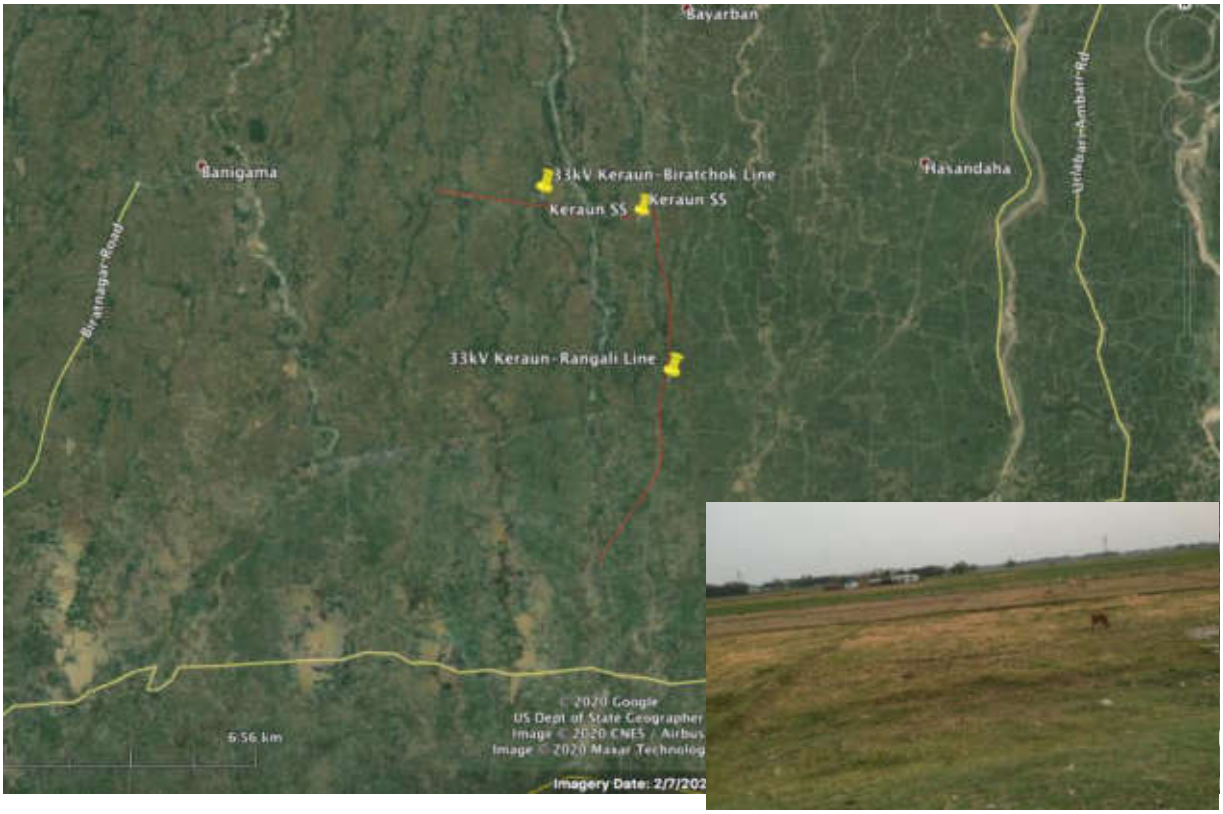
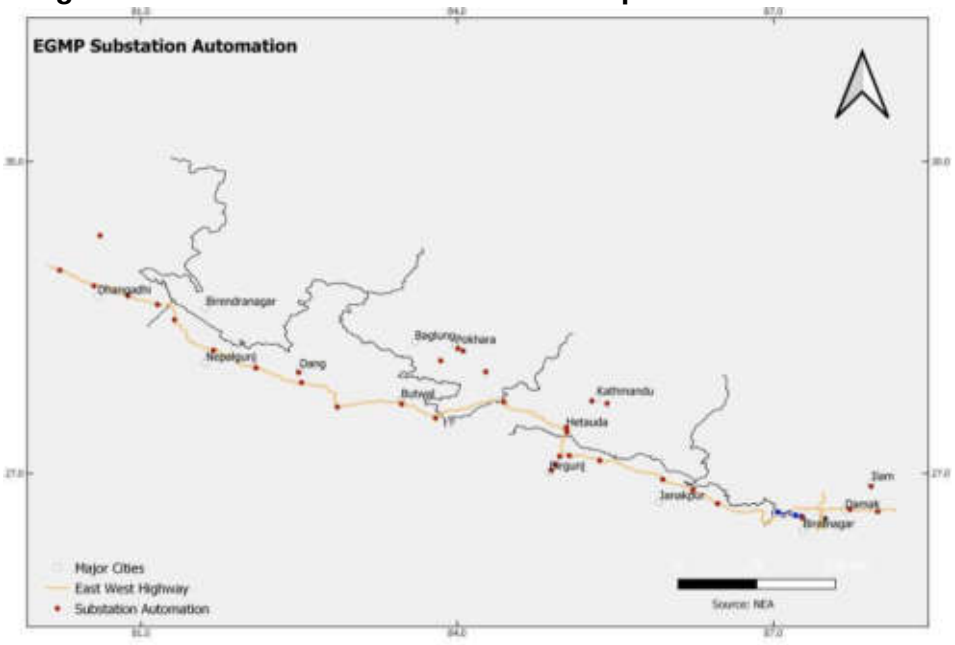


Table 17: Physical and Technical Parameters of 132/33 kV Keraun Substation

Parameter	Qty	Unit
Substation Type	AIS	
Capacity/Voltage Level	132/33/11	kV
132 kV Line bay	4	no.
132/33 kV Transformer Bay	4	no.
132/33 kV 148.5 MVA Transformer	2	no.
33 kV Line Bay	4	no.
33/11 kV 8 MVA Transformer	1	no.
Substation Area	New 3.52	ha
Land use/Terrain	Agriculture/Flat	

62. **Component 6. Grid Substation Automation:** This component includes the installation of substation automation systems at 34 nos. of existing 400/220/132/66/33/11kV substations all over the country (outside of the Kathmandu Valley). The substations identified for automation are Anarmani, Attariya, Bardhghat, Bhaktapur, Bharatpur, Bhurigaun, Birganj, Butwal, Chanauta, Chapur, Damak, Damauli, Dhalkebar, Duhabi, Ghorahi, Godak, Hetauda, Kamane, Kohalpur, Kusum, Lahan, Lamahi, Lamki, Lekhanath, Mahendranagar, Mirchaiya, Pahalmanpur, Parwanipur, Pathlaiya, Pokhara, Sayaule, Simara, Suichatar, and Syangja. Figure 12 show the locations of these substations. The automation system activities involve the installation of hardware (panels, monitors, fittings etc.) and software connected to the existing substation system inside existing buildings at the substations, therefore no land acquisition is required. Some of these existing substations are located in Protected Area or Buffer Zone/IBA namely Bharatpur, Bhuriguan, Ghorahi, Godak, Hetauda, Kamane, Kusum, Lakhanatri, Lamahi, Mahendranager, Pokhara, and Simra.

Figure 12: Location of the Substations Proposed for Automation



63. **Component 7. Distribution Command and Control Center:** This component includes the construction of a distribution command and control (DCC) center within the premises of the existing substation of Suichatar of Nagarjun Municipality, Kathmandu District, Bagmati Province (Figure 13). Currently NEA engages manual control of Kathmandu's power distribution which operates under basic conditions and is not keeping up with international best practice. The proposed DCC center would provide for 24/7 control and operation of the medium voltage (MV or 11 kV) and low voltage (LV or 400/230 V) distribution system in Kathmandu Valley. This will thereby improve the reliability and quality of supply to the end customer. Coupled with the rollout of customer smart metering, the DCC center would reduce losses, especially non-technical, and improve NEA's performance indicators. It is also expected that associated improvements in the supply of power would provide the foundation for new investments in Kathmandu Valley while providing an added social value to the general population. The DDC center would also interface with NEA's existing Kathmandu load dispatch center (LDC) which provides for the operation of NEA's generation and high voltage (HV) transmission system.

Figure 13: Location of Distribution Command and Control Centre

64. The work under this component involves the construction of a building and associated infrastructure such as toilets, canteen etc., as well as hardware and software. The DCC center building will include a data center for NEA. The DCC building will be built using a container system and it will be installed on the open space next to an existing building (Figure 13). The total footprint of the existing substation is 14,770m^2.

65. **Smart Metering in Kathmandu Valley:** This component includes the enhancement and reinforcement of the metering system by the installation of about 350,000 smart meters and related equipment such as cables, panels, and fixings in nine distribution centers of NEA (Table 18).

TABLE 18: DETAILS OF SMART METERING COMPONENT

Sl. No.	Name of Distribution Center	Connections number	
		Single Phase	Three Phase
1	Thimi	24,127	685
2	Pulchowk	21,896	985
3	Bhaktapur	33,407	1,169
4	Kirtipur	17,329	476
5	Kuleshwor	47,556	1,750

6	Lagankhel	56,654	2,051
7	Baneshwor	60,097	1,768
8	Jorpati	20,363	550
9	Balaju	22,103	504
		303,532	**9,938**
	Total including 10% extra	**344,817**	

66. This will be done by replacing existing electromechanical meters with smart meters, along with related hardware and software. The work will be done at the premises of the consumers.

67. **Component 9. 132 kV /66 kV Transmission Line Conductor Upgradation:** This component includes the upgradation of existing 132kV and 66kV transmission lines by replacing existing ACSR conductors with high-temperature, low-sag (HTLS) conductors together with related hardware such as clamps, anchor shackles, bolts, clevis, tower attachments, sockets, links, sag plates etc. The scope includes (i) existing 102km-long 132kV Pathlaiya – Dhalkebar transmission line passing through 5 districts of Province 2 (Figure 14); (ii) existing 28km-long 132kV Duhabi – Kusaha transmission line in Sunsari District of Province 1 (Figure 15); and (iii) existing 14 km-long 66kV lines inside Kathmandu valley of Bagmati province (Figure 16).

68. **Component 9a**. The existing 132 kV transmission line from Pathlaiya – Dhalkebar consists of ACSR Bear conductor. It is critical to the grid as the supply of power can be routed from Hetauda, Dhalkebar or Parwaniur substations. Currently, the major feeding point is from Dhalkebar and as the power flow is supplied up to Butwal, the line tends to be overloaded. Therefore, to avoid outages during contingency and normal loading conditions, it is proposed to upgrade this line by replacing existing ACSR conductors with HTLS conductors. There will be no change in the number or arrangement of conductors installed, only the type. The alignment runs through five districts namely Bara, Rautahat, Sarlahi, Mahottari, and Dhanusha of Province 2. It starts from the existing Pathlaiya substation and ends at the exiting Dhalkebar substation traversing several municipalities (Jitpur Simara SMC, Nijgad Municipality, Gujara Municipality, Chandrapur Municipality, Bagmati Municipality, Hariwan Municipality, Lalbandi Municipality, Ishworpur Municipality, Bardibas Municipality, Gaushala Municipality, Mithila Municipality). From Pathlaiya substation its western extremity runs for about 7.4km through forest land in the newly extended Parsa National Park (existing substation and transmission line was constructed before the boundary extension) with about 3-4 towers falling within the extended boundaries. Two other sections of the transmission line (about 5.1km at the Bagmati River crossing and 4.3km on its eastern extremity) pass through the southern boundary of Chure Conservation Area (Figure 15).

69. **Component 9b.** Upgrading the conductor on the existing 28 km long 132kV Duhabi – Kusaha transmission line by replacing existing ACSR conductors with HTLS conductors will aid in power trade with India through the existing cross-border 132kV Kusaha (Nepal, 13km)-Kataiya (India, 3km) transmission line (used for both import and export) with 150MW capacity. There will be no change in the number or arrangement of conductors installed, only the type. The alignment is located in Sunsari district of Province 1. It starts from the existing Duhabi substation and ends at existing Kusaha substation traversing several municipalities (Koshi RM,

Bokraha RM, Inaruwa Municipality, Gadhi RM, Duhabi Municipality). About 5.7km of the transmission line runs in the buffer zone of the Koshi Tappu Wildlife Reserve which is also a Ramsar site; all towers are outside the Wildlife Reserve and Ramsar, located on modified agricultural habitat (Figure 17).

70. **Component 9c.** The transmission network in Kathmandu Valley currently consists of ACSR Bear, Panther, Wolf and Dog conductors. But its transmission lines are overloaded and unable to handle the contingency conditions. In few instances, even the normal loading creates system instability. Therefore, it is proposed to upgrade the following 3 Kathmandu Valley transmission lines by replacing existing ACSR conductors with HTLS conductors under the EGMP: (i) Suichatar – Matatirtha 5km DC ACSR Bear; (ii) Suichatar – Balaju 4.5km SC ACSR Bear; and (iii) Suichatar – Teku 4.5km DC ACSR Bear. These lines are located within Kathmandu Valley (Kathmandu, Nhaktapur, Lalitpur districts) of Bagmati province. There will be no change in the number or arrangement of conductors installed, only the type.

71. About 150m length of the Suichatar-Balaju 66kV line passes through the current boundary of the UNESCO Kathmandu Valley (Swayambhu) World Heritage Site (WHS) (Figure 18) with an additional 450m length falling within the proposed boundary extension. The main monument for which it is designated, Swayambhunath Stupa, is about 500m away from the line alignment, although smaller monuments are found closer to the alignment. Land use under the alignment within the current boundary is forest, in the proposed boundary extension it is dense built up area. To execute work within the WHS prior permission will be required from the Department of Archeology.

72. The upgradation work under Component 9 will be carried out on existing towers and within the ROW of the existing lines. Therefore, no additional land acquisition is required. Figures 14, 16, and 18 show the alignments of the transmission lines under this project component.

FIGURE 14: ALIGNMENT OF THE EXISTING PATHLAIYA- DHALKEBAR TRANSMISSION LINE

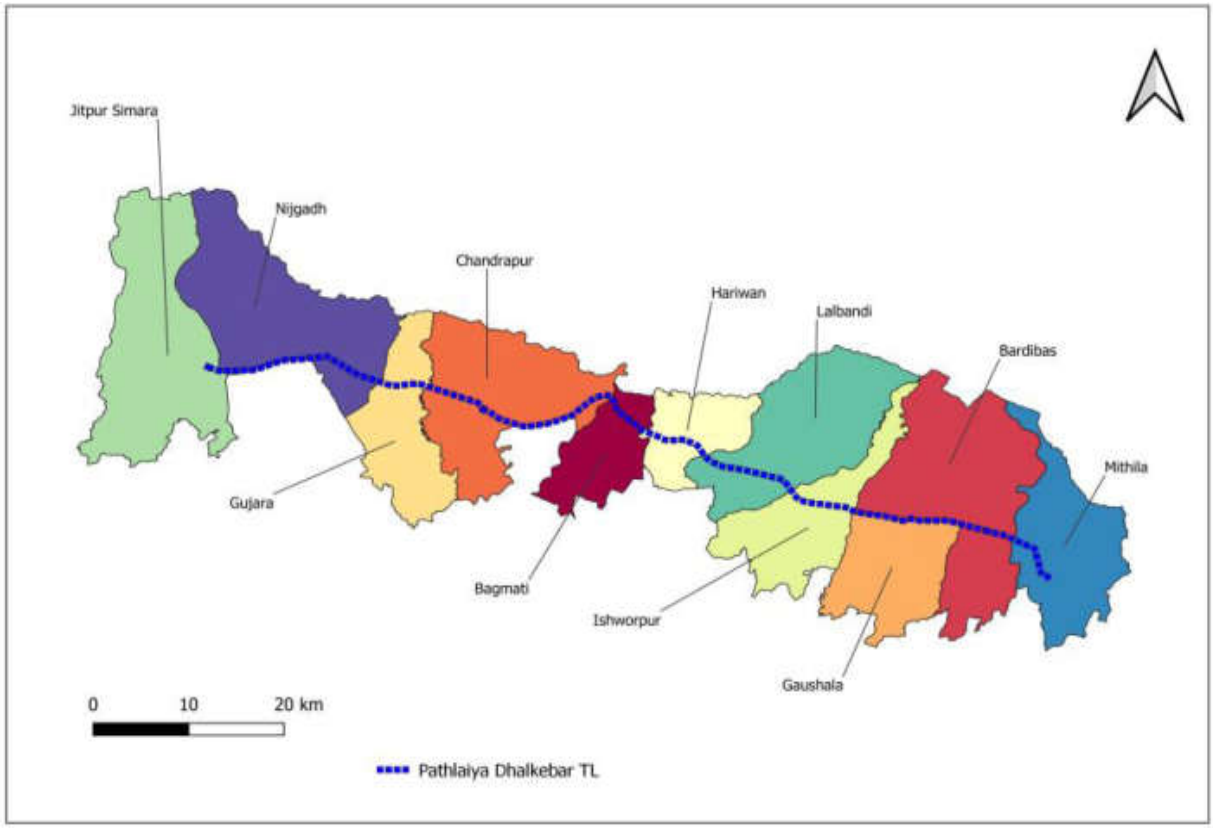


FIGURE 15: EXISTING PATHLAIYA- DHALKEBAR TRANSMISSION LINE IN RELATION TO PARSA NATIONAL PARK/CHURE CONSERVATION AREA

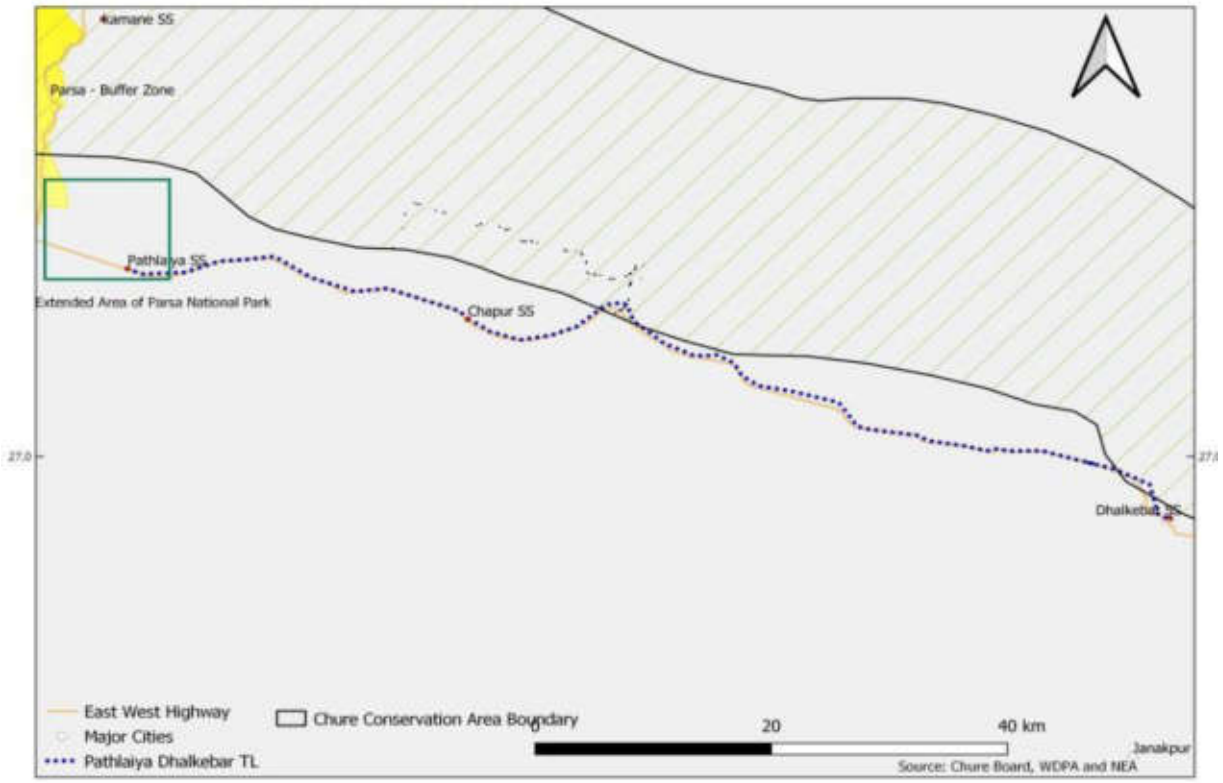


FIGURE 16: ALIGNMENT OF THE EXISTING DUHABI KUSAHA TRANSMISSION LINE

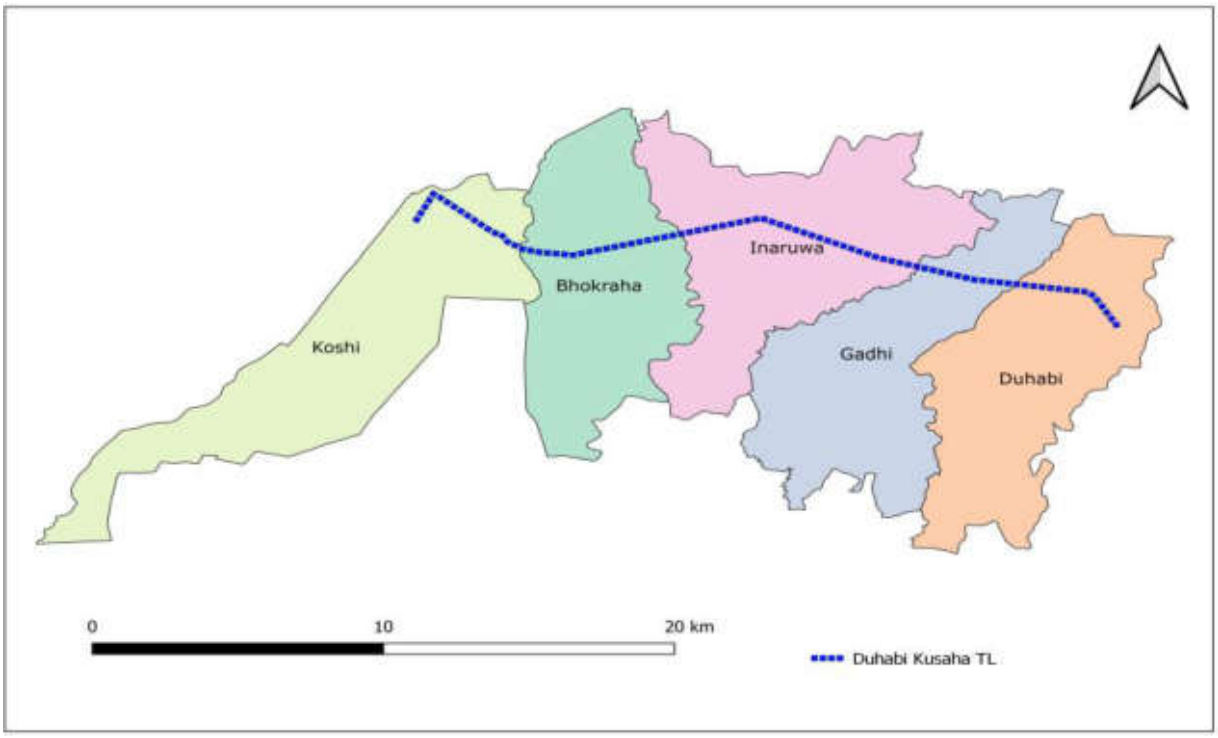


FIGURE 17: EXISTING DUHABI KUSAHA TRANSMISSION LINE WITHIN KOSHI TAPPU WILDLIFE RESERVE BUFFER ZONE

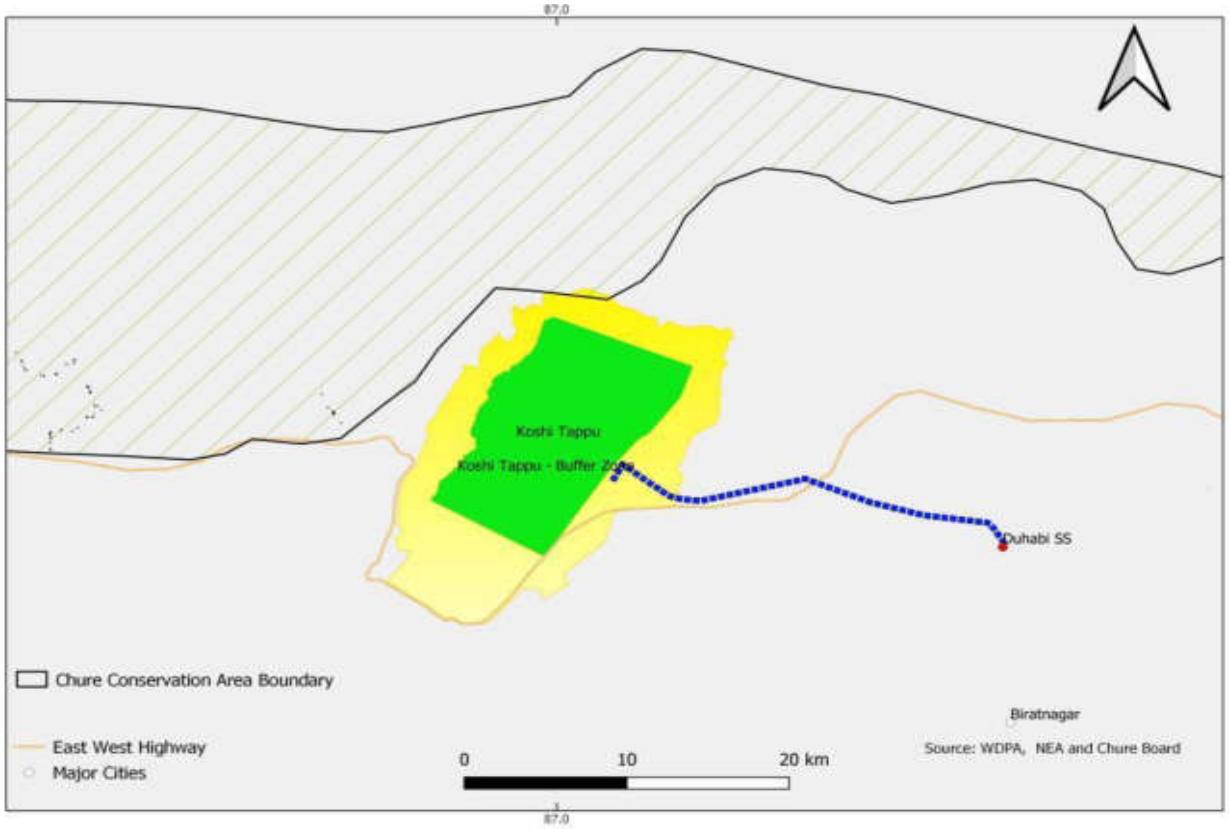


FIGURE 18: ALIGNMENT OF 3 OF 4 OF THE EXISTING 66 KV LINES IN KATHMANDU VALLEY

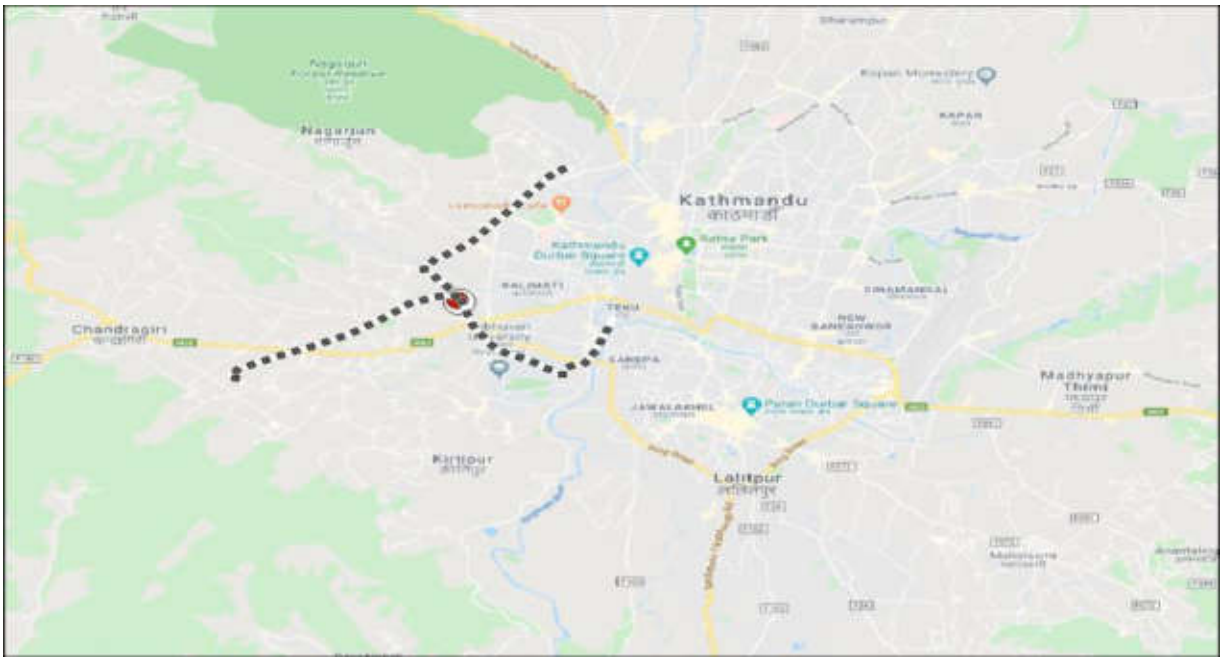


Figure 19: Approximate Alignment of the Existing Suichatar-Balaju 66kV line in related to the Current UNESCO Kathmandu Valley (Swayambhu) World Heritage Site Boundary

73. The project components are packaged into 9 different contract packages with 2 lots for package B1. The footprint of the 3 new transmission lines and new substations (Components 1-3) combined occupies 250.55 ha of land while the stand-alone new substations (Components 4-5) occupy 6.17 ha land with 0.01 ha for 33kV distribution lines. Details are summarized in Table 19.

TABLE 19: SUMMARY OF PROJECT COMPONENTS, LOCATIONS AND FOOTPRINT

Sl. No.	Contract Package No.	Project Component	Scope/Activities under Component	Location (Province/ Districts)	Status	Right of Way (ROW) m	Footprint outside of existing infrastructure (ha)
1	A-2	Construction of Dandakhet - Rahughat 132 kV Transmission Line and associated Substations	a. Construction of 25km long 132 kV transmission line from Dandhakhet - Rahughat	Gandaki / Myagdi	New	18	44.61
			b. Construction of new 220/132 kV GIS substation at Rahughat	Gandaki / Myagdi	New	n/a	4.61
			c. Construction of new 132/33 kV substation at Dandakhet	Gandaki / Myagdi	New	n/a	2.60
2	A-3	Construction of Ghorahi - Madichaur 132 kV Transmission Line and associated Substation	a. Construction of 40 km long 132 kV transmission line from Ghorahi to Madichaur	No. 5 / Rolpa, Pyuthan, Dang	New	18	66.43
			b. Construction of new 132/33 kV substation at Madichaur	No. 5 / Rolpa	New	n/a	2.41
			c. Extension of Ghorahi substation		Existing		n/a
3	A-5	Construction of Borang - Lapang - Ratmate (132/220kV)	a. Construction of 25 km long 220 kV transmission line from Ratmate to Lapang	Bagmati / Dhading, Nuwakot	New	30	116.5

Sl. No.	Contract Package No.	Project Component	Scope/Activities under Component	Location (Province/ Districts)	Status	Right of Way (ROW) m	Footprint outside of existing infrastructure (ha)
		Transmission Line and associated Substations	b. Construction of 23 km long 132 kV transmission line from Lapang to Borang	Bagmati / Dhading	New	18	
			c. Construction of new 220/132/33 kV substation at Lapang	Bagmati / Dhading	New	n/a	5.69
			d. Construction of new 132/33 kV substation at Borang	Bagmati / Dhading	New	n/a	7.70
4	B-1	Construction of 132/33/11 kV Substation at Pangtang	a. Construction of new 132/33 kV substation at Pangtang and extension of Barhabise Substation	Bagmati / Sindhupal chowk	New	n/a	2.65
					Existing (under construction, ADB financed)		n/a
5	B-2	Construction of 132/33/11 kV substation at Keraun (Morang)	a. Construction of new 132/33 kV substation at Keraun.	No. 1 / Morang	New	n/a	3.52
			b. Construction of 30 km long 33 kV distribution lines.	No. 1 / Morang	New	7	0.01
6	C-1	Grid Substation Automation (Outside Kathmandu Valley)	a. Installation of substation automation system at 34 nos. of 400/220/132/66/33/11 kV existing substation	Bagmati, 2, 1, 5, Gandaki Far Western	Existing	n/a	n/a

Sl. No.	Contract Package No.	Project Component	Scope/Activities under Component	Location (Province/ Districts)	Status	Right of Way (ROW) m	Footprint outside of existing infrastructure (ha)
			outside of the Kathmandu Valley				
7	C-2	Construction of Distribution Command and Control Center	b. Construction of DCC center [Building and Infrastructure, Software and Hardware]	Bagmati / Kathmandu	New but on Existing Substation Land	n/a	n/a
8	C-3	Smart Metering in Kathmandu Valley (2nd Phase)	a. Installation of 350000 smart meters and related equipment in 9 distribution centers of NEA.	Bagmati / Kathmandu, Lalitpur, Bhaktapur	Existing	n/a	n/a
9	D-1	132 kV /66 kV Transmission Line Conductor Upgradation	a. Upgrading conductor on 102km long 132kV Pathlaiya- Dhalkebar line	No. 2 / Bara, Rautahat, Sarlahi, Mahottari, Dhanusha	Existing	18	n/a
			b. Upgrading conductor on 28 km long 132kV SC Duhabi - Kusaha line	No. 1 / Sunsari	Existing	18	n/a
			c. Upgrading conductors on 14 km long 66kV lines inside Kathmandu valley	Bagmati / Kathmandu, Nhaktapur, Lalitpur	Existing	12	n/a
						Total (ha)	**256.73**

C. Design Principles and Construction Works

74. The project facilities (transmission and distribution lines, substations and DCC center) and related equipment (transformers, capacitors, insulators, conductors, and other electrical accessories) are and will be designed, fabricated, tested, and installed following national (Nepal) and international electricity regulations, guidelines, standards, and best practices. This includes the Electricity Regulation 2050 (1993) of Nepal, as well as Bureau of Indian Standards (IS), International Energy Commission (IEC), and Institute of Electrical and Electronics Engineers (IEEE) guidelines.

75. Based on current NEA practices, the detailed design, pre-construction, and construction phases will involve a series of activities as indicated in Table 20.

TABLE 20: PHASING OF CONSTRUCTION WORKS

Component	Activities		
	Detailed Design and Pre-construction	**Construction**	**Operation & Maintenance**
Transmission/ Distribution Lines	Tender documents, detailed route survey and design, land acquisition, forest clearance, contractor and manpower recruitment	Clearing of ROW (forest clearance)	O&M* including ROW maintenance
		Establishment of material storage areas**	
		Establishment of construction camps for workers**	
		Sourcing of construction materials, transport of materials and equipment to tower sites, provision of power supply**	
		Civil works (foundation work, RCC*, spoil disposal etc.)	
		Tower/pole erection	
		Insulator fittings, conductor, and ground wire stringing**	
		Testing and commissioning**	
Grid Substations and DCC Center	Tender documents, topographical survey and detailed design, land acquisition, contractor and	Establishment of construction site and material storage areas	O&M*
		Establishment of construction camps for workers	
		Establishment of temporary access tracks	

	manpower recruitment	Sourcing of construction materials, transport of materials and equipment to site, provision of power supply	
		Site clearance	
		Civil works (earthworks, foundation work, RCC*, spoil disposal etc.)	
		Substation equipment installation	
		Testing and commissioning	

* O&M = operations and maintenance, RCC = reinforced cement concrete.
** Activities required for upgraded of transmission lines under Component 9

(a) Transmission lines

76. The process of constructing 220kV and 132 kV overhead transmission lines will engage multiple construction crews working in parallel along the alignments. The size of each construction crew depends upon site conditions, the volume of works and techniques used, but typically, 60 to 80 (7 skilled and remaining unskilled) people will be employed in each construction crew and around 2-3 weeks will be needed for the construction of 1 km of transmission line. The following sections elaborate on the work to be carried out under the project. Figures 20 to 22 show the typical design, layout and installation work of transmission lines.

(i) **Preliminary Works:** Preliminary works for the transmission lines consist of tendering and contract award, detailed design, and mobilization of the contractors. During the detailed route survey, spotting of the tower locations, preparation of longitudinal profiles, geological field test and laboratory tests, to inform the tower and foundation design will be carried out.

(ii) **Land Acquisition:** After consensus on the tower locations, the required land will be acquired by NEA as per Land Acquisition Act, 2034 in coordination with the Compensation Determination Committee (CDC) and Resettlement and Indigenous Peoples Plan (RIPP). The project shall permanently acquire tower footings, while certain areas will be under restricted land use as ROW of a transmission line; these areas will permitted to be used for seasonal crop farming but construction of structure and growing of trees will be prohibited (the land ownership certificated will still be with the land owners after partial compensation).

(iii) **Recruitment of Work Force:** During construction stage of a transmission line approximately 300-350 people will be employed (about 230 unskilled, 45 semi-skilled and 25 skilled) from the start to end of the construction stage. Most of the unskilled manpower will be hired locally as per available skill and experiences. Semi-skilled and skilled manpower will be managed by the contractor and NEA.

(iv) **Forest Clearance:** Trees will be felled at the tower location for the foundation and under the ROW in coordination with the Division Forest Office (DFO) and Community Forest User Groups.

(v) **Camp and Storage Areas:** Contractors are responsible for the construction of camps for their workforce. Construction camps are to be well-managed and located within substations and the ROW of transmission lines with a permit from NEA. The number of mobile camps and storage areas will be defined by the contractors. The source of water for drinking will be taken from a water source (with proper testing of water quality to ensure it meets drinking water standards) which is used by the local community, while ensuring no social conflict is created

due to increased demand on the water resource. For each mobile camp, separate toilet and washing facilities will be provided. Open defecation and pit latrines will be categorically prohibited.

(vi) **Construction Materials:** The key materials required for civil works related to the tower foundations will be cement, coarse and fine aggregate, steel reinforcement and stone. Locally available materials such as coarse and fine aggregates will be purchased from licensed local suppliers, while cement, steel reinforcement and others material which are not locally available will be purchased from licensed manufacturers or suppliers. Since large volume of stone is not required in construction of tower foundations, the project will not require any separate site for quarrying stone.

(vii) **Transportation of Equipment and Materials:** Tower locations will be accessed from existing village roads, district roads, and feeder roads. No permanent access roads will be constructed to tower sites from existing road. Existing roads will be used for construction and maintenance where available. The construction material will be carried by vehicle up to the nearest road head and later it will be transported manually up to the individual tower location.

(viii) **Construction Power Source:** For the construction work of transmission lines diesel generating sets will be used.

(ix) **Tower Foundation:** The excavation and construction of tower foundations will be undertaken by manual labor assisted by the mechanical plant wherever possible. The mechanical plant will be limited to small demountable steel skid framed concrete mixers, air compressors, air drills/chisels and tamping/compaction tools. Excavation and the concreting of the tower foundations will be carried out as per the design requirements. The concrete is left to dry and once it has attained its required strength, the foundations are be backfilled with suitable material. Pile foundation in case of marshy land and hilly terrain will be required and in rocky areas blasting may be necessary.

(x) **Spoil Disposal:** Since the construction of the transmission lines requires clearing and excavation of only a small area at tower locations, it will not generate large volumes of spoil. Spoil generated during excavation and construction period will be used in backfilling and compaction of the foundation area as much as possible. On average, about $25m^3$ to $30m^3$ volume of concrete is occupied by the substructure of the tower foundation and this equal volume of excavated soil can generally be used in leveling the surface of the land around the tower foundation.

(xi) **Erection of the Tower:** All the parts of the tower and related equipment will be manufactured in the supplier's factory and be transported by vehicle or manually to the respective tower locations. These parts will be assembled on the site to erect the tower manually (by employing pulleys, wenches, etc.) into the tower foundation.

(xii) **Insulator Fittings, Conductor and Ground Wire Stringing:** The transmission lines utilize two types of towers: (i) angle towers, where conductors (wires) are spliced with a loop across insulators which are approximately horizontal, and (ii) suspension towers, from which the conductors are connected to vertical-hanging insulators. Suspension towers are used for straight segments of the line, while angle points are normally used for angles in the alignment. Typically, there are several suspension towers between angle towers. This allows for a continuous conductor to be installed across several suspension towers between two angle points. The fitting of the insulators and stringing of conductors will be carried out manually as per design requirements with no use of construction cranes. For stringing a series of pulleys are installed on the transmission towers in a working

segment between tension towers. A guide rope or wire is passed from one end of the segment through the successive pulleys until the other end of the segment is reached. The guide rope installation requires traversing the ROW either manually or with a tractor or truck. The conductors are attached to one end of the guide rope, which is then pulled by a powered winch. After the conductors are pulled through the working segment, they are drawn mechanically to the design tension and then attached to the insulators.

(xiii) **Testing and Commissioning**: The lines and conductors will be tested and commissioned following completion of construction work.

(xiv) **Construction of line at road/highways and railway crossings**: In the event the line crosses roads/highways and railway lines, a detailed survey of location of the crossing will be carried out by the contractor. Prior approval from roads and railway authorities for execution of this work shall be obtained by the contractor through the NEA. Traffic management will take place during the work at road and railway crossings.

(xv) **Construction of line at waterways crossings**: In the event the line crosses rivers or waterbodies, a detailed survey of location of the crossing will be carried out by the contractor to choose the optimum crossing location. Prior approval from waterways authorities for execution of this work shall be obtained by the contractor through the NEA.

(b) Substations/DCC Center

77. Construction or expansion of substations and the DCC Center will first require site establishment, including an unloading area, storage area and workshop and the establishment of any temporary work camp which will be located at the substation site itself. In the first phase of construction, civil works will be carried out, this includes earthworks for ground leveling and the construction of boundary walls, control building, bay foundation, office cum staff quarter buildings, etc. In the second phase, electrical work will be carried out including transportation and installation of power transformer, current transformers, potential transformer, erection of substation bus bar, erection of transformer bay, line bays, incoming and outgoing lines, terminal gantry, transformer oil filling, control room accessories, lighting arrester and others equipment. Finally, the testing and commissioning stage follows. Typically, a crew of 20 to 25 (7 skilled and remaining unskilled workers) people will be employed and around 6 months will be needed for the construction.

(c) 33 kV Distribution Lines

78. Construction of 33 kV distribution lines will follow a similar process to transmission lines with surveys carried out to ascertain the need to clear the ROW which may have vegetation to be trimmed etc. Equipment (distribution poles, conductors, and transformers) will be transported to the construction site and temporary traffic diversions will be put in place. Digging of any foundation pits is done manually using auguring tools, concrete mixture for foundation is cast, and poles are erected which is done using chain and pulley blocks. Stringing of conductors will be carried out manually on the towers as per design requirements. The process of stringing the cables will engage crew members ranging from 5 to 10 people with multiple groups posted along the alignment for about 1 week. In the event a distribution line crosses road/highways, rivers, or waterbodies, a detailed survey of location of the crossing will be carried out by the contractor to choose the optimum crossing location. Prior approval from roads and waterways authorities for execution of this work shall be obtained by the contractor through NEA. Traffic management will take place during the work at road crossings.

FIGURE 20: TYPICAL NEW TRANSMISSION LINE TOWER DESIGN

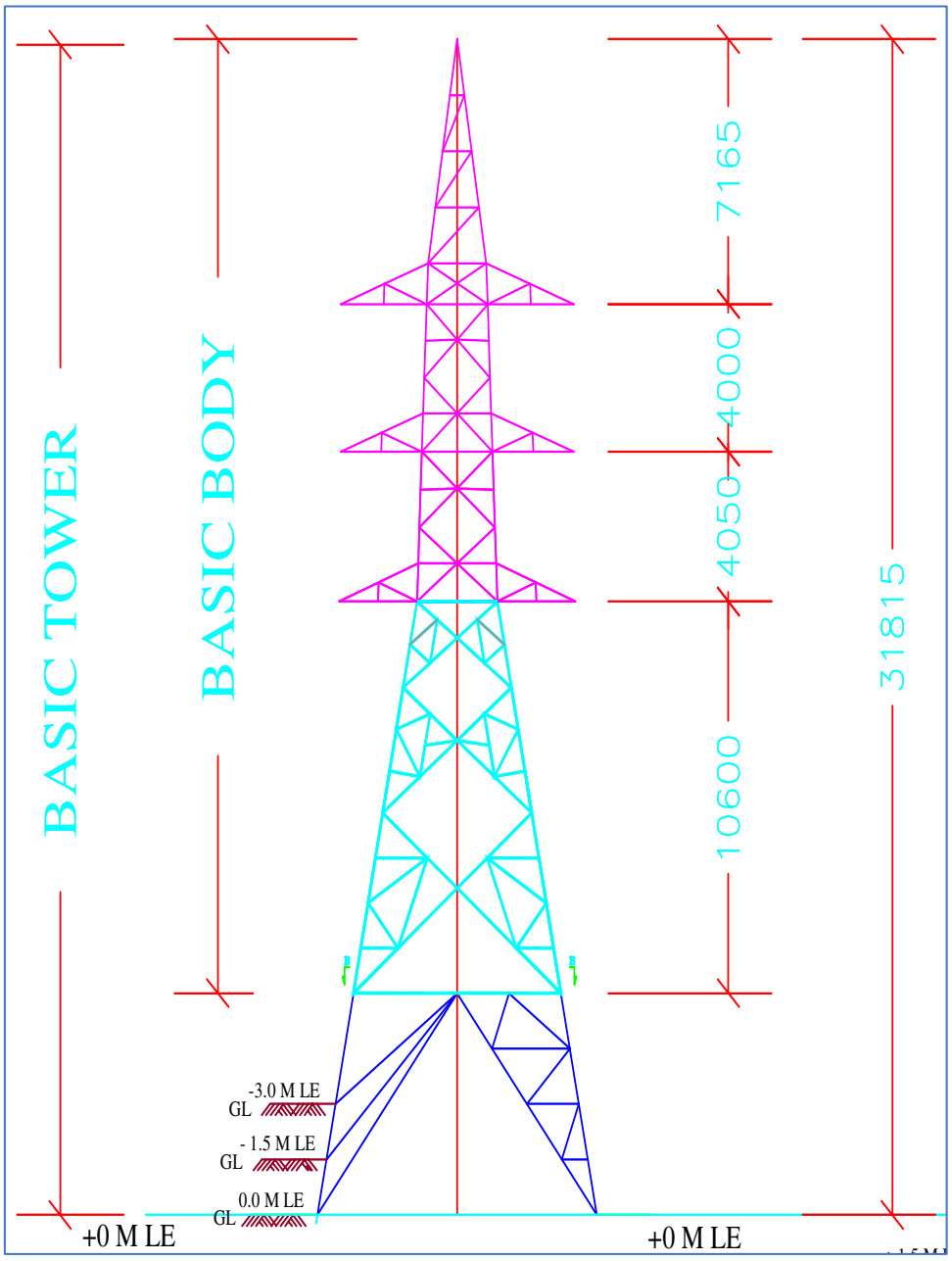


FIGURE 21: TYPICAL PLAN OF TRANSMISSION TOWER FOOTINGS

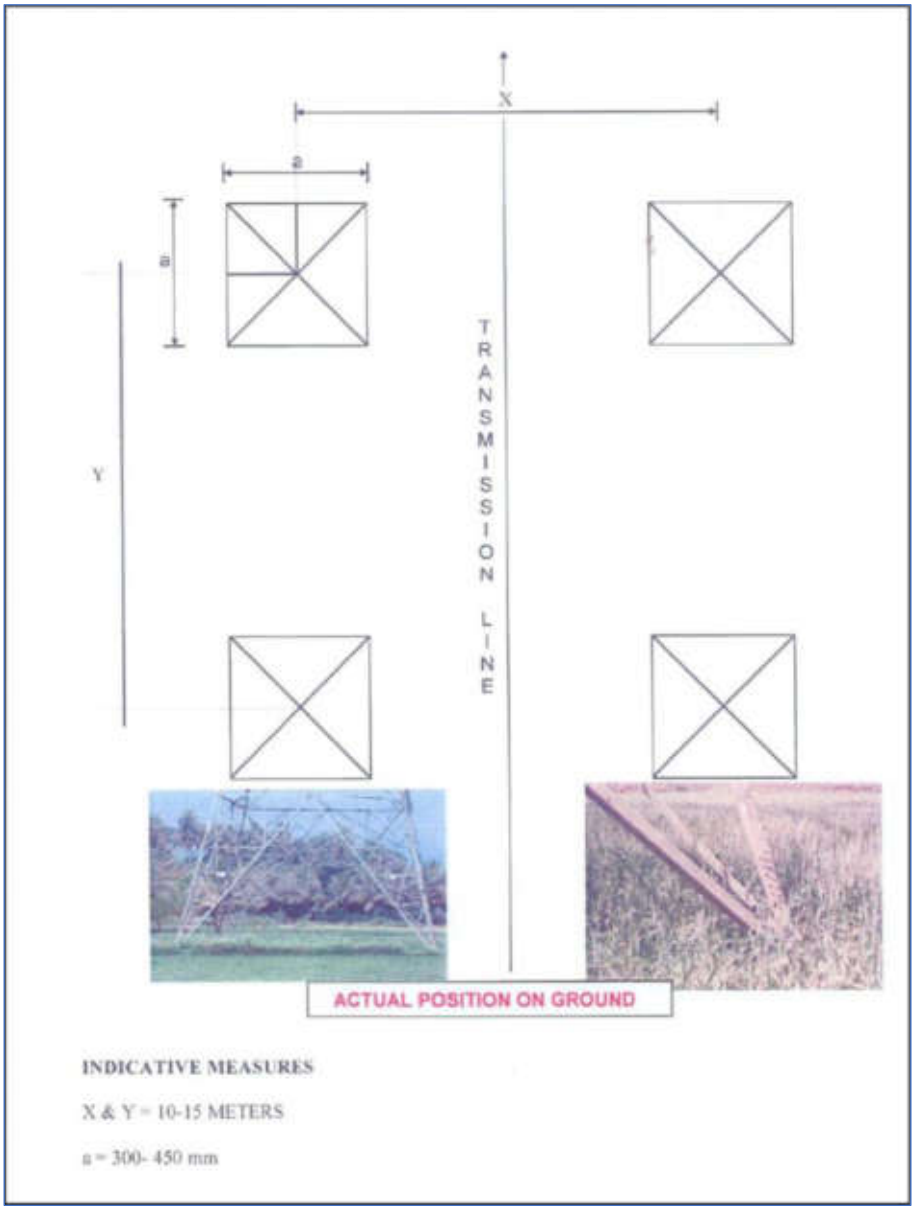


FIGURE 22: TYPICAL CIVIL WORKS FOR INSTALLATION OF TRANSMISSION LINE

D. Operation and Maintenance

79. During the operation and maintenance phase, regular activities that will be implemented include routine monitoring and inspection by NEA's regional/district O&M staff to check the condition and integrity of towers, lines and transformers and that the required safety clearances from trees and structures are being maintained. Maintenance activities will include replacement of missing or corroded parts and the trimming of trees and vegetation if required. The clearing of vegetation will be done manually without the use of heavy equipment and herbicides.

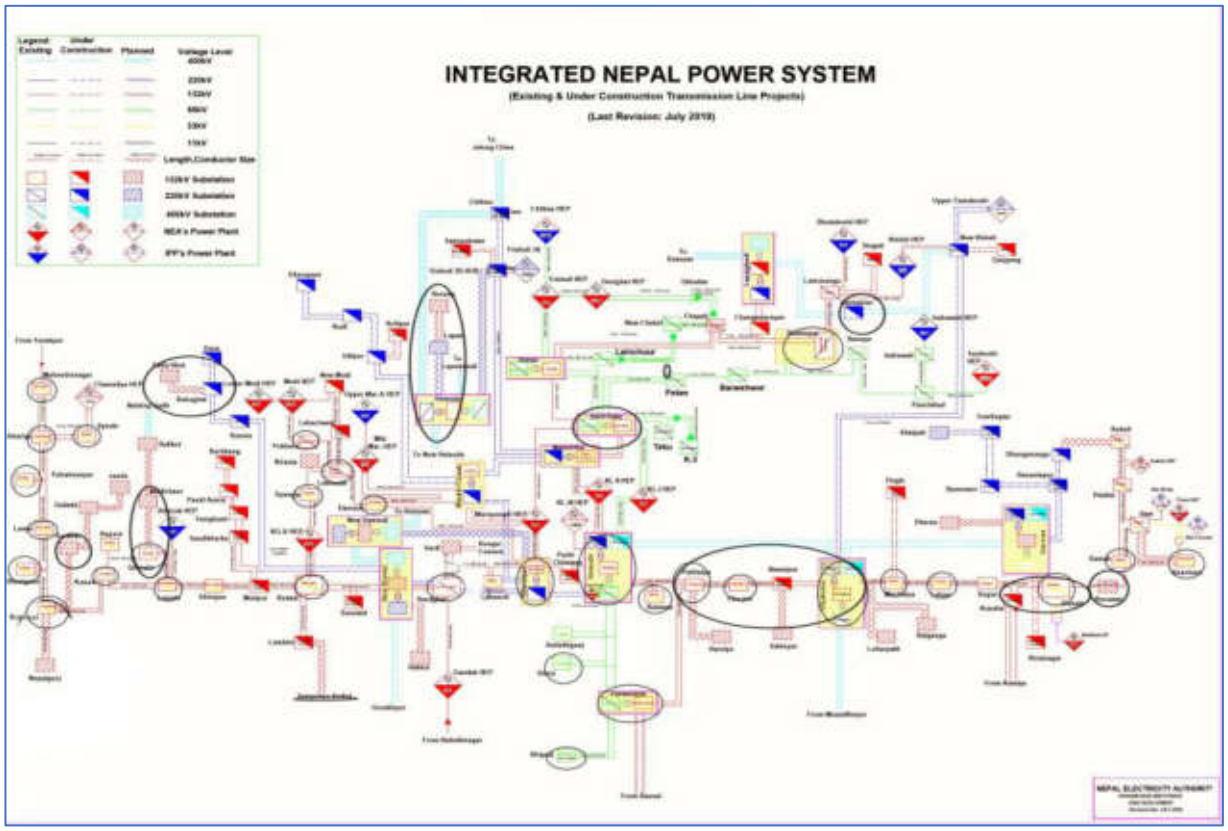
E. Existing Facilities

80. The Project involves expansion and strengthening of the transmission and distribution system of country by construction of new transmission and distribution lines and substations as well as rehabilitation and augmentation of the capacities of the existing transmission infrastructure. The expansion work involves increasing capacities of existing substations (2 nos. namely Ghorahi 132/33/11kV substation and Barhabise 220/132kV substation), and automation of existing substations (34 nos. 220/132/33/11kV, including Ghorahi). These 35 substations are classified as existing facilities as per ADB's Safeguard Policy Statement (2009). An environmental audit of these substations has been undertaken, for Component 6 this comprises the environmental assessment as automation will have minimal impact on the environment. The audit report is provided in Appendix 3, based on which a corrective action plan has been developed which forms part of the project's EMP.

F. Associated Facilities

81. The project components will enhance the capacity of the INPS as shown in Figure 23 which is designed to facilitate delivery of electricity from generation sites to load centers and strengthen in-country transmission systems that will eventually support cross-border power exchange.

FIGURE 23: INTEGRATED NEPAL POWER SYSTEM



82. Nepal has an annual load growth rate of 13.8%. Obviously more power generation is required to meet the increasing load growth. The peak electricity demand of Nepal was about 1,500 megawatts (MW) in 2018 while the total installed generation was only about 1,150 MW. Of the total installed capacity, NEA owned about 600 MW (generating 33% of total electricity sales) and private investors about 550 MW (generating 29% of total electricity sales). This gap between the demand and supply of electricity particularly widens during dry winters (October to March) because of the dominance of run-of-river hydropower plants and the lack of hydropower plants with sufficient storage capacity. To minimize the gap, Nepal is currently importing up to 400 MW of power from India. To reduce the country's power shortfall, the Thirteenth Three-Year Plan, Fiscal Year (FY) 2014–FY2016 envisaged completing 668 MW of new generation and commencing construction of 584 MW of new generation within this period. This target was not achieved. The government has therefore set new targets for generating 15,000 MW by 2027. Survey licenses for 302 new generation projects with a total capacity of 15,885 MW have been issued by the government, of which construction is ongoing for 4,642 MW. Power purchase agreements have been completed for 244 projects with a total capacity of 4,138 MW. The successful completion of these projects will increase electricity supply in Nepal.

83. Transmission lines of different voltage levels totaling 3,990 circuit-kilometers (Ckm) and substations with a total capacity of 3,935 megavolt-amperes (MVA) are operational across the country. About 3,023 Ckm of new transmission lines and substations with capacity of 9,500 MVA are under construction, but even the completion of this additional capacity would be not be sufficient to meet demand. Therefore, the government has given high priority to building new transmission lines and substations. The Fourteenth Three-Year Plan aimed to add 785 km by FY2019. This target was not achieved mainly because of delays in the acquisition of land along the ROWs, delays in forest clearance, and inadequate project management during execution.

84. Inadequate transmission infrastructure has also been a bottleneck in attracting greater investment in new hydropower development by IPPs, the private sector companies permitted under current laws to generate electricity in Nepal. The timely completion of transmission lines under construction and those being planned for the future will be key to developing Nepal's hydropower resources and being able to meet its peak electricity demand in-country. Future hydropower development in the river basins served may be dependent on the 3 new transmission lines to evacuate power to the national grid, and hydropower development in these river basins may be induced as a result of the grid extensions. There are also hydropower currently under construction and in advance stages of preparation, including those that have already secured generation licenses.[7] However, approved hydropower projects in the subject river basins already have agreement from NEA to connect to the national grid by other means and not to the project. The project will not construct any dedicated power evacuation transmission line/substation, therefore, no associated facilities have been identified, as the project components are not dependent on individual hydropower projects being permitted and constructed. Further, any future hydropower projects will be developed independently of the project.

85. All EGMP transmission lines and substations will be connected to the existing grid except the Pangtang substation. Pangtang substation will be connected to the grid through the 18.16 km long Balefi Corridor 132 kV transmission line being developed by the Transmission Directorate of NEA under government financing. Since the viability of these facilities exclusively depends on each other, it is classified as associated facility as per ADB's Safeguard Policy

[7] For hydropower to be approved the developer needs to first secure a survey license from Government of Nepal and during the 5 years that is valid they will seek EIA approval, after which they can be issued with a generation license (https://doed.gov.np/license/66) and will also need to enter into a power purchase agreement with NEA.

Statement (2009). As NEA is developing the Balefi Corridor 132 kV transmission line, they have control over it.

86. Associated facilities of an ADB project must achieve an outcome consistent with the requirements applied to the project i.e. no significant irreversible environmental impacts, environmental assessment, planning and management, consultation and participation, grievance redress, monitoring and reporting etc. Appendix 4 sets out the anticipated impacts and risks of the associated facility informed by the national EIA/IEE completed by NEA.

87. The Balefi Corridor 132 kV transmission line was subject to a national IEE, including baseline surveys and public consultations. The IEE which includes a costed EMP was disclosed and cleared by the Ministry of Energy, Water Resources, and Irrigation in September 2019. NEA awarded a contract for the associated facility in May 2020 but due to the ongoing COVID-19 restrictions mobilization of the contractor is delayed. Impacts and risks associated with this associated facility are similar in nature to those of the 3 new transmission lines included in the project. No protected areas or key biodiversity areas are traversed, but approximately 5.19 km (28.58%) of the alignment lies passes through forest area with a crossing of the Bhotekoshi River. Therefore, to ensure the associated facility is consistent with the requirements applied to the project, NEA and its contractor will also follow the project EMP for the Balefi Corridor 132 kV transmission line with its implementation supervised and monitored by PMD as part of the project.

G. Project Benefits

88. There will be beneficial technical as well as socio-economic impacts as a result of the EGMP implementation. After completion of the project components, the following outputs will benefit the NEA and its customers in seven project provinces of Nepal as well as to the nation:

- Available energy will be best utilized and expected energy spillage in next few years will be better managed.
- Adequate, reliable, and quality power will be ensured for socioeconomic development. Favorable atmosphere will be created for Nepal's economic growth from which more jobs may be created, and the country's economy may be improved.
- Transmission capacity of Kathmandu Valley and other regions of Nepal will increase, to help meet growing demand in the country whilst ensuring a quality and reliable electricity supply.
- Transmission and distribution system modernization will ensure quality and reliable supply, reduce technical losses, provide better service to the consumers, and reduce the number of NEA staff which are required to deliver the required level of service, thereby helping to increase revenue and improve the financial health of NEA.

H. Analysis of Alternatives

89. ADB's Safeguard Policy Statement (2009) and as a key aspect of good environmental practice potential alternatives to the project should be evaluated. In order to achieve this, environmental and social considerations need to be brought into planning from the early stages. In case of EGMP, a range of alternatives to the project and its components has been considered by NEA.

90. **No Project Alternative:** This would have no adverse environmental impacts since no construction works would be involved. However, socioeconomic benefits would not be realized. Unprecedented growth in power consumption has led to severe imbalance in demand and supply of electricity power in the country which has resulted in load shedding. Customers (in 2019 figures show 42.06% of sales were to domestic consumers, followed by 38.21% to industrial customers) would continue to experience unreliable and poor-quality electricity supply. Relying on an old mechanically operated system, NEA would continue to experience technical losses and future increased demand for electricity could not be met, the resulting imbalance in optimization of demand and supply creating an unfavorable environment for economic growth and providing affordable clean energy for all (UN Sustainable Development Goal 7). Moreover, after the current COVID-19 related economic slump in Nepal, there has also been a slump in power consumption. With the economic slowdown, NEA's proactive role in ensuring modern infrastructure makes implementation of this project even more important. There are no current practical alternatives to the project in Nepal for demand and supply economics of energy other than having consumers producing their own energy in isolation. The project will also be helpful for the expansion of rural electrification program to help reduce pressure on fuel wood. Therefore, the "with project" alternative was preferred by NEA over the "no project" alternative.

91. **Location/Route Alternatives**: Location/route alternatives were analyzed by NEA in selecting sites for new substations and the alignment of the 3 new transmission lines, taking into consideration the following criteria.

- RoW which have minimal environmental impact;
- Improvement of reliability of the power system;
- Provide the shortest straight route as far as possible with minimum number of angle points;
- Minimum number of structure crossings;
- Avoid built up, swampy, and unstable areas;
- Provide easy access for construction and maintenance works;
- Avoid settlements as far as possible;
- Proximity of road; and
- Provide short, easy, safe, and economical route for access road.

92. For the 3 new transmission lines comparative studies of different routes, design, and construction methods were done by NEA, as detailed in Appendix 5. Routes have been selected to minimize forest clearance and although a "no forest" option was considered, practically forest could not be completely avoided. Specifically, for the Ghorahi-Madichaur transmission line, the option to avoid the Chure Conservation Area was considered but determined practically not possible as Ghorahi substation is located within the protected area. However, within the Chure Conservation Area the proposed alignment has been routed through agricultural land in the river valley to avoid forest clearance taking place within the protected area.

93. **Other Alternatives**: Other alternatives such as use of existing substation land for construction of new substations; use of existing transmission lines to install additional conductors (avoiding new transmission lines); and air (AIS) or gas (GIS) insulated substations (GIS) the former requiring a greater footprint, and having greater risk of flashover, but the latter

using sulfur hexafluoride (SF6) a potent greenhouse gas were considered in the project planning stages.

94. The principle that has (and will be) adopted for the selection and design of new equipment is to comply with national requirements as well as considering international good practice per the IFC EHS Guidelines particularly with respect to avoiding the use of PCB oils in purchase of transformers, and the use of all asbestos containing materials in new construction.

I. Climate Change Risks

95. The climate change impact of the project is categorized as medium. The project has been assessed for its risk and vulnerability to climate change impacts, identified risks being extremes of temperature and rainfall and more frequent/severe extreme weather events. Design measures have been identified to ensure that these risks can be minimized, including raising plinth heights at substations to avoid inundation by floodwater, constructing retaining walls around substations, providing fire walls between transformers, ensuring project infrastructure withstands 55m/s windspeeds, providing protection/retaining walls for tower foundations in hilly terrain, using pile foundations in flood prone areas, revetment and use of geo-synthetic material in foundation, concrete encasing and painting of stub in water logged areas, use of ACSR Moose conductors, and the usage of pre-stressed cement concrete poles.

96. In addition, the project contributes to climate mitigation by reducing technical losses from the transmission and distribution network and allowing higher penetration of hydropower.

J. Project Cost and Implementation Schedule

97. The total cost estimate for the project is $195 million. ADB will provide $156 million through its ordinary capital resources (OCR) facility with $39 million counterpart funding of NEA. The project will be implemented progressively over five years with completion date by March 2026.

98. Each new transmission line or substation component is anticipated to take 36 months including a 6 months pre-construction phase and a 30 months construction, testing and commissioning phase. The construction work on transmission lines will primarily be carried out during the dry season when ground conditions are essentially dry to allow easy movement of materials and placement of tower. Construction activities during the monsoon season will primarily be restricted to stringing of conductors. For the distribution DCC center, smart metering components and transmission line upgrades estimated implementation schedule is 42 months.

99. Table 21 gives the component wise schedule with an indicative schedule for a new transmission line in Figure 24.

TABLE 21: COMPONENT WISE CONSTRUCTION SCHEDULE

Project Component	Schedule (months)
1. Dandakhet Rahughat Transmission Line	30
2. Ghorahi Madichaur Transmission Line	30
2. Borang Ratmate Transmission Line	30
4. Pangtang SS and Barhabise Bay Extension	30
5. Keraun SS	30
6. Substation Automation	30
7. Distribution Command and Control Center	42
8. Smart Metering	42
9a. Pathlaiya Dhalkebar Transmission Line	42
9b. Duhabi Kusaha Transmission Line	
9c. In Kathmandu 14 km 66kV DC Lines	
1. Suichatar - Matatirtha 5km DC ACSR Bear	
2. Suichatar - Balaju 4.5km SC ACSR Bear	
3. Suichatar - Teku 4.5km DC ACSR Bear	

FIGURE 24: INDICATIVE CONSTRUCTION SCHEDULE FOR NEW TRANSMISSION LINE COMPONENT

SN	Activity	Period in Months																																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	Survey, Soil Investigation and Contouring																																				
2	Design Work																																				
3	Supply of Stubs and Towers																																				
4	Foundations																																				
5	Erection of Towers																																				
6	Supply of Line Material																																				
7	Stringing																																				
8	Protection of Tower Footings																																				
9	Testing, Commissioning and Handing Over																																				

IV. DESCRIPTION OF THE ENVIRONMENT

100. In order to establish the physical, biological socio-economic and physical cultural conditions/baseline setting of the 3 new transmission lines and associated substations as well as the new Pangtang substation field surveys were carried out for by a team of consultants appointed by NEA as part of the national environment assessment processes who also undertook consultations as part of the detailed route surveys for the 3 new transmission line and associated facilities starting in 2018. For remaining components due to COVID-19 restrictions the physical, biological socio-economic and physical cultural conditions were primarily identified through secondary data and information collected through consultation questionnaires although field visits and consultations were undertaken in Kathmandu Valley until July 2020.

101. In this chapter, the environmental setting of the project components is discussed first followed by the description of the environment (physical, biological, and socio-economic and physical cultural) in the project area of influence. As the project activities are spread over seven provinces of the country, the general environmental setting of the affected provinces is presented with specific details focused on key components mainly new and upgraded transmission lines.

A. Environmental Setting of the Project Components

102. Key environmental setting features of the project components are presented in Table 22 and discussed in subsequent paragraphs.

Table 22: Summary Environmental Setting Features of Project Components

Sl. No.	Project Component	Scope/Activities under Component	Location			Key Environmental Features
			Province	Districts	Municipalities	
1	Construction of Dandakhet - Rahughat 132 kV Transmission Line and associated Substations	a. Construction of 25km long 132 kV overhead transmission line (TL) from Dandhakhet - Rahughat	Gandaki	Myagdi	Beni Municipality, Rahughanga RM, Mangala RM, Malika RM and Dhaulagiri RM	• Terrain – hilly with mild and steep slopes, to undulating landforms and flat terrain. • Land Use – mix of cultivated land, forest land, barren land, waterbodies, and roads. • Structures within 500m – 1,401 • Structures within ROW – 4no. (3 houses and 1 cowshed). • Private land affected – 18.98 ha & 57 households (HH) • Crossings – 39 earthen roads, 6 major rivers, 27 small rivulets, 1 no. 220kV line, and 13 nos. 11kV lines. • Habitat – Natural and Modified • Forests – 18 community forests and 1 Government Forest • Trees Lost – 6,678 (2,936 trees from forest land and 3,742 private trees) • Protected Areas within 25 km – Annapurna Conservation Area, Dhorpatan Hunting Reserve, Lake Cluster of Pokhara Valley Ramsar Site • Key biodiversity area within 25km – Annapurna Conservation Area, Dhorpatan Hunting Reserve • Physical Cultural Resources in 500m – None (subject to reconfirmation on site) • Existing Access to the Project Area – Yes, Gravel Road
		b. Construction of new 220/132 kV substation at Rahughat	Gandaki	Myagdi	Rahughanga RM	• Land Area – 4.61 ha • Land Type and Status – private, acquired by NEA • Terrain – undulating • Land Use – agricultural cultivated land • Structures within 500m – None • Wells or water bodies within 500m – River

Sl. No.	Project Component	Scope/Activities under Component	Location			Key Environmental Features
			Province	Districts	Municipalities	
						• Habitat – Modified • Trees – none • Protected Areas within 10 km – Annapurna Conservation Area • Key biodiversity area within 10km – Annapurna Conservation Area • Physical cultural resources within 500m – None • Existing Access to the Project Area – Yes • New Access Track to Substation Required - No
		c. Construction of new 132/33 kV substation at Dandakhet	Gandaki	Myagdi	Malika RM	• Land Area – 2.61 ha • Land Type and Status – private, acquired by NEA • Terrain – hilly (undulating with slope 23%) • Land Use – agricultural cultivated land • Structures within 500m – None • Wells or water bodies within 500m – River • Habitat – Modified • Trees – none • Protected Areas within 10 km – None • Key biodiversity area within 25km – None • Physical cultural resources within 500m – None • Existing Access to the Project Area – Yes • New Access Track to Substation Required - No
2	Construction of Ghorahi - Madichaur 132 kV Transmission Line and associated substation	a. Construction of 40 km long 132 kV overhead transmission line from Ghorahi to Madichaur	5	Rolpa, Pyuthan, Dang	Surwarnawati RM, Sworgadwary Municipality, Banglachuli RM, Ghorahi SMC	• Terrain – mixed, flat with gentle slopes, steep slopes, and undulating landforms • Land Use – mix of cultivated land, forest land, barren land, waterbodies, and road. • Structures within ROW – None • Private land affected – 25.60 ha & 47 HH

Sl. No.	Project Component	Scope/Activities under Component	Location			Key Environmental Features
			Province	Districts	Municipalities	
						• Crossings – 4 roads including Ghorahi-Lamahi Highway, 24 rivers, 64 small rivulets, 6 nos. 33kV line, and 5 nos. 11kV lines. • Habitat – Natural and Modified • Forests – 18 community forests and 3 Government Forests • Trees Lost – 5,109 (4,674 trees in forest and 435 private trees) • Protected Areas within 25km – about 7.4 km passes directly through Chure Conservation Area (Environmental Protection Area). • Key biodiversity area within 25km – Dang Deukhuri Foothill Forests and West Rapti Wetlands, about 400m passes through the outer edge of recently-revised (unpublished) boundary • Physical cultural Resources within 500m – Janaki Temple at ward no 1, Kalimati, Dang district within 50m (subject to reconfirmation on site) • Access to the Project Area – Yes, Earthen Road
		b. Construction of new 132/33 kV substation at Madichaur	5	Rolpa	Surwarnawati RM	• Land Area – 2.4006 ha • Land Type and Status – Private, acquired • Terrain – flat to undulating • Land Use – Agricultural cultivated land • Structures within 500m – Yes • Wells or water bodies within 500m – River • Habitat – Modified • Trees – none • Protected Areas within 10 km – None • Key biodiversity area within 10km – None • Physical cultural resources within 500m – None

Sl. No.	Project Component	Scope/Activities under Component	Location			Key Environmental Features
			Province	Districts	Municipalities	
						• Existing Access to the Project Area – Yes • New Access Track to Substation Required – No
		c. Extension of Ghorahi substation				• Extension will be carried out within boundary of the existing substation. • Structures within 500m – 136 houses • Wells or water bodies within 500m – Wells, River • Habitat - Modified • Protected Areas within 25km – within Chure Conservation Area (Environmental Protection Area). • Key biodiversity area within 10km – Dang Deukhuri Foothill Forests and West Rapti Wetlands • Physical cultural resources within 500m – None
3	Construction of Borang - Lapang - Ratmate (132/220kV) Transmission Line and associated substations	a. Construction of 25 km long 220 kV overhead transmission line from Ratmate to Lapang	Bagmati	Dhading, Nuwakot	Tripurasundari RM, Netrawati RM, Neelkantha Municipality, Tarkeshwar RM, Belkotgadhi Municipality	• Terrain – mix of flat land with gentle slopes, steep slopes, and undulating landforms • Land Use – mix of cultivated land, forest, barren land, and others • Structures within 500m – 3,563, including school within 50m at Dabjong village of Netrawati RM, ward no 1, Dhading district. • Structures within ROW – 28 (12 residential, 3 kitchen, 6 cowshed and 7 toilet) • Private land affected – 79.6 ha & 149 HH • Crossings – 83 roads crossings, 6 river crossings, 82 rivulets, and 20 nos. 33/11kV lines. • Habitat – Natural and Modified • Forests –15 community forests and 6 Government Forest • Trees –9,521 (5,340 in trees in forest land and 4,181 private trees)
		b. Construction of 23 km long 132 kV overhead transmission line from Lapang to Borang	Bagmati	Dhading	Rubi Valley RM, Khaniyabash RM, Netrawati RM, Tripurasundari RM	

Sl. No.	Project Component	Scope/Activities under Component	Location			Key Environmental Features
			Province	Districts	Municipalities	
						• Protected Areas within 25 km – Jiang Cun (PRC) Nature Reserve (province level), Langtag National Park, Manaslu Conservation Area, Shivapuri-Nagarjun National Park • Key biodiversity area within 25km – Langtang National Park, Shivapuri-Nagarjun National Park • Physical Cultural Resources in 500m – No (subject to reconfirmation on site) • Existing Access to the Project Area – Yes
		c. Construction of new 220/132/33 kV substation at Lapang	Bagmati	Dhading	Tripurasundari RM	• Land Area – 5.69 ha • Land Type and Status – private, acquisition in progress. • Terrain – flat to undulating • Land Use – agricultural cultivated land • Structures within 500m – Yes, 1 school, 500 houses • Wells or water bodies within 500m – River • Habitat - Modified • Trees – none • Protected Areas within 10 km – None • Key biodiversity area within 10km – None • Physical cultural resources within 500m – None • Existing Access to the Project Area – Yes • New Access Track to Substation Required - No
		d. Construction of new 132/33 kV substation at Borang	Bagmati	Dhading	Rubi Valley RM	• Land Area - 7.70 ha • Land Type and Status – private, acquired by NEA • Terrain – undulating • Land Use – agricultural cultivated land • Structures within 500m – 12 Houses • Wells or water bodies within 500m – Rivers

Sl. No.	Project Component	Scope/Activities under Component	Location			Key Environmental Features
			Province	Districts	Municipalities	
						• Habitat - Modified • Trees – none • Protected Areas within 10 km – None • Key biodiversity area within 10km – None • Physical cultural resources within 500m – None • Existing Access to the Project Area – Yes • New Access Track to Substation Required - No
4	Construction of 132/33/11 kV Substation at Pangtang	a. Construction of new 132/33 kV substation at Pangtang	Bagmati	Sindhupal chowk	Jugal RM	• Land Area – 2.65 ha • Land Type and Status – private, acquired by NEA • Terrain – Hilly • Land Use – agricultural cultivated land • Structures within 500m – 14 Houses • Wells or water bodies within 500m – Stream • Habitat - Modified • Trees – none • Protected Areas within 10 km – Gauri-Shankar Conservation Area, Langtang National Park BZ • Key biodiversity area within 10km – Langtang National Park • Physical cultural resources within 500m – None • Existing Access to the Project Area – Yes (gravel road will need upgrading) • New Access Track to Substation Required - Yes, about 250m access track to substation door
		b. Extension of Barhabise Substation				• Extension will be carried out within boundary of the existing substation. • Structures within 500m – 1 school and 67 houses • Wells or water bodies within 500m – stream and spring • Habitat - Modified

Sl. No.	Project Component	Scope/Activities under Component	Location			Key Environmental Features
			Province	Districts	Municipalities	
						• Protected Areas within 10 km – Gauri-Shankar Conservation Area • Key biodiversity area within 10km – none • Physical cultural resources within 500m – None
5	Construction of 132/33/11 kV substation at Keraun (Morang)	a. Construction of new 132/33 kV substation at Keraun.	1	Morang	Kanepokhari RM	• Land Area – 3.52 ha • Land Type and Status – private, acquired by NEA • Terrain – flat • Land Use – agricultural cultivated land • Structures within 500m – Yes 249 houses • Wells or water bodies within 500m – Yes, Irrigation Canal and Pond • Habitat - Modified • Trees – None • Protected Areas within 10 km – None • Key biodiversity area within 10km – None • Physical cultural resources within 500m – None • Existing Access to the Project Area – Yes • New Access Track to Substation Required - No
		b. Construction of 30 km associated 33 kV distribution lines.	1	Morang	Kanepokhari RM	The alignment of 33kV lines will mostly run along existing canal and roads. Final route will be finalized following detailed route surveys and this IEE will be updated accordingly. • Protected Areas within 10 km – None • Key biodiversity area within 10km – None
6	Grid Substation Automation (Outside	Installation of substation automation system at around 34 nos. of	Bagmati, 2, 1, 5, Gandaki,	See Table 25	See Table 25	Grid substation automation will be carried at 34no. existing substations all over the country (outside of the Kathmandu Valley).

Sl. No.	Project Component	Scope/Activities under Component	Location			Key Environmental Features
			Province	Districts	Municipalities	
	Kathmandu Valley)	400/220/132/ 66/33/11 kV existing substations outside of the Kathmandu Valley	Far Western			Detailed baseline of these substations is provided in Appendix 3. • Existing substations in Protected Areas and their buffer zones– o Bharatpur, Ghorahi, Hetauda, Kamane, and Lamahi – Chure Conservation Area o Bhurigaun –Bardiya National Park BZ o Kusum – Banke National Park and Chure Conservation Area o Lakhanatri – Lake Cluster of Pokhara Valley Ramsar Site o Mahendranagar - Suklaphanta Wildlife Reserve BZ o Pokhara – Lake Cluster of Pokhara Valley Ramsar Site o Simra –Parsa National Park BZ • Existing substations in key biodiversity area– o Bhurigaun –Bardiya National Park o Godak – Mai Valley Forests o Kusum - Dang Deukhuri Foothill Forests and West Rapti Wetlands, Banke National Park o Lamahi – Dang Deukhuri Foothills Forest and West Raptai Wetlands o Mahendranagar - Suklaphanta Wildlife Reserve o Simra – Parsa National Park Buffer Zone
7	Construction of Distribution Command and Control Center	Construction of Distribution Command and Control Center	Bagmati,	Kathmandu	Nagarjun Municipality	To be constructed at existing Suichatar substation of Nagarjun Municipality, Kathmandu District, Bagmati Province. Works will be carried out within the boundary of existing substation. Detailed baseline for this substation is

Sl. No.	Project Component	Scope/Activities under Component	Location			Key Environmental Features
			Province	Districts	Municipalities	
		Building and related infrastructure, hardware, and software				provided in Appendix 3. It is not located in a protected area or key biodiversity area.
8	Smart Metering in Kathmandu Valley (2nd Phase)	Installation of 350,000 smart meters and related equipment in 9 distribution centers of NEA.	Bagmati	Kathmandu, Lalitpur, Bhaktapur		The smart metering work will be done in Kathmandu Valley by replacement of existing electromechanical meters with smart meters and related equipment (hardware and software) at the current premises of the existing consumers.
9	132 kV/66 kV Transmission Line Conductor Upgradation	a. Upgrading conductor (DC) on 102km 132kV Pathlaiya-Dhalkebar transmission	2	Bara, Rautahat, Sarlahi, Mahottari, Dhanusha	Jitpur Simara SMC, Nijgad Municipality, Gujara Municipality, Chandrapur Municipality, Bagmati Municipality, Hariwan Municipality, Lalbandi Municipality, Ishworpur Municipality, Bardibas Municipality, Gaushala Municipality,	• Terrain – flat to undulating • Land Use – mix of cultivated land, forest, barren land, and others • Structures within 500m – 204 • Structures within existing ROW – 147 • Crossings – 32 rivers, rivulets, 87 roads/highways, and transmission lines (132/66/11 kV). • Habitat – Natural and Modified • Forests – 47.76km alignment passes through forest area, existing ROW. • Trees – work will be carried out on existing towers and within the exiting ROW. However, trimming of trees (more than 5m height) below the transmission line within the ROW may be required particularly in forest areas. • Protected Areas within 25km –passes through Chure Conservation Area and within the boundary of the newly extended Parsa National Park; Proposed Bara Conservation Area.

Sl. No.	Project Component	Scope/Activities under Component	Location			Key Environmental Features
			Province	Districts	Municipalities	
					Mithila Municipality	• Key biodiversity area within 25km – Parsa National Park. • Physical Cultural Resources within existing ROW – None • Existing Access to the Project Area – Yes
		b. Upgrading conductor on 28 km 132kV SC Duhabi-Kusaha transmission line	1	Sunsari	Koshi RM, Bokraha RM, Inaruwa Municipality, Gadhi RM, Duhabi Municipality	• Terrain – mostly flat • Land Use – mix of cultivated land and barren land • Structures within 500m – 113 • Structures within ROW – 76 • Private land affected – None • Crossings – 10 rivers, rivulets, 34 roads/highways, and distribution lines (33/11 kV). • Habitat – Natural and Modified • Forest - None • Trees – work will be carried out on existing towers and within the existing ROW. However, trimming of trees (more than 5m height) below the transmission line within the ROW may be required. • Protected Areas within 25 km – passes through the buffer zone of Koshi Tappu Wildlife Reserve; Koshi Tappu Wildlife Reserve, Koshi Tappu Ramsar Site, Chure Conservation Area, Ramdhuni Protected Forest. • Key biodiversity area within 25km – situated within Koshi Tappu Wildlife Reserve and Koshi Barrage IBA; Dharan Forest IBA. • Physical Cultural Resources within existing ROW – None • Existing Access to the Project Area – Yes

Sl. No.	Project Component	Scope/Activities under Component	Location			Key Environmental Features
			Province	Districts	Municipalities	
		c. Upgrading conductors on 14 km 66kV transmission lines inside Kathmandu valley	Bagmati	Kathmandu, Bhaktapur, Lalitpur		• Terrain – flat to undulating • Land Use – dense urban • Structures within 500m – 642, there are schools and government buildings along the alignment of the lines in Kathmandu Valley. • Structures within ROW – 249 • Private land affected – None • Crossings – urban road crossings, river crossings, and crossings of 33/11kV lines. • Forests – Swayambhu Forest / religious forest • Trees – work will be carried out on existing towers and within the existing ROW in urban area. However, trimming of trees (more than 5m height) below the transmission line within the ROW may be required. • Habitat – Modified • Protected Areas within 10 km – Shivapuri Nagarjun National Park, Proposed Phulchoki Conservation Area • Key biodiversity areas within 10km – None (Phulchoki Mountain Forest is further southeast; its boundaries are different to Proposed Phulchoki Conservation Area) • Physical Cultural Resources within ROW – Yes, about 150m length of the Suichatar-Balaju 66kV line passes through the current boundary of the UNESCO Kathmandu Valley (Swayambhu) World Heritage Site. Also, there are small temples along the alignment of the lines in Kathmandu Valley. • Existing Access to the Project Area – Yes

(a) Component 1. Dandakhet - Rahughat 132 kV Transmission Line and associated Substations

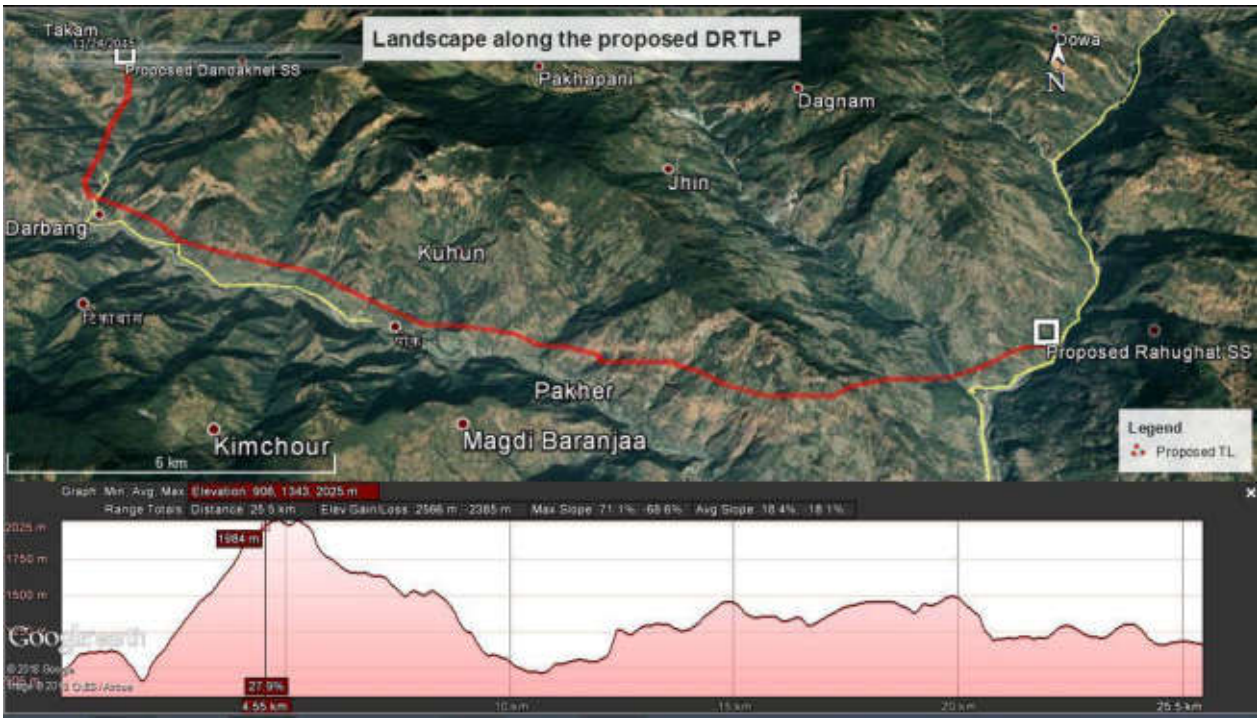
103. **Dandakhet - Rahughat Transmission Line:** the alignment mostly runs (Figure 25 and linked photographs) through rugged hills with mild and steep slopes, to undulating land forms and flat terrain with ground elevation ranging from 959m to 2,023.37 meters above sea level (masl) at Kaseri Muhan village, Mangala RM-2 (AP15) and Dholsthan village, Beni Municipality-9 (AP7) respectively. The main land use pattern along the alignment is mix of 20.58% cultivated land, 52.28% forest, 22.44% barren land, 3.78% waterbodies and 0.92% road [13.0% rainfed cropland, 4.5% herbaceous cover, 0.9% irrigated or post-flooding cropland, 9.5% mosaic >50% cropland/<50% tree, shrub, herbaceous cover, 20.1% mosaic >50% tree, shrub, herbaceous cover/<50% cropland, 6.1% tree cover, >15% broadleaved, evergreen, closed to open, 17.4% tree cover, >15% broadleaved, deciduous, closed to open, 8.3% tree cover, >40% broadleaved, deciduous, closed, 20.2% tree cover, >15% needle leaved, evergreen, closed to open] (Figure 26).

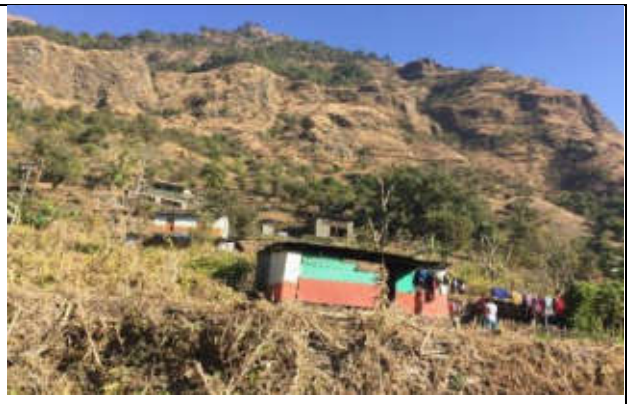
104. The alignment avoids densely populated areas, major structures, religious places, schools, and other community infrastructures. Major crossings include the 39 earthen roads, 6 major rivers, 27 small rivulets, 1 no. 220kV line, and 13 nos. 11kV lines. Major river crossings are Myagdi Khola crossed 5 times and Rahuganga Khola crossed once. 12.87 km (52.28%) length of the alignment lies is in the forest area (canopy cover not recorded by surveyors) affecting 23.17 ha of forest land across 18 community forests (22.217 ha) and 1 government forest (0.949 ha). 0.403 ha of forest land is permanently required for 28 tower pads. 2,936 trees (823 trees and 2,113 poles) are estimated to be lost from this forest land. Besides this, about 3,742 trees are expected to be lost from private land. Total number of trees expected to be lost is 6,678 but subject to confirmation on site. Whilst there are protected areas and key biodiversity areas in the wider area, the ROW is not located within any protected area or key biodiversity area. No physical cultural resources have been identified within 500m, subject to reconfirmation on site. The main access to the transmission line alignment is Prithivi Highway and Pokhara-Baglung surfaced road up to Galeshwor-Myagdi.

105. **Rahughat substation**: The terrain is undulating (sloping towards the east at 20-25%) and ground elevation is 976.96 masl. The land is cultivated but currently there are no crops. The land belonged to a private owner and NEA has completed the land acquisition process. The site is undulating therefore some cut and fill will be required. Within 500m, sensitive receptors are a river (Kaligandaki River) flowing at 200m to the east. The site is accessible through Beni-Jomsom highway.

106. **Dandakhet substation**: The terrain is undulating (sloping towards west at 10-15%) and ground elevation is 1,153.75 masl. The land is cultivated, currently paddy and seasonal crops. The land belonged to a private owner and NEA has completed the land acquisition process. The site is undulating therefore some cut and fill will be required. Within 500m, sensitive receptors are a river (Myagdi Khola) flowing at 50m to the west with river training works being required due to proximity to the substation site. The site is accessible through Beni-Tatopani-Darwang surfaced road.

Figure 25: Alignment of Dandakhet - Rahughat Transmission Line and Substation Locations

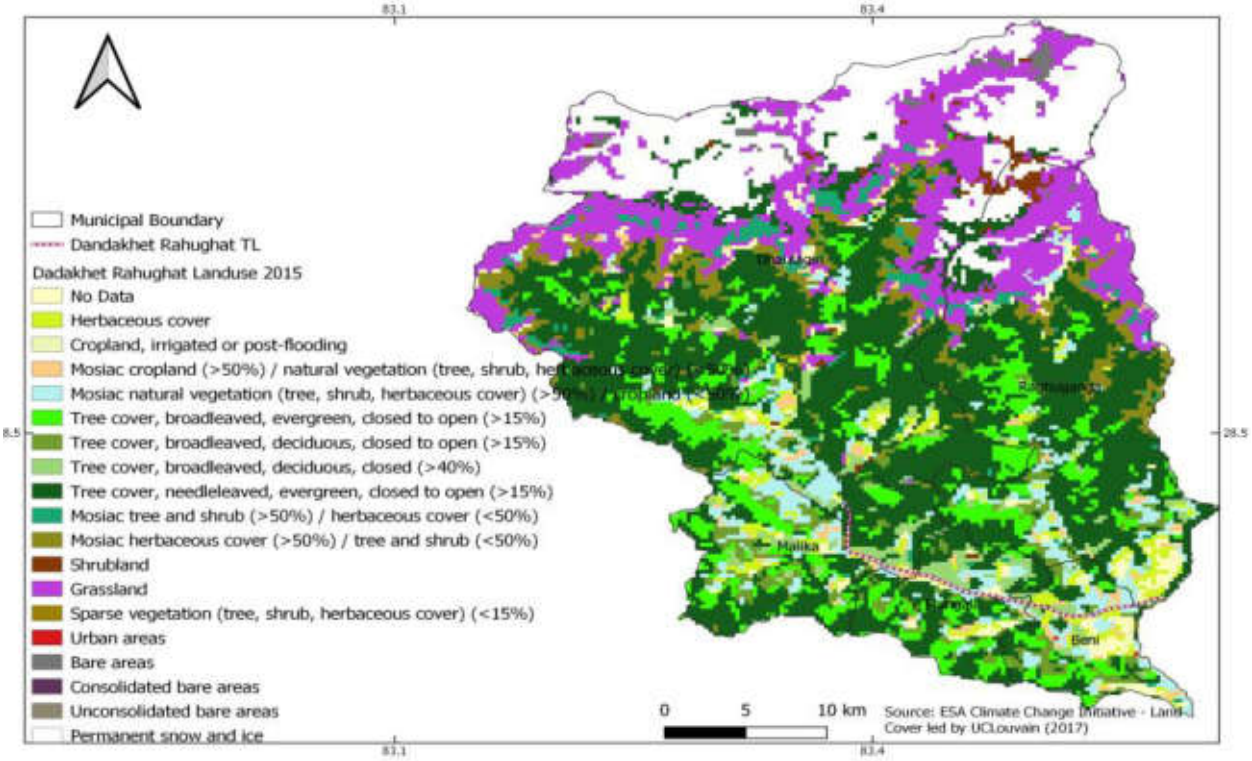


	
Alignment route of the transmission line	**Settlement along the alignment of the transmission line (outside ROW)**

Proposed site of Rahughat Substation

Proposed site of Dandakhet Substation

Figure 26: Land use map along Dandakhet-Rahughat line



(b) Component 2. Ghorahi - Madichaur 132 kV Transmission Line and associated Substation

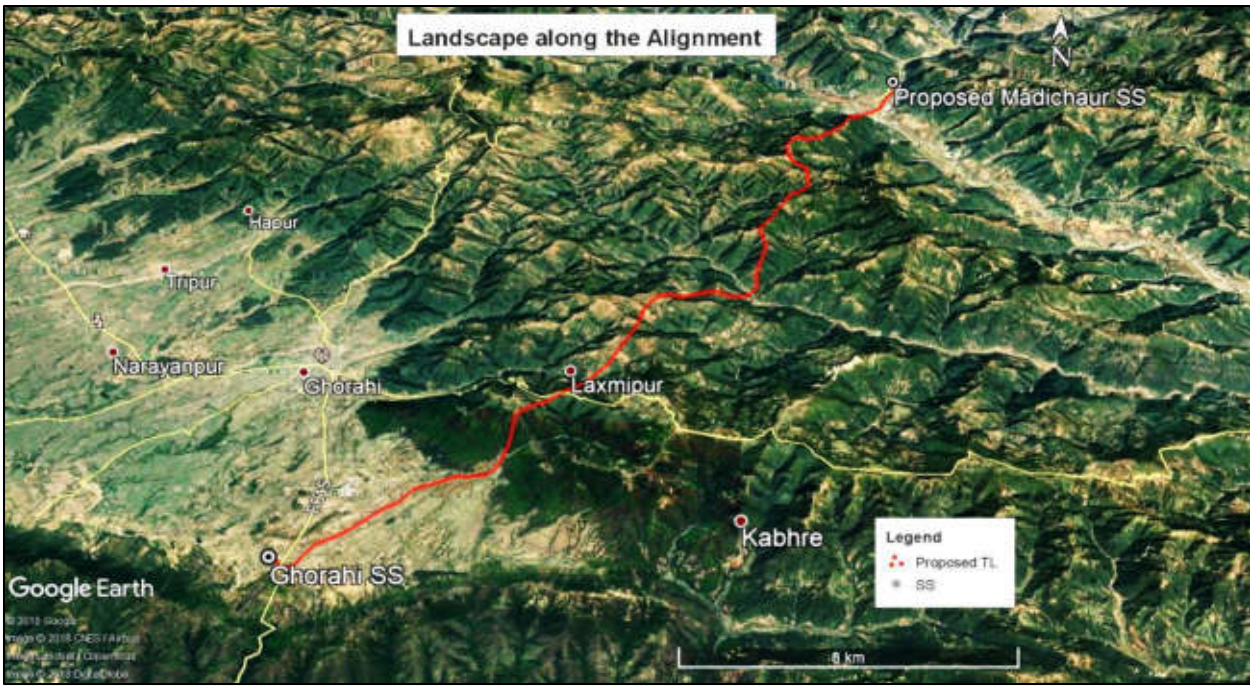
107. **Ghorahi - Madichaur Transmission Line:** The alignment (Figure 27 and linked photographs) mostly runs through mixed terrain comprising of flat land with gentle slopes, steep slopes, and undulating landforms with ground elevation ranging from 602.52 to 1838.42 masl. The main land use pattern along the alignment is mix of 26.67% cultivated land, 49.12% forest, 14.38% barren land, 7.73% waterbodies and 2.10% road [17.7% rainfed cropland, 4.6% herbaceous cover, 7.8% irrigated or post-flooding cropland, 2.5% mosaic >50% cropland/<50%, tree, shrub, herbaceous cover, 13.9% mosaic >50% tree, shrub, herbaceous cover/<50% cropland, 13.3% tree cover, >15% broadleaved, deciduous, closed to open 24.4% tree cover, >40%broadleaved, deciduous, closed, 13.6% tree cover, >15% needle-leaved, evergreen, closed

to open, 1.4% mosaic >50% tree and shrub/<50% herbaceous cover, 0.8% evergreen shrubland] (Figure 28).

108. The alignment avoids densely populated areas, major structures, religious places, schools, and other community infrastructures. Major crossings include 4 roads including Ghorahi-Lamahi Highway, 24 rivers, 64 small rivulets, 6 nos. 33kV line, and 5 nos. 11kV line. Major river crossings are Madi River once, Arun Khola once, Tyan Tyan Khola once, Sisne Khola once, and Balim Khola 18 times, and Babai Khola 2 times. About 15.39 km (42.12%) length of the alignment passes through forest area (canopy cover 20 to 50%) affecting 33.8 ha of forest land across 18 community forests (26.47 ha) and 3 government forest (7.33 ha). 1.52 ha of forest land is permanently required for 122 tower pads. 4,674 trees (2,527 trees and 2,147 poles) are estimated to be lost from this forest land. Besides this, about 435 trees are expected to be lost from private land. Total number of trees expected to be lost is 5,109 but subject to confirmation on site. 7.4km of the alignment from Ghorahi substation runs within the Chure Conservation Area (Figures 7 and 28) affecting 13.32 ha land (0.36 ha permanent for towers). The land use traversed within the Chure Conservation Area is a mix of cultivated land, barren land, waterbody, and road. About 400m of the alignment also runs through the recently revised (unpublished) boundary of the Dang Dekhuri Foothill Forest and West Rapti Wetlands a Key Biodiversity Area, its original boundary lies 5-6km to the south of Ghorahi substation. Consultation with Bird Conservation Nepal (BCN) officials indicated that this site is globally significant as it is habitat of threatened bird species and that the Charinge Community Forest in the foothills of the Chure Hills to the east of the alignment is a good nesting site for White-rumped Vulture and Slender-billed Vulture. The nesting site of vultures as indicated by BCN officials is about 2 km from the alignment. There are also vulture feeding stations at Bijauri far west of the alignment. Figures 30 and 31 shows the location maps of the original and recently revised boundary of Dang Dekhuri Foothill Forest and West Rapti Wetlands. Janaki Temple at ward no 1, Kalimati, Dang district is within 50m of the alignment (Figure 32) -- no other physical cultural resources have been identified, subject to reconfirmation on site. The main access to the transmission line alignment is Liwand road which runs parallel at a distance of 200-300m and through Domai surfaced road and Ghorahi-Lamahi Highway.

109. **Madichaur substation**: The terrain is flat to undulating (sloping towards east at 15-20%) and ground elevation is 790 masl. The land use is cultivated land with crops. The land belongs to private owner and NEA has completed the land acquisition process. The site is flat to undulating therefore some cut and fill will be required. There are no settlements within 500 m. However, individual structures are located at about 150m distant. The Madi river is about 200m away to the east. The proposed substation site is accessible through Liwang surfaced road.

Figure 27: Alignment of Ghorahi to Madichaur 132 kV Transmission Line and Substation Location



Alignment Route of the Transmission Line

Proposed Site of Madichaur Substation

Forest Habitat along the Alignment

Modified Habitat Along the Alignment

Figure 28: Land use map along Ghorahi-Madichaur line

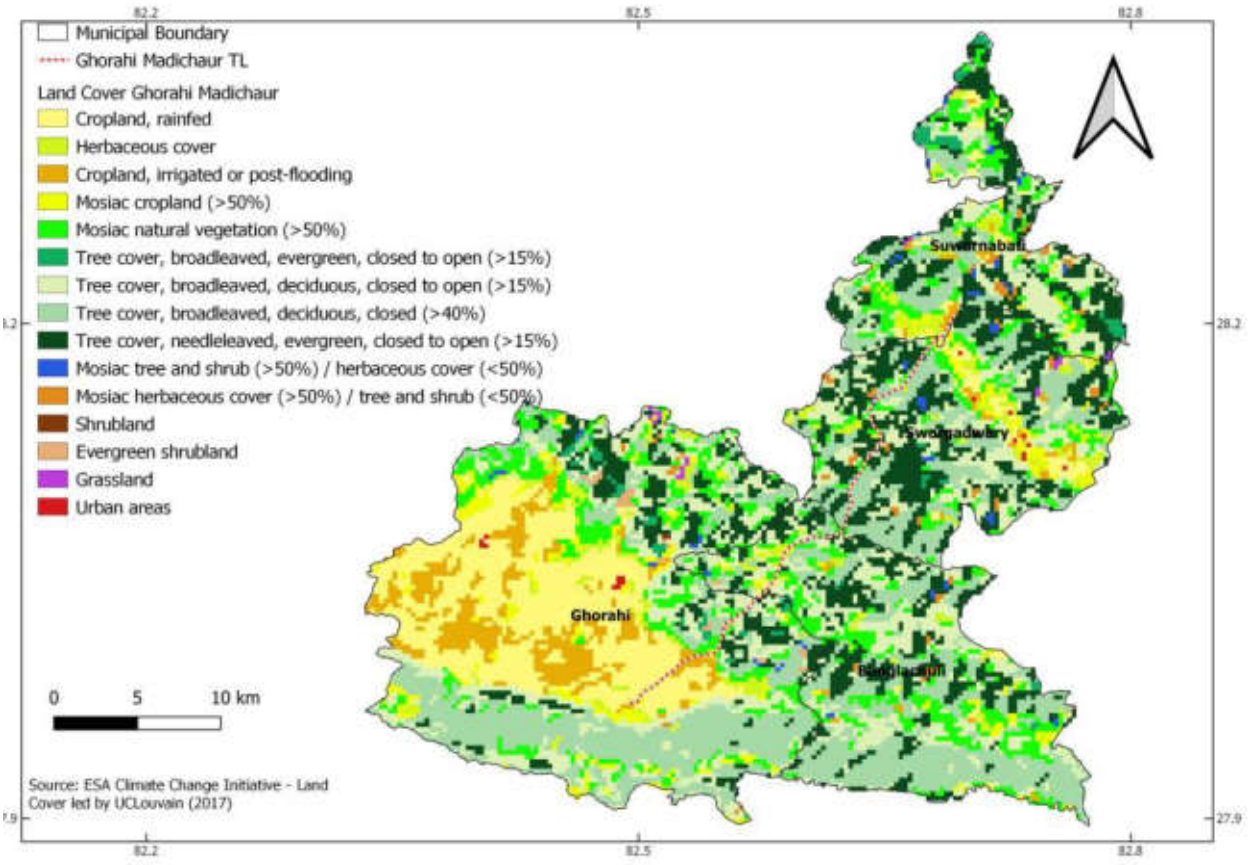


Figure 29: Alignment in Chure Conservation Area (from Ghorahi Substation-Tower AP36)

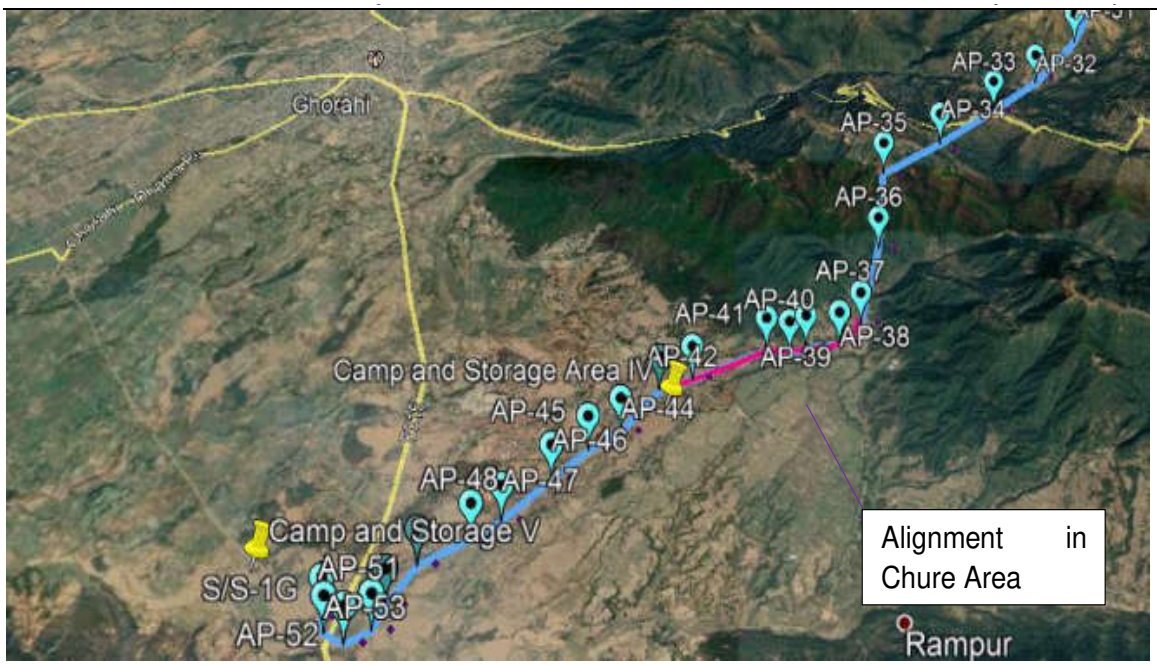
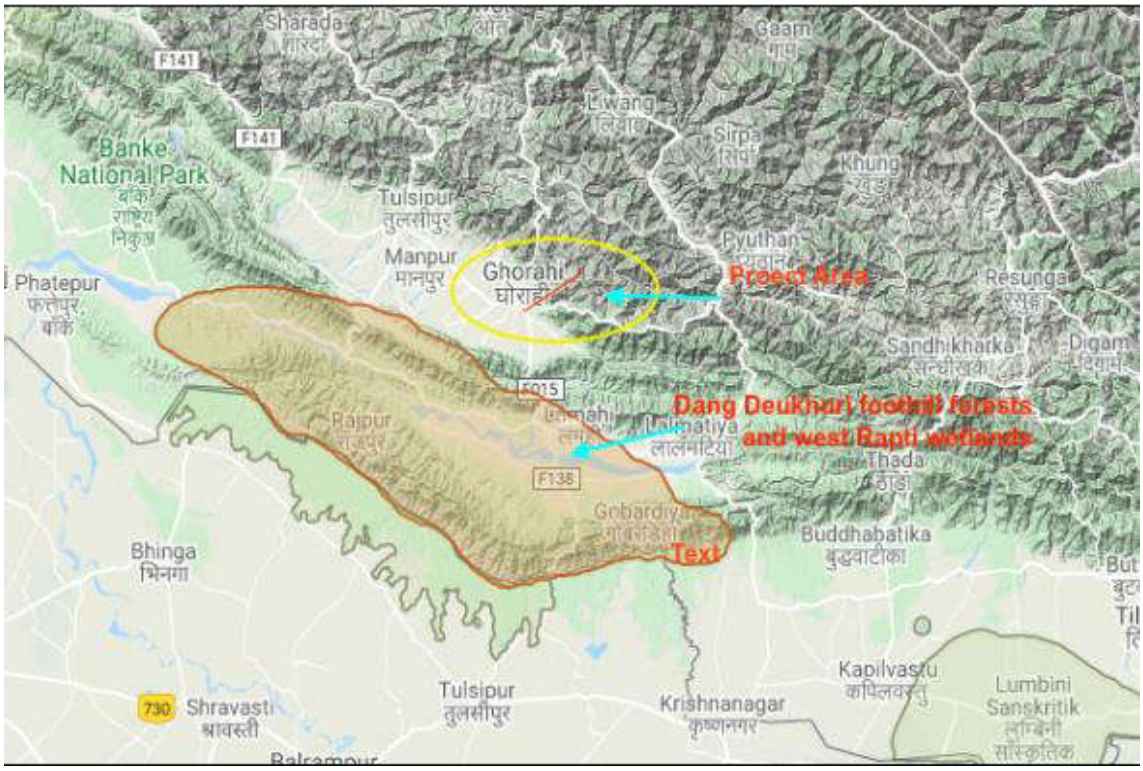


Figure 30: Original Boundary of Dang Deukhuri Foothill Forests and West Rapti Wetlands



Source: Birdlife International Data Zone (http://datazone.birdlife.org/site/factsheet/dang-deukhuri-foothill-forests-and-west-rapti-wetlands-iba-nepal)

Figure 31: Recently Revised Boundary of Dang Deukhuri Foothill Forests and West Rapti Wetlands and Location of Vulture Nesting Site

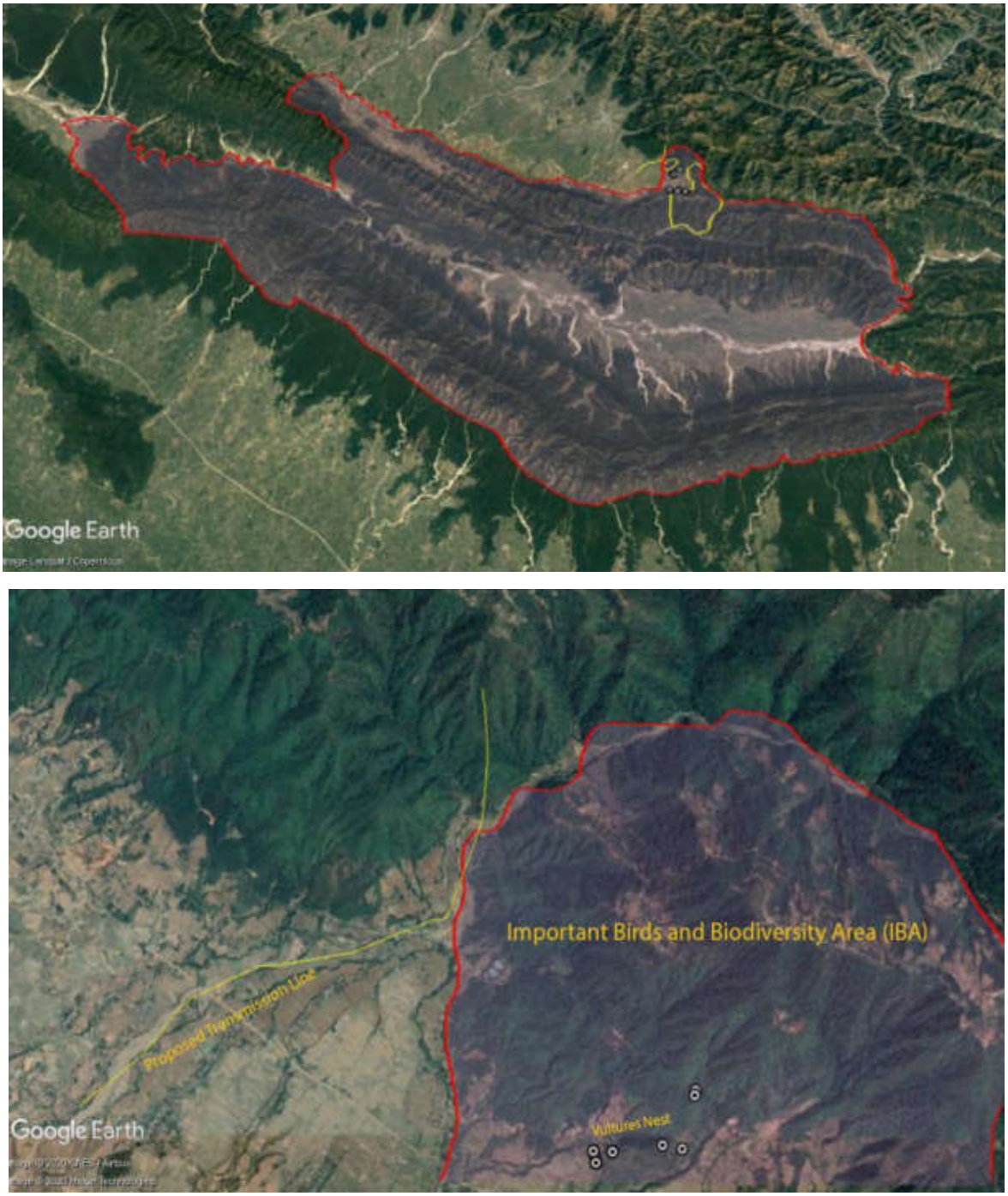


Figure 32: Janaki Temple in Relation to Alignment

(c) Component 3. Borang - Lapang - Ratmate Transmission Line and associated Substations

110. **Borang - Lapang - Ratmate Transmission Line:** The alignment (Figure 33 and linked photographs) mostly runs through mixed terrain comprising of flat land with gentle slopes, steep slopes, and undulating landforms with ground elevation ranges from 440 to 1,568 masl. The main land use pattern along the alignment is a mix of cultivated land (34.92%), forest land (25.83%), barren land (34.90%) and others (4.35%). For *Borang to Lapang* the types of land cover varies from 0.3% mosaic >50% cropland/<50% tree, shrub, herbaceous cover, 9.7% mosaic >50% tree, shrub, herbaceous cover / <50% cropland, 13.4% tree cover, >15% broadleaved, evergreen, closed to open, 25.6% tree cover, >15% broadleaved, deciduous, closed to open, 10.1% tree cover, >40% broadleaved, deciduous, closed, 36.3% tree cover, >15% needle-leaved, evergreen, closed to open, 3.5% mosaic >50% tree and shrub / <50% herbaceous cover, 1.0% mosaic >50% herbaceous cover / <50% tree and shrub. From *Lapang to Ratmate* it is 13.0% rainfed cropland, 4.5% herbaceous cover, 0.9% irrigated or post-flooding cropland, 9.5% mosaic >50% cropland / <50% tree, shrub, herbaceous cover, 20.1% mosaic >50% tree, shrub, herbaceous cover / <50% cropland, 6.1% tree cover, >15% broadleaved, evergreen, closed to open, 17.4% tree cover, >15% broadleaved, deciduous, closed to open, 8.3% tree cover, >40% broadleaved, deciduous, closed, 20.2% tree cover, >15% needle-leaved, evergreen, closed to open (Figure 35).

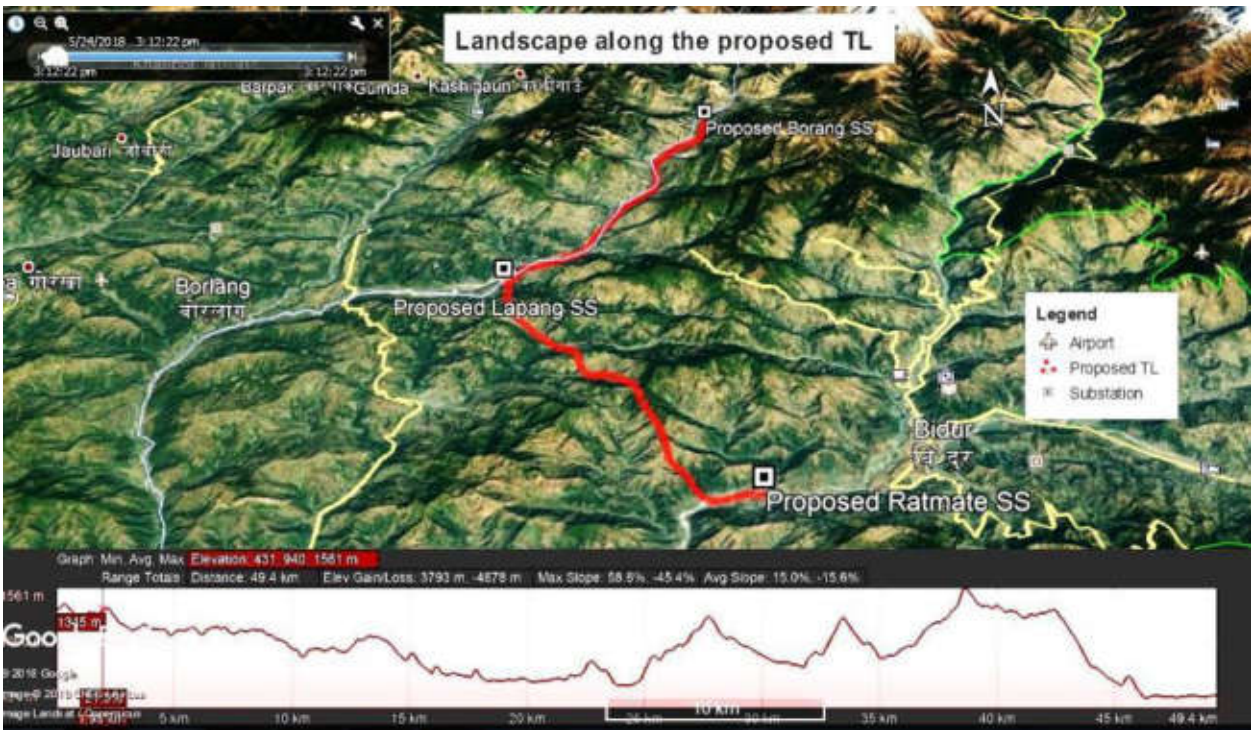
111. The alignment avoids densely populated areas, major structures, religious places, and other community infrastructures. However, there is one school at Dabjong village of Netrawati RM, ward no 1, Dhading district without a compound boundary wall in close proximity (Figure 34) which was raised as a concern by consultees. However, the actual tower location is 50m away

from the school ground. During detailed route survey efforts will be made by the contractor to shift the tower footing away from the school compound wall. However, as suggested by the local communities during the consultation, NEA has allocated funds for fencing the school compound. Major crossings include the 83 roads crossings, 6 river crossings, and 20 nos. 33/11kV lines. Major rivers crossed are Kintan Khola once, Lapan Khola once, Thoppal Khola once, and Trishuli River 3 times. About 12.966 km (27.39%) length of the alignment lies in the forest area (canopy cover 40 to 60%) affecting 29.7 ha of forest land across 15 community forests (17.912 ha) and 6 government forests (11.787 ha). 0.991 ha of forest land is permanently required for 35 tower pads. 5,340 trees (4,976 trees and 364 poles) are estimated to be lost from this forest land. Besides this, about 4,181 trees are expected to be lost from private land. Total number of trees expected to be lost is 9,521 but subject to confirmation on site. Whilst there are protected areas and key biodiversity areas in the wider area, the ROW is not located within any protected area or key biodiversity area. No physical cultural resources have been identified within 500m, subject to reconfirmation on site. The main access to the transmission line alignment and substations is through Dhadingbeshi – Lapang – Kintangfedi – Dundure - Borang surfaced road.

112. **Borang substation**: The terrain is undulating (sloping towards east at 30%) and ground elevation is 1,362 masl. The land use is cultivated land. The land belongs to private owner and NEA has completed the land acquisition process. The site is undulating therefore some cut and fill will be required. Within 500m, sensitive receptors are Ankhu Khola river about 100m to the east. The proposed substation site is accessible through existing paved road.

113. **Lapang substation**: The terrain is flat to undulating (sloping towards north at 20-30%) and ground elevation is 458 masl. The land use is cultivated land. The land belongs to private owner and NEA has completed the land acquisition process. The site is flat to undulating therefore some cut and fill will be required. There are no settlements within 500 m. However, individual structures are located within 200m including 1 school and many individual houses. The Trishuli river is about 250m to the northeast and river training structure will be required. There are no trees or vegetation on the proposed site. The substation site is accessible through existing paved road.

Figure 33: Alignment of Borang - Lapang - Ratmate Transmission Line and Substation Locations

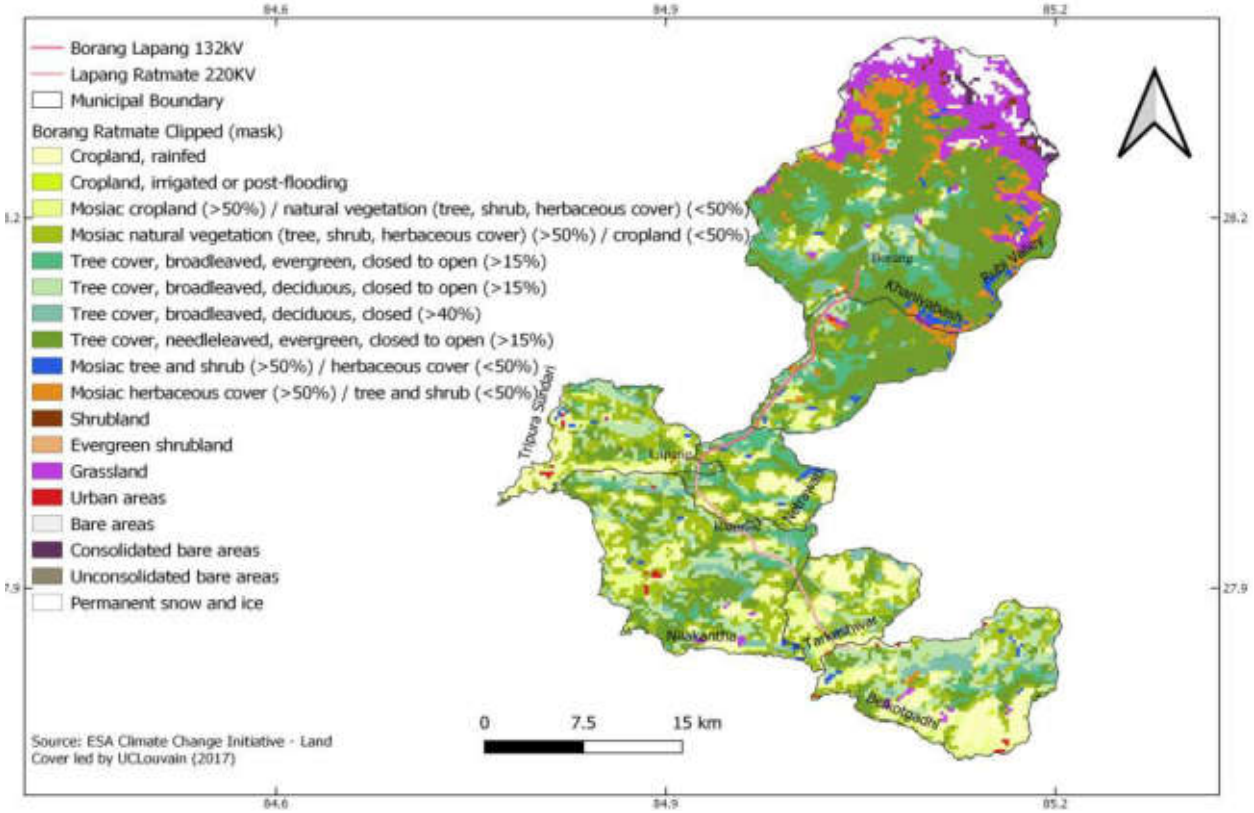


	
Alignment Route of the Transmission Line through Forest Area	**Alignment Route of the Transmission Line Crossing Dundure Khola River**

	
Proposed site of Borang Substation	**Proposed Site of Lapang Substation**

Figure 34: School Along Alignment of Borang-Ratmate transmission line

Figure 35: Land use map along Borang-Ratmate transmission line



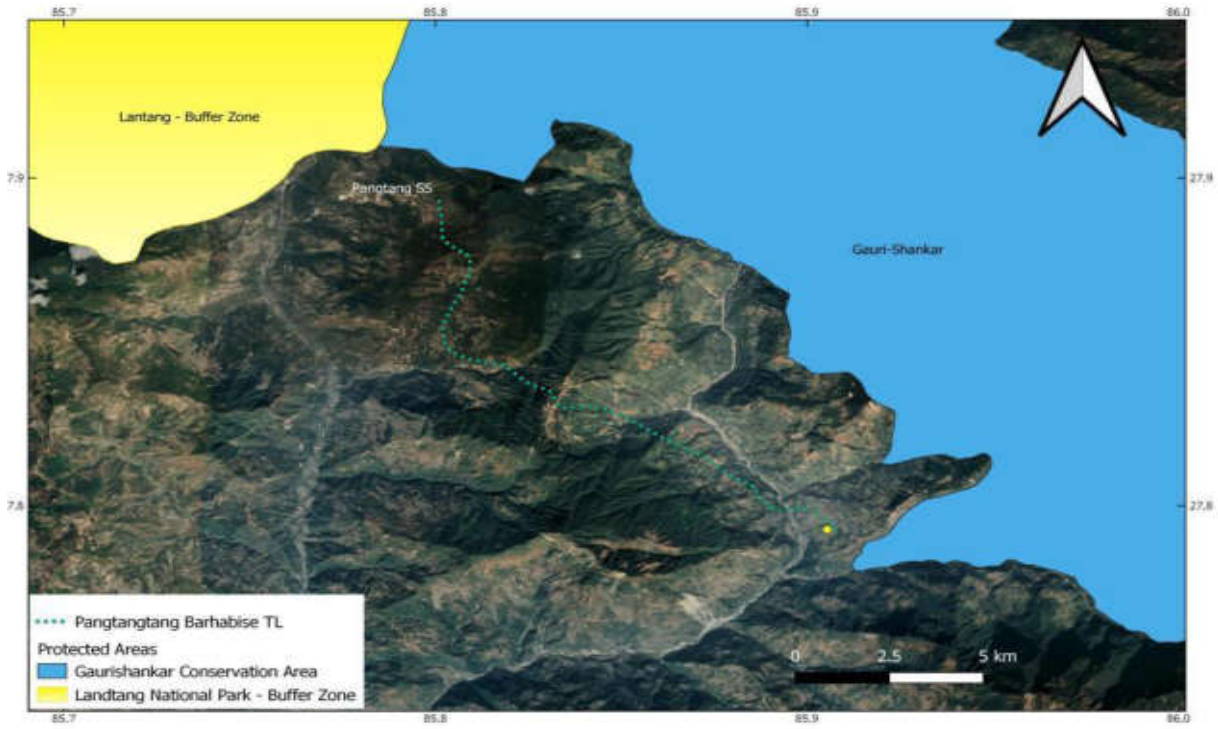
(d) Component 4. New 132/33/11 kV Substation at Pangtang

114. The terrain (Figure 36 and linked photographs) is hilly (40-50% slope) and ground elevation is 2,195 masl. The land is under cultivation, mainly paddy and seasonal crops. The land belongs to private owner and NEA has completed the land acquisition process. The site is sloping therefore cut and fill will be required. Within 500m, there is a stream. Nearest village is about 650m distance but there are about 14 individual structures within 500m. The Gauri Shankar Conservation Area, Langtang National Park Buffer Zone (BZ) and Langtang National Park IBA whose boundaries are concurrent with the BZ are within 10km north of the substations (Figure 37). There is an access road up to the nearest habitation, but construction of the substation will require upgrading of existing gravel road for about 5 km length and about 250 m new access track to the substation door.

Figure 36: Location of the Pangtang Substation

Site of Pangtang Substation

Figure 37: Location of the Pangtang and Barhabise Substations and Associated Transmission Line in Relation to Protected Areas



(e) Component 5. New 132/33/11 kV Substation at Keraun

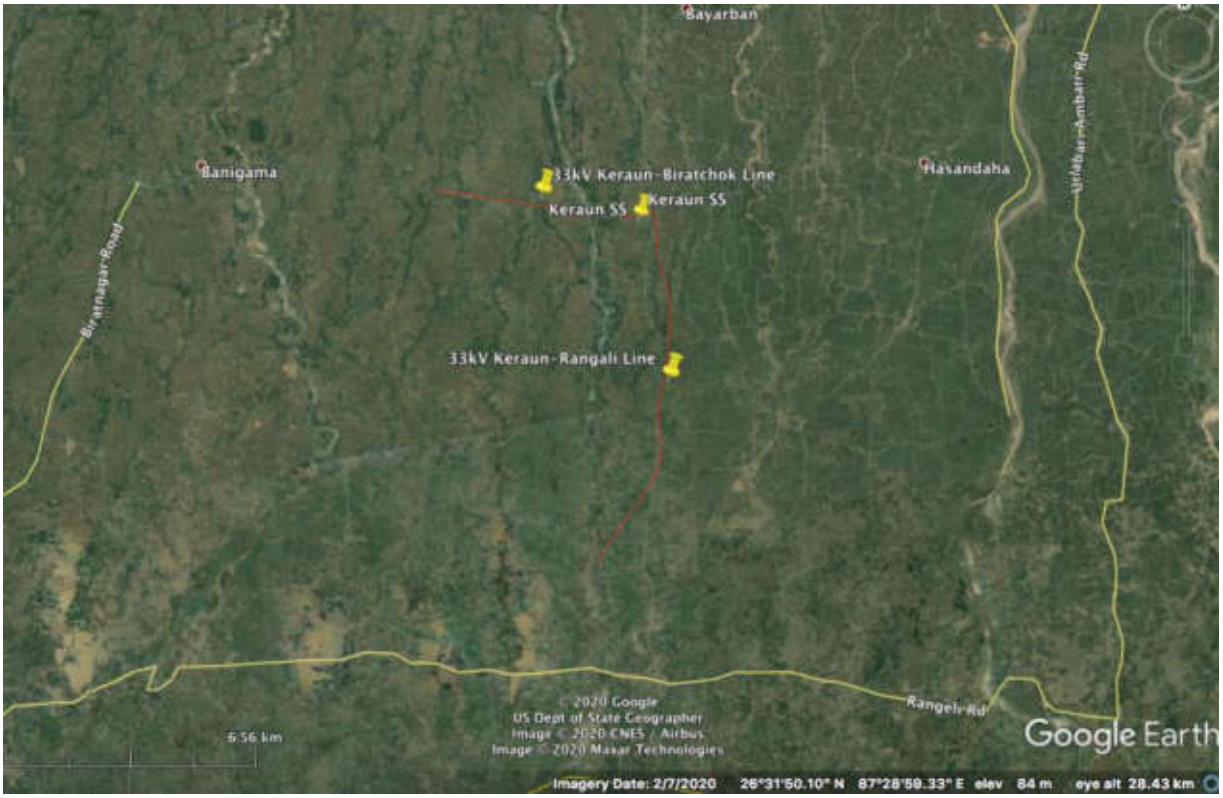
115. The terrain (Figure 38 and linked photographs) is flat and ground elevation is 95 masl. The land use is agricultural and under paddy cultivation. The land belongs to private owner and NEA has completed the land acquisition process. The site is flat therefore cut and fill will not be

required. The nearest settlement is Keraun Bazar which is about 400m away and nearest structures are at about 325 m away (along the highway) from the site. There is a power and an irrigation canal within 500m of the substation site. There are no protected areas or key biodiversity areas or within 10 km. The site is well connected with Kanepokhari-Rangeli single lane all weather road. The purposed substation will also feed the different 33 kV substations of Morang districts by constructing about 30 km length of 33 kV lines. The alignment of 33kV lines mostly runs along existing canals and roads (Figure 39) but the routes will be finalized following detailed route surveys.

Figure 38: Location of the Proposed Keraun Substation

Site of Keraun Substation

Figure 39: Location of the 33 kV Distribution Lines



(f) Components 6, 7, and 8. Grid Substation Automation, DCC Center and Smart Metering

116. Baseline for all these components is summarized in Table 23 with further details of the existing substations provided in Appendix 3. Figure 40 show the locations of the Substation Automation Components along with protected areas maps. Twelve of the existing substations are in protected areas/buffer zones or important bird areas. Other substations are situated near forest land etc. However, at these substations all works will be undertaken within the existing boundaries with installation of automation equipment inside the existing buildings at the substations therefore no impacts on biodiversity are anticipated, although due to the additional presence of construction workers biodiversity related prohibitions will need to be enforced during works.

Figure 40: Protected area map showing locations of Substation Automation Components

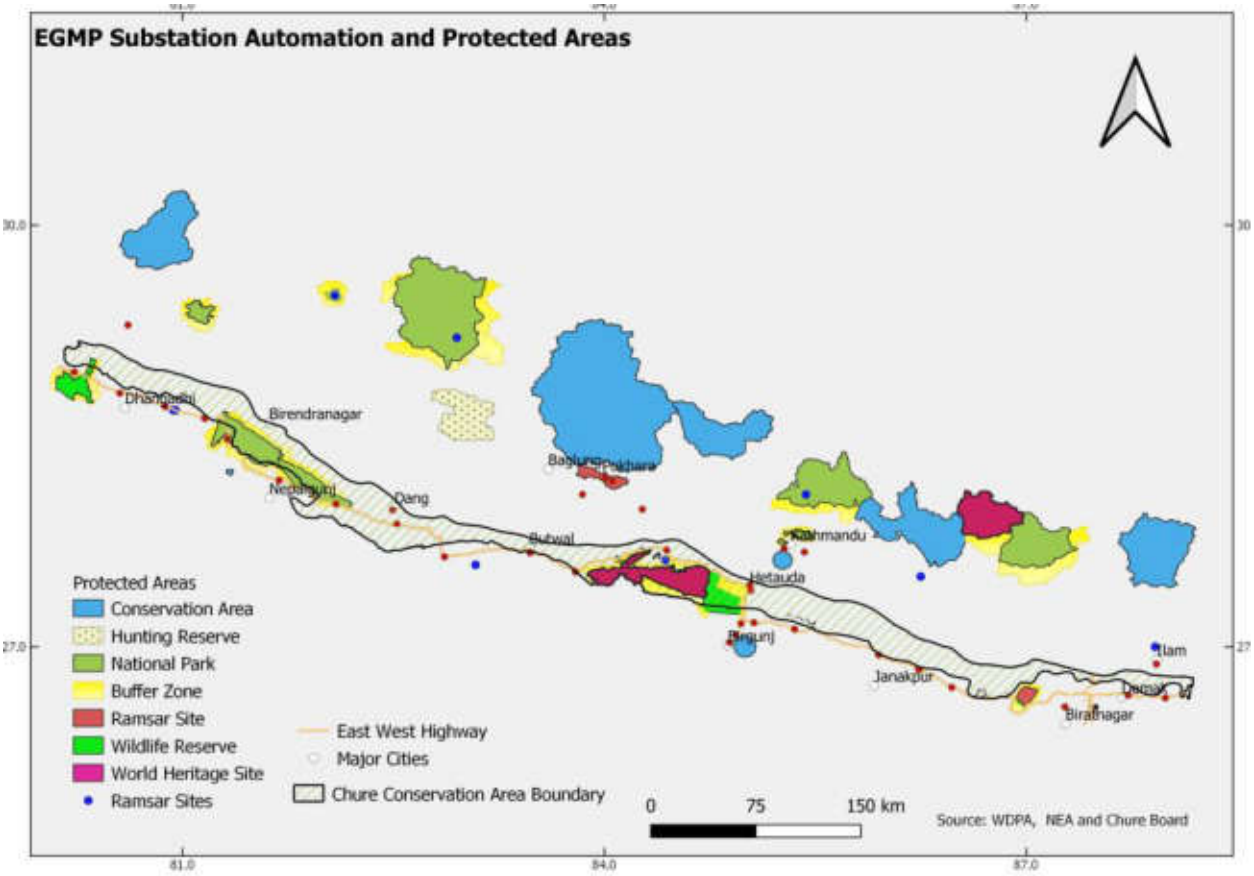


Table 23: Summary Environmental Features of Existing Substations

Sl. No.	Baseline Setting of Substations
1.	**Anarmani Substation**: Located in Birtamod Municipality of Ward No. 3 of Jhapa District next to Birtamod Bhadrapur Road. Occupies 24,161 m^2 and is in a residential area. There are houses within 50m. Within 500m there are 14 school at a distance for 150m to 490m and a hospital 480m south west of the substation.
2.	**Attariya Substation.** Located in Godawari Municipality of Ward No. 1 of Kailali District next to the Mahakali/Bhimdatta Highway. Occupies 13,266 m^2 next to residential area. It is within 50m of houses but there are no school or community buildings within 100m. East within 500m there is cultivated land and to the south west corner wetland pondage is observed. A river exists 523 m east. It is 1.6 km to the Laljhadi Corrdior that links Sulkaphanta Wildlife Reserve through Mohana Corridor to the Dudhwa National Park in India.
3.	**Bardhghat Substation**: Located in Bardhaghat Municipality of Ward No. 5 of Nawalparasi District next to Tirveni Road. Occupies 15,773 m^2 and is in a semi residential area. There are houses within 50m. There is an irrigation canal at a distance for 200m west across the

Sl. No.	Baseline Setting of Substations
	road, a stream 180 next to the canal and at 60m and 130m there are fishponds west of the substation.
4.	**Barhabise Substation**: Located in Barhabise Municipality of Ward No. 4 of Sindhupalchok District. Occupies 70647.44 m^2 and is partially in agricultural area with undulating terrain and ground elevation is 1202.31m above sea level. The substation is under construction. Within 500m is agricultural and community forests. There are 10 structures within 100m including house within 50m.
5.	**Bhaktapur Substation**: Located in Bhaktapur Municipality of Ward No. 1 of Bhaktapur District next to Nagarkot Road. Occupies 10,204 m^2 and is in semi residential area. There are houses within 50m. There are 3 public ponds at a distance for 150m to 300m and a stream 340m south of the substation.
6.	**Bharatpur Substation**: Located in Bharatpur Metropolitan City of Ward No. 11 of Chitawan District 120m east of Bharatpur Bypass Road. Occupies 8,747 m^2 and is in residential area. There are houses within 50m at 370m distance there is sports ground. Also, the substation is located in Bharandabhar Corridor. However, the forest of the corridor is 1.6km east (this biological corridor connects Chitwan National Park to Forests of the Hills). The substation is located in Chure Conservation Area. Bharatpur Airport is 1.5km south west.
7.	**Bhurigaun Substation**: Located in Thakurbaba Municipality of Ward No. 2 in Bardiya District next to ithe East West Highway. Occupies 6,244 m^2 and is next to residential area. It is within 50m of houses. East and west of the substation there is a road and beyond it within 500m there is cultivated land. A river exists within 500 m east. It is located in the buffer zone of Bardiya National Park and in the Bardiya National Park IBA, it is 1.2 km away from the National Park boundary itself.
8.	**Birganj Substation**: Located in Birgunj Metropolitan City of Ward No.13 of Parsa District next to the Tribhuwan Highway. Occupies 4,095 m^2 and is next to residential area. It is within 50m of houses. A sports stadium exists north east of the substation at 300m distance.
9.	**Butwal Substation**: This is located in Butwal Submetropolitan City of Ward No. 10 of Rupandehi District 550m east of Sihddartha highway. Occupies 12,597 m^2 and is in a residential area. There are houses within 50m. Beyond substation is forest land to the north and east. Endangered species are observed in the local area.
10.	**Chanauta Substation**: Located in Shivaraj Municipality of Ward No. 5 of Kapilvastu District next to the Krishnanagar Chandrauta Road. Occupies 14,550 m^2 and is in a semi residential area. There are houses within 50m. Beyond the substation within the 500m is cultivated land.
11.	**Chapur Substation**: This is located in Chandrapur Municipality of Ward No. 4 of Rautahat District at the East West Highway. Occupies 22,053 m^2 and is in a semi residential area. There are houses within 50m. Beyond the substation is cultivated land and forest land. Endangered species are observed in the local area. The substation falls in Chandranigahapur Corridor and the Corridor Forest is 230m west of the substation.
12.	**Damak Substation**: Located in Kamal Rural Municipality of Ward No. 5 of Jhapa District 220m south of the East West Highway. Occupies 6,334 m^2 and is in a residential area. There

Sl. No.	Baseline Setting of Substations
	is a river and houses within 50m. The eastern boundary wall of the substation is a riverbank. Beyond the substation is cultivated land to the north, north across the highway is a river. Endangered species are observed in the local area.
13.	**Damauli Substation**: Located in Byas Municipality of Ward No. 4 of Tanahu District 115m east of Prithivi highway. Occupies 5,227 m^2 and is in a residential area. There are houses within 50m. Within the 500m of the substation is forest land to its north, rest is residential area.
14.	**Dhalkebar Substation**: Located in Mithila Municipality of Ward No. 7 of Dhanusha District 400m north of the East West Highway. Occupies 77,657 m^2 and is in a partial residential area. There are houses within 50m. Within the 500m is cultivated land and at the western boundary there is river.
15.	**Duhabi Substation**: Located in Duhabi Municipality of Ward No. 3 of Sunsari District 360m west of Dharan Road. Occupies 11,817 m^2 and is in a residential area. There are houses within 50m. Within 500m of the substation is residential area and cultivated land.
16.	**Ghorahi Substation**: Located in Ghorahi Sub Metropolitan City of Ward No. 3 of Dang District next to the Ghorahi Lamahi Highway. Occupies 23,493 m^2 and is next to semi residential area. It is within 50m of houses. East and west there is road and beyond it within 500m there is cultivated land. A river exists 160m to the south. It is located in the Chure Conservation Area.
17.	**Godak Substation**: Located in Illam Municipality of Ward No. 10 of Illam District next to Lodiya road. Occupies 11,487 m^2 and is in a partial residential area. There are houses within 50m. There is a river 70m to the west. Within the 500m is cultivated land, residential area, and grass land to the east. It falls within the Important Bird Area of Mai Valley Forests.
18.	**Hetauda Substation**: Located in Hetauda Submetropolitan City of Ward No. 1 of Makwanpur District next to the Tribhuwan Highway and 90m east of a river. Occupies 20,509 m2 and is partially in residential area, partially in hill, close to river and there are houses within 50m. Beyond substation within 500m are residential area, forest, and river. It is located in Chure Conservation Area.
19.	**Kamane Substation**: Located in Hetauda Submetropolitan City of Ward No. 8 of Makwanpur District 100m south of Hetauda Phaparbari Road. Occupies 7,354 m^2 and is partially in residential area. There are houses within 50m. Within the 500m is forest land to the north, rest is residential area. It is located in Chure Conservation Area.
20.	**Kohalpur Substation**: Located in Kohalpur Municipality of Ward No. 11 of Banke District next to the Ratna Highway. Occupies 14,560 m^2 and is next to residential area. It is within 50m of houses. Beyond substation within 500m there is cultivated land. The Buffer Zone of Banke National Park is 1.1 km away and it is 1.2 km west from Kamdi Corridor Forest that connects Banke National Park to Suhelwa Wildlife Sanctuary.
21.	**Kusum Substation**: Located in Rapti Sonari Rural Municipality of Ward No. 1 of Banke District 500m north of East West Highway. Occupies 17,723m^2 and is 200 m away from residential area. Beyond the substation within 500m there is mostly forest land, it is situated

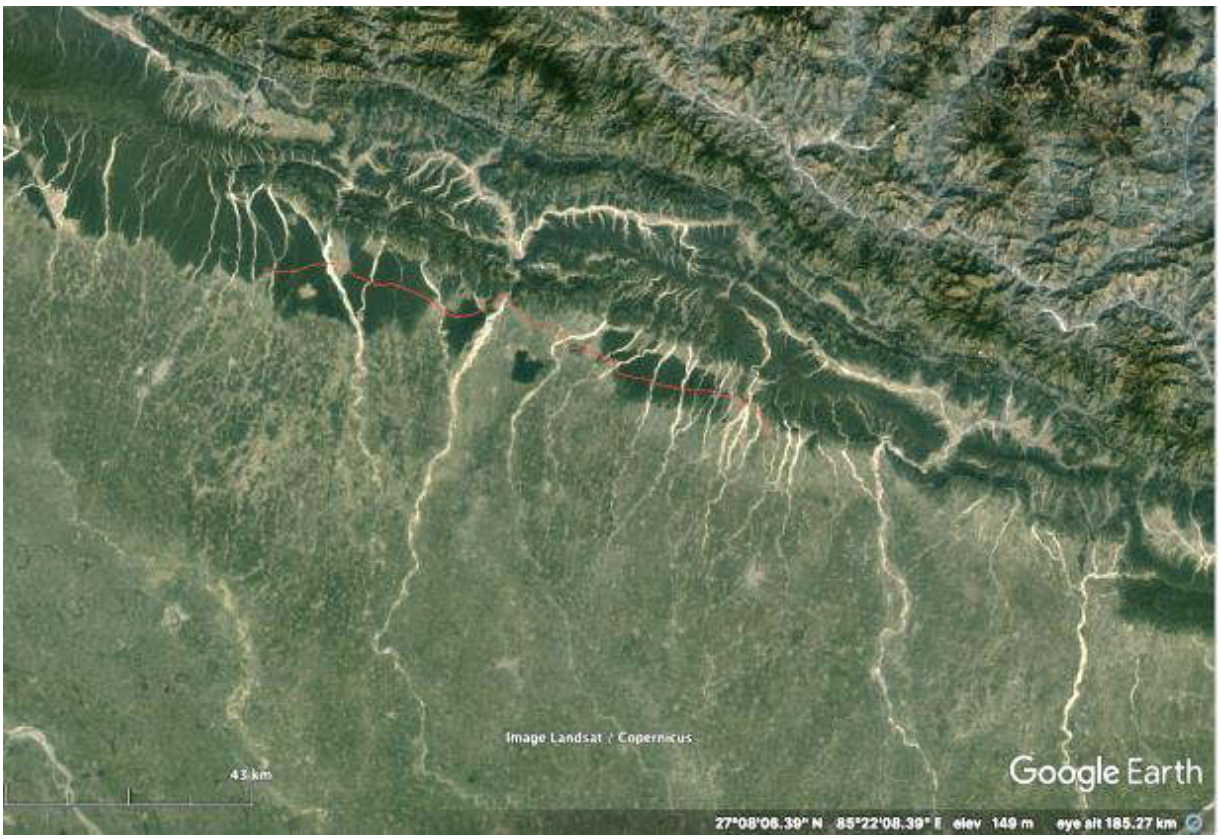
Sl. No.	Baseline Setting of Substations
	within Banke National Park and Dang Deukhuri Foothill Forests and West Rapti Wetlands IBA as well as Chure Conservation Area. Towards the east within 93m is a river.
22.	**Lahan Substation**: Located in Lahan Municipality of Ward No. 1 of Siraha District 350m south of the East West Highway. Occupies 21,060 m^2 and is partially in residential area. There are houses within 50m. Within the 500m is cultivated land. There is a drain 220m east and based on consultation during a previous project in 2019 substation in-charge informed that during monsoon season water floods the ground level rooms inside substation.
23.	**Lamahi Substation**: This is located in Lamahi Municipality of Ward No. 5 of Dang District 140m north of the East West Highway. Occupies 13,600 m2 and is in residential area. There are houses within 50m. Within the 500m is forest land to its north, rest is residential area. The area falls in Lamahi Corridor and also falls under IBA: Dang Deukhuri Foothills and West Rapti Wetlands. It is located in Chure Conservation Area.
24.	**Lamki Substation**: Located in Lamkichuha Municipality of Ward No. 1 of Kailali District 67m south of East West Highway. Occupies 4,988m^2 and is in a residential area. There are houses as close as 50 m to the substation. The substation is 680 m west of Karnali Corridor forest and 9.3km west of Bardiya National Park.
25.	**Lakhanatri Substation**: Located in Pokhara Lekhnath Metropolitan City of Ward No. 27 of Kaski District next to Kaligandaki Road. Occupies 21,180 m^2 and is partially in residential area. There are houses within 50m Within 500m is cultivated land and forest. The area falls in Lake Cluster of Pokhara Valley Ramsar Site and is 90m south of a river.
26.	**Mahendranagar Substation**: Located in Bedkot Municipality of Ward No. 9 of Kanchanpur District south of Mahendra Highway. Occupies 5,737m^2 and is in a residential area. There are houses as close as 50 m. Beyond the substation within 500m there is mostly cultivated land. In this cultivated land there are 9 water pondage areas; 5 on the side of the substation and 4 across the highway (ranging in area from 0.02 to 0.19 ha). Also, 150m west of the substation is an irrigation canal. It is located in Suklaphanta Wildlife Reserve BZ and Suklaphanta Wildlife Reserve IBA. The Bharmadev Corridor Forest is 3km north of the substation.
27.	**Mirchaiya Substation**: This is located in Mirchaiya Municipality of Ward No. 1 of Siraha District 530m north of Mahendra Highway. Occupies 22,327m^2 and is in residential area. There are houses as close as 50 m. Beyond the substation within 500m there is mostly cultivated land. In this cultivated land,178m east there is a river. At a distance of 188m east there is orchard.
28.	**Pahalmanpur Substation**: This is located in Ghodaghodi Municipality of Ward No. 10 of Kailali District 208m south of the East West Highway. Occupies 20,201m^2 and is in a residential area. Up to 150m on east and west there is cultivated land but beyond that till 500m there is forest land. This whole area is Basanta Corridor which connects to Dudhwa National Park of India. Also, the substation is 6.3km west of Ghodaghodi Lake Ramsar Site.
29.	**Parwanipur Substation**: Located in Jitpur Simara Submetropolitan City of Ward No. 23 and is 280m east of Tribhuwan Highway. Occupies 22,327 m^2 and is next to residential area and cultivated land. Within 50m there are houses. A river exists 280m to the south.

Sl. No.	Baseline Setting of Substations
30.	**Pathlaiya Substation**: Located in Jitpur Simara Submetrolopitan City of Ward No. 1 of Bara District next to the East West Highway. Occupies 20,731m^2 and is in forest area (its boundary walls are the boundary of the newly extended Parsa National Park). Beyond the substation there is forest land. Endangered species of wildlife are encountered in this area.
31	**Pokhara Substation**: Located in Pokhara Lekhnath Metropolitan City of Ward No. 10 of Kaski District next to Prithivi Highway. Occupies 21,180 m^2 and is partially in residential area. There are houses within 50m. Within 500m is residential area. The area falls in Lake Cluster of Pokhara Valley Ramsar Site. Pokhara Airport is 1.5km south east.
32.	**Sayaule Substation**: Located in Amargadhi Municipality of Ward No. 1 of Dadeldhura District 260m south of Mahakali Highway. Occupies 2,052m^2 and is in residential and cultivated land area. Beyond substation within the 500m there is forest land.
33.	**Simara Substation**: Located in Jitpur Simara Submetrolopitan City of Ward No. 2 of Bara District 360m west of Tribhuwan Highway. Occupies 5,026m^2 and is in residential area. There are houses within 50m. Shree Nepal Secondary School is 170m south west and 200m south west there is Simara College (no schools within 100m). Also, 200m south east there is Surya Nepal Industry. Also, the SS is 800m west of Simra Airport. It is situated in Parsa National Park Buffer Zone and Parsa Wildlife Reserve IBA.
34.	**Suichatar Substation/ Distribution Command and Control Centre Location**: Located in Nagarjun Municipality of Ward No. 10 of Kathmandu District, 460m from Ring Road. Occupies 14,770 m^2 and is in a residential area. There are houses within 50m. Within 500m there are 14 school at a distance for 150m to 490m and a hospital 480m south west (no schools within 100m). There are no heritage or cultural sites within 500m of the substation.
35.	**Syangja Substation**: Located in Putalibazar Municipality of Ward No. 11 of Syangja District next to Siddhartha Highway. Occupies 17,723 m^2 and is in a small residential area, 260m south of a river and 130m east of a stream. Beyond the substation within the 500m there is cultivated land and hill.

(g) Component 9. 132 kV /66 kV Transmission Line Conductor Upgradation

117. **Upgrading conductors on 102km 132 kV Pathlaiya- Dhalkebar transmission line:** The alignment mostly passes through flat to undulating terrain (Figure 41) and land use is mixed type (cultivated, barren land, forests). Major crossings are 32 rivers, rivulets, 87 roads/highways, and transmission lines (132/66/11 kV) including Bagmati River. It passes within the perimeter of newly extended Parsa National Park, and within the Chure Conservation Area at two points – Figure 15). Work will be carried out on existing towers and within the existing ROW. However, trimming of trees (more then 5m height) below the transmission line with the ROW may be required, particularly in forest areas of which 47.76km falls within, with prior permission from concerned authority i.e. DNPWC.

Figure 41: Alignment of the Existing Pathlaiya- Dhalkebar Transmission Line



118. **Upgrading conductors on 30km 132 kV Duhabi-Kusaha transmission line:** The alignment mostly passes through flat terrain and land use is mostly cultivated and barren land (Figure 43). Major crossings are 10 rivers, rivulets, 34 roads/highways, and distribution lines (33/11 kV). One end of the line (towards Kusaha) lies within the buffer zone of the Koshi Tappu Wildlife Reserve (Figure 17) which is also an important bird area on modified agriculture habitat. The work will be carried out on existing towers and within the ROW of the existing lines. However, trimming of trees (more then 5m height) below the transmission line with the ROW may be required, if any, with prior permission from concern authority i.e. DNPWC although there is no forest land involved.

Figure 42: Alignment of the Existing Duhabi Kusaha Transmission Line

119. **Upgrading conductors on 14 km 66kV transmission lines inside Kathmandu valley**: The alignment (Figures 19 and 43) of these four lines passes through mixed land use (dominated by dense urban residential) and the terrain is flat to undulating. The work will be carried out on exiting towers and within the existing ROW. There are no protected areas, key biodiversity areas or areas of international or national archeological or cultural significance within the direct impact zone except for along the Suichatar-Balaju 66kV line which is passing through the boundary of the UNESCO Kathmandu Valley (Swayambhu) World Heritage Site (WHS) (Figure 19). To execute work in this area prior permission will be required from the Department of Archeology.

120. Land use under the 150m situated with the current boundary of the WHS is mostly forest (Swayambhu Forest has an area of 24 ha and the total religious forest has an area of 31.38 ha). The main WHS monument (Swayambhunath Stupa) is about 500m away from the alignment and will not be impacted. However, there are smaller monuments that the alignment is in proximity to; these are understood to have been built about 20 years ago and are known as Chaityas and Dungyurs (Figure 43). A further 400m of alignment is within the proposed boundary which is in dense built up urban area with no WHS monuments. Consultations were held with the Department of Archeology as well as the forest department.

Figure 43: Alignment of the Existing 66kV Lines Transmission Line within Kathmandu Valley

	
School about 60m from Siuchatar-Balaju transmission line alignment	**Teku-Siuchatar transmission line over open land after crossing Tribhuvan University**
	
Alignment of Siuchatar-Balaju 66 kV Transmission Line through Swayambhu Forest (tower inside WHS boundary)	**Alignment of Siuchatar-Balaju 66 kV Transmission Line along the street prior to crossing into the Forest (north)**

Alignment of Siuchatar-Balaju 66 kV Transmission Line along the street prior to crossing into the Forest (south)

Alignment of Siuchatar-Balaju 66 kV Transmission Line next to the Ring Road

Nagarjun Sub-division Forest Office, Swayambhu where the Siuchatar-Balaju 66 kV line crosses

Boundary wall within Swayambhu area with plaque informing of construction of Chaitya in 1998/1999




Chaityas and Dungyurs in the World Heritage Site

B. Physical Environment

(a) Physiography, Land Use, Geology and Soil

121. The EGMP project components will be implemented in seven provinces of Nepal, a landlocked country occupying an area of about 147,181 sq.km.

122. EGMP components lie within regions of significant topographic variability, ranging from as low as 100 masl to 3,548 masl (Figure 44). The EGMP components are lying into five distinct physiographic zones: Terai, Siwaliks, Hills, Middle Mountains, and High Mountains/Himalayas. The Terai region (14% of country area) consists mostly of alluvial plains lying in the range of 60-200 masl. The Siwaliks region (13% of country area) covers the foothills regions immediately north of the Terai region, reaching up to 1,800 masl and stretching from east to west. Hills (29% of country area) are characterized by a moderate elevation range of 1,500-2,500 masl. Middle Mountains (20% of country area) are characterized by steep slopes and narrow valleys lying north of the hills physiographic zone and their elevation ranges from 2,000 to 4,000 masl. High Mountains/Himalayas (24% of country area) are the northernmost part of the country and the elevation in this region is above 4,000 masl.

123. Land use in the EGMP areas of influence is dominated by agriculture (22%) and arable (12%) followed by forest land (19%). Permanent pastures and other grazing lands cover about 9% of the land area. Table 24 shows the land use pattern in the country and Figure 45 presents the land use map overlaid with the EGMP components.

Table 24: Land Use Pattern of Nepal (2001-2012)

Land Use Categories	Area in '000 ha	Percentage
Total Area	14,335	
Agriculture Area	4,180.47	22
Arable Area	2,247.31	12
Permanent Crops	142.63	1
Permanent pastures and other grazing lands	1,790.53	9
Forests	3,680	19
Other Land	6,474.53	35
Inland Water	383.0	2

Source: FAOSTAT, 2016

124. Geology of the project areas is dynamic as a result of active lithospheric plate tectonics. Geologically, the EGMP components are located in five zones each of which is separated from others by distinct fault structures, most of which are thrust faults. These zones are: Indo-Gangetic Plain, Siwaliks, Lesser Himalaya, Higher Himalaya and Tibetan Tethys zone, from south to north. Each of these zones has its own inherent geological characteristics. The Main Frontal Thrust ("MFT") marks the northern boundary between the Indo-Gangetic Plains and the Siwalik Zone. Major types of rocks in the project area are schists, phyllites, gneiss, quartzite, granite, limestone.

125. Soils in the project areas (Figure 46) are dominated by clay loam, sandy clay loam, loam, and sandy loam.

Figure 44: Map Showing EGMP Components and Elevation Profile of the Project Areas

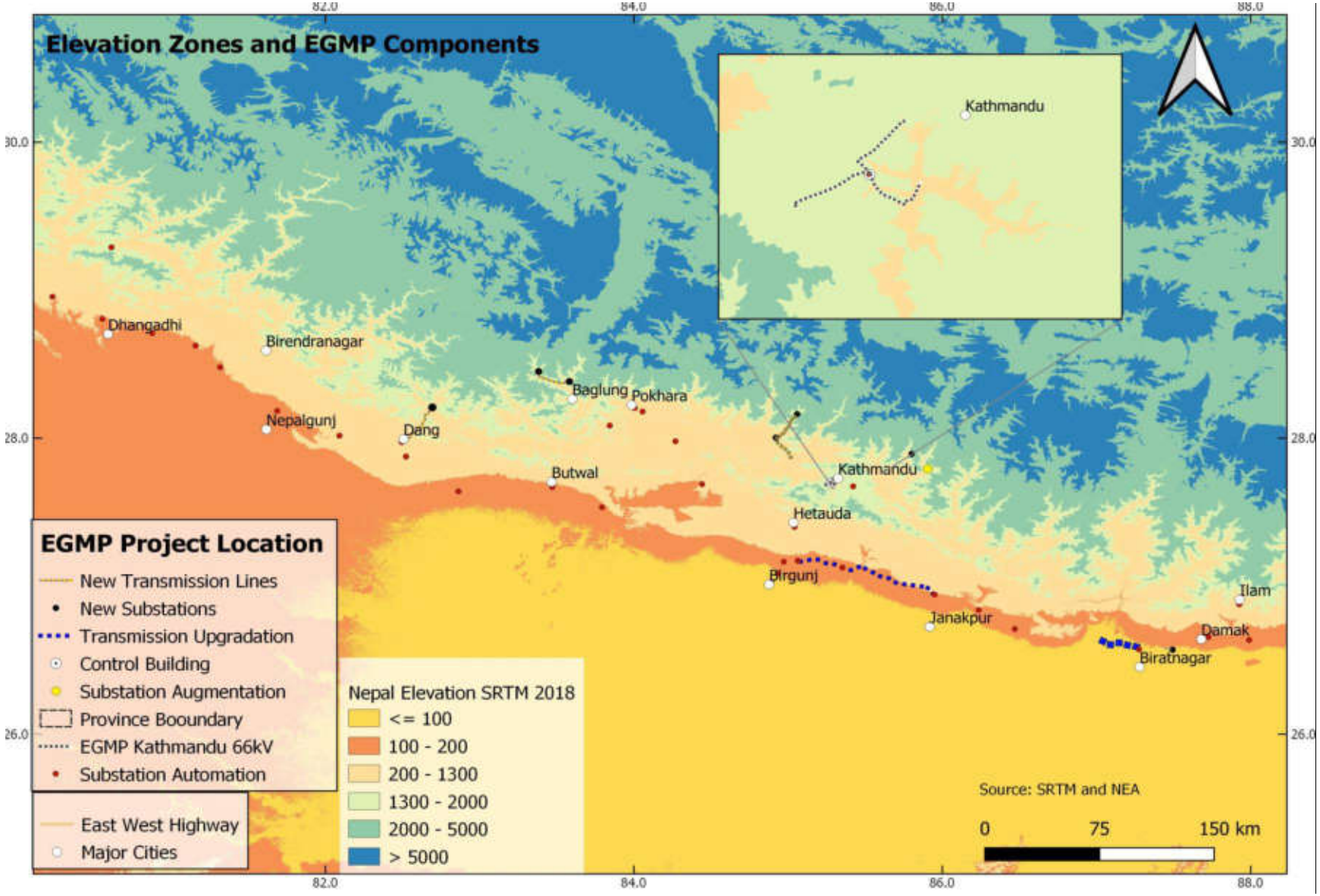


Figure 45: Map Showing EGMP Components and Land Use Feature of the Project Areas

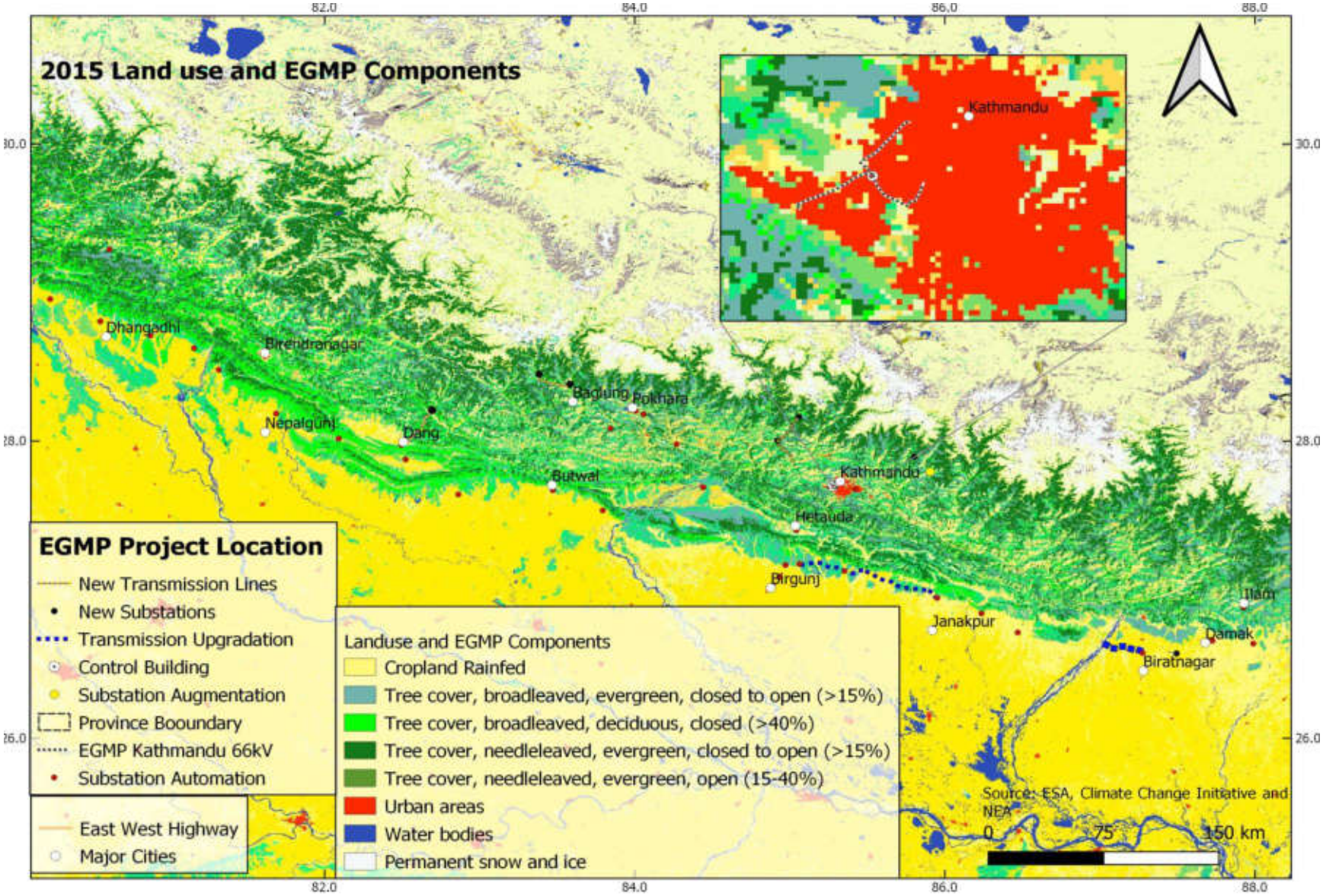
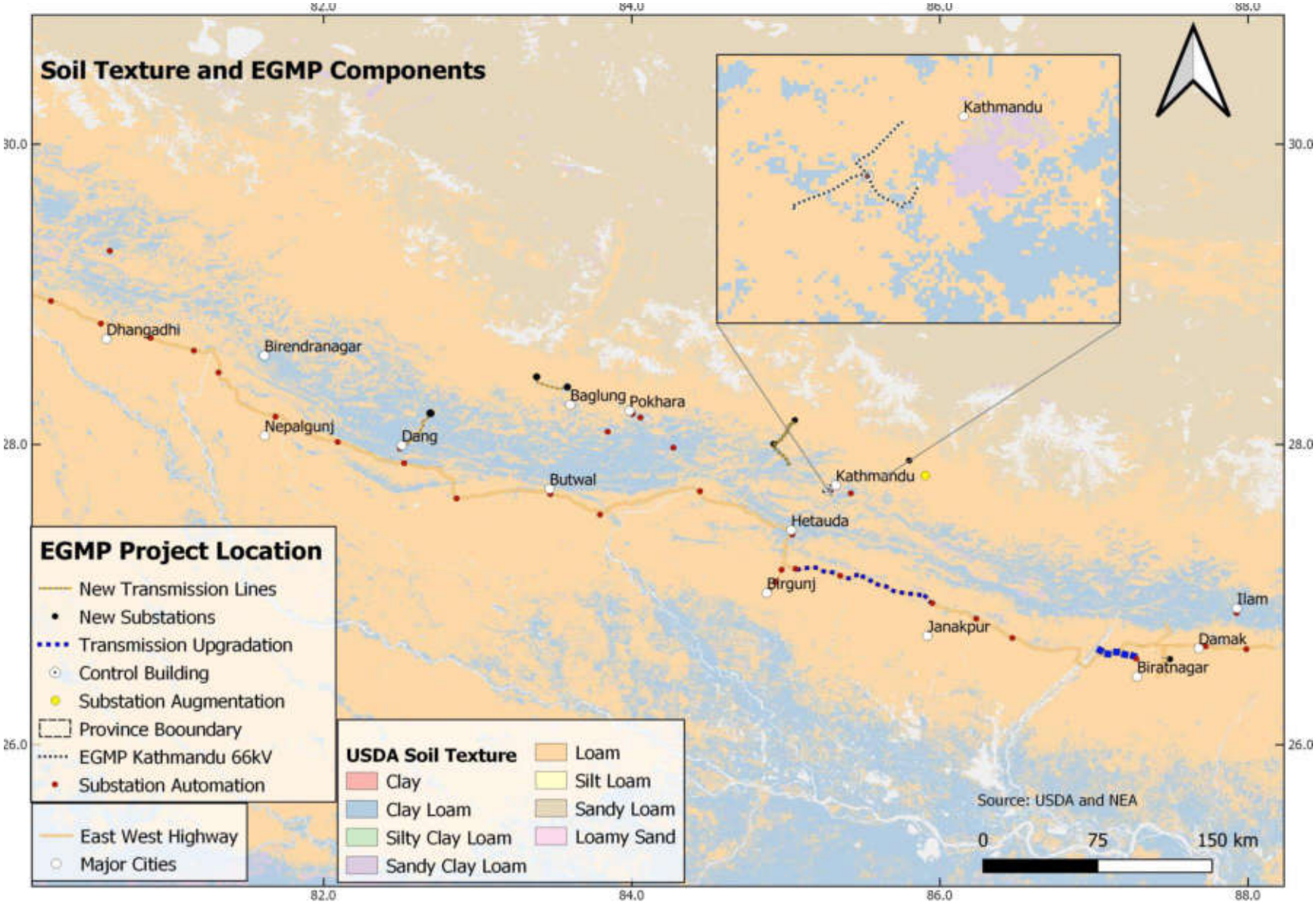


Figure 46: Map Showing EGMP Components and Soil Type of the Project Areas



126. **Component 1.** The alignment traverses through Middle Mountain of Western Nepal. Main rock types found in this zone are schists, phyllites, gneiss, quartzite, granite, limestone etc. Rocky outcrop, boulders are seen along the alignment. Geologically area has Seti formation and Kushma formation. Seti formation has grey greenish grey gritty chlorite muscovite sandstones grit stones with conglomerates and white massive quartzite in the upper parts. Kushma formation has greenish grey white fine to medium grained at places ripple marked massive quartzite intercalated with green phyllites. The soil texture found here includes loam and clay loam.

127. **Component 2.** The alignment traverses the Sub-Himalayan (Siwalik/Chure Zone) and Lesser Himalayan Zones. Major rocks found here include fluvial mudstone, siltstone, sandstone and conglomerate for Siwalik Groups and schists, phyllites, gneiss, quartzite, granite and limestone for Lesser Himalayan Zones. The transmission line crosses Lakharpata, Sangram Formations, Quaternary, Swat Formation, Suntar Formations, Lower Siwalik and Middle Siwalik geological formations successively from Madichaur to Ghorahi. Major soil types found here include Dystrochrepts, Haplustalfs, Rhodustalfs, Haplumbrepts, Udipsamments, Eutrochrepts and Argiudolls. The soil texture found here includes loam and clay loam.

128. **Component 3.** The alignment traverses the Middle Mountain and Hills topographical zones. Geologically this line alignment falls under the Lesser Himalayan Zone with schists, phyllites, gneiss, quartzite, granite, limestone as major types of rocks found here. About two thirds of the alignment passes through Ranimatta formation which consists of grey greenish / grey gritty phyllites grilstones with conglomerates and white massive quartzite. Major formations in this area include Ranimatta formation, Ulleri formation, Sangram formation and Naudanda formation[8]. Major soil types found along the alignment include Dystrochrepts, Haplumbrepts, Haplustalfs and Rhodustalfs[9]. The soil texture includes loam and clay loam.[10]

129. **Component 4, Pangtang:** The site is located in Middle Mountain and Hills topographical zones. Geologically the site falls under the Himalayan Zone with schists, phyllites, gneiss, quartzite, granite, limestone as major types of rocks found here. Major soil types found along the alignment include Dystrochrepts, Haplumbrepts, and Haplustalfs and the soil texture includes loam and silty clay.

130. **Component 5.** The site is in the Terai Region of Gangetic Plains consisting of quaternary alluvial deposits. The Gangetic Plains represents Pleistocene to recent Gangetic alluvial deposits over 1,000 m thick belonging to the last episode of the Himalayan upheaval. The Main Frontal Thrust ("MFT") marks the northern boundary to the Siwalik Zone. Major soil types found here include Haplaquents, Haplaqepts and Eutrocrepts. The soil texture found here includes loam, silty loan and clay.

131. **Components 7, 8 and 9c.** Kathmandu Valley and its sites are located in the mid Himalayan region of Nepal. The valley is 30 km east to west and 25 km north to south with surrounding mountain ranges composed of sedimentary and metamorphic rocks with gneiss and migmatites[11]. The valley basin consists of Plio-Pliestocene fluvial, fluvial lacustrine and

[8] IEE of Boran Naubise 220kV (2020) Transmission Line Project, ESSD, NEA, Kharipati, Bhaktapur, Nepal
[9] MENRIS ICIMOD
[10] Tomislav Hengl. (2018). Soil texture classes (USDA system) for 6 soil depths (0, 10, 30, 60, 100 and 200 cm) at 250 m (Version v0.2) [Data set]. Zenodo. http://doi.org/10.5281/zenodo.2525817
[11] Stocklin, J. (1980). Geology of Nepal and its regional frame. *Journal of Geological Society of London, 137*, 1-34.

fluvio-deltaic sediments.[12] It is drained by the Bagmati River with Bishnumati, Dhobi Khola, Manhara, Hanumante, Godawari, Kodku, Nakhu, and Balkhu Rivers as its main tributaries. The soil texture consists of sand, silt and clay. Major soil types found in the valley includes Dystrochrepts, Halpumbrepts, Haplustalfs-calcarious Materials, Hapludalfs, Rhodustalfs, Haplaquepts, Dystrochrepts, Haplaquents and Udipsamments.

132. **Component 9a.** The transmission line is located on flat plains of the Terai, and Chure (Churiya) area of the Gangetic Plains consisting of quaternary alluvial deposits. The Gangetic Plains represents Pleistocene to recent Gangetic alluvial deposits over 1,000 m thick belonging to the last episode of the Himalayan upheaval. Major soil types found here include Haplaquents, Haplaqepts and Eutrocrepts. The soil texture found here includes loam, silty loan and clay.

133. **Component 9b**. This transmission line also traverses the Terai Region of the Gangetic Plains consisting of quaternary alluvial deposits. Major soil types found in the project affected district of Sunsari include Haplaquepts, Pasmmaquents, Ustrotents, Haplaquepts and Eutrocrepts. The soil texture found there consists mostly of loam and clay loam.

(b) Seismology

134. Nepal is the 11th most earthquake-prone country in the world (NPC, 2015). Ever since the first recorded earthquake of 1225 AD that killed one-third of the population of Kathmandu Valley, Nepal has experienced a major earthquake every few generations. Baisakh 12, 2072 (April 25, 2015) was the major latest such incident. Figure 47 shows the map of earthquake density heat map and EGMP components.

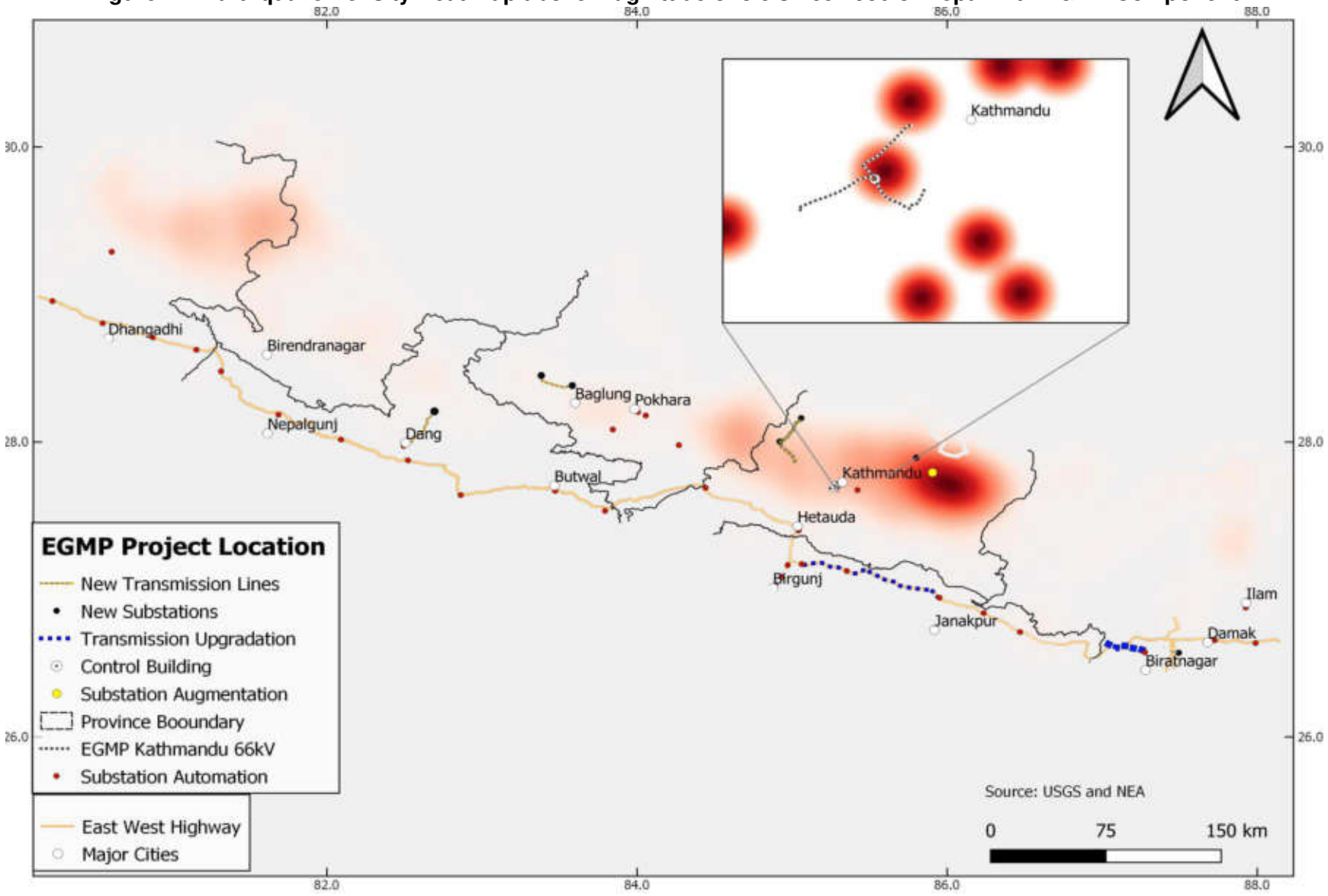
135. Peak ground acceleration for the Maximum Considered Earthquake is presented in terms of zone factors based on intensity of ground shaking (in g, 1 g=9.81m/s^2). The EGMP project components are situated in seismic zone factor of 0.3 to 1 which can pose serious seismic risks. The adequate structural designs will be considered for such seismic zones. When compared to the seismic risk profile at national scale, the transmission line alignments do not pass through the most dangerous seismic zone:

- Dandakhet-Rahughat 132kV transmission line (component 1) is located over seismic zone factor 1 with return period of 500 years[13]
- Ghorahi-Madichaur 132kV line (component 2) crosses over seismic zone factors 0.9 and 1 with return period of 500 years
- Borang-Ratmate transmission line (component 3) including its substations falls under contour 0.36g with return period of 500 years.

136. But some substations are present in the area of highest seismic risk. The Keraun substation is located in 0.36 gal region under the seismic contour of 100 gals.

[12] Yoshida, M., & Igarashi, Y. (1984). Neogene to quaternary lacustrine sediments in the Kathmandu Valley, Nepal. *Journal of Nepal Geological Society, 4*, 73-100.
[13] Department of Mines and Geology, Seismological Map of Nepal

Figure 47: Earthquake Density Heat Map above magnitude of 3.5 since 1950 of Nepal with EGMP Component



(c) Climate and Meteorology

137. Climatic and meteorological factors play a major role in causing natural disasters such as floods and landslides. Therefore these factors, when viewed in light of topographical and geological conditions, can be used to assess the risk of occurrence of such disasters, although nature and extent of such disasters for any affected areas are determined with the combination of both natural and anthropogenic factors. Extreme weather events associated with the level of precipitation (rainfall duration and intensity) that triggers a landslide, debris flow or other similar event is known as precipitation threshold. Several studies have been done in the Himalaya region to derive relationships between rainfall amount and intensity, and the number and size of landslides and debris flows. In one study done in Kolpu River in Central Nepal, the region hosting the highest density of EGMP components, the precipitation threshold was observed to be 100 mm of rain within 24 hours[14]. Therefore, an understanding of weather conditions, geomorphology and geology are important while planning and designing infrastructure.[15]

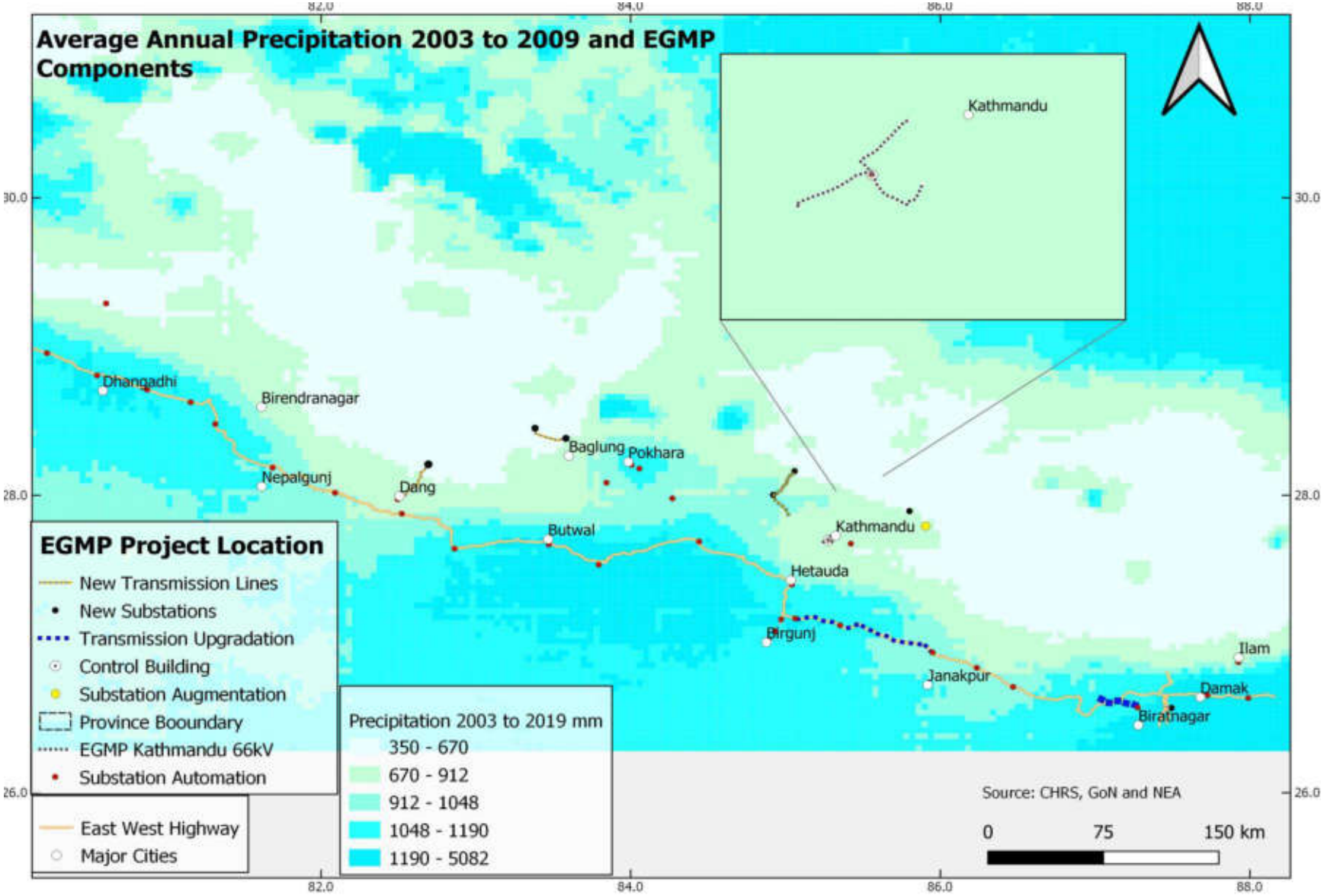
138. As the EGMP components are located in areas with high topographic variability, these will experience different types of climatic regimes and precipitation pattern. Average precipitation of the region is 1530 mm but this figure shows huge variation from the south to north as well as east to west. There are two patterns of monsoon seasons appearing in summer (easterlies) and winter (westerlies). Summer monsoon advances from Bay of Bengal to the west and it is the country's wettest period of the year when 75% of total yearly rainfall occurs within a few months (June-September). Usually, the western parts receive less rainfall than the east during summer monsoon due to decreased moisture gradient as the wind approaches the eastern side. The winter monsoon (originating from the Arabian Sea) usually brings cold air and modest precipitation along the northwest regions. The winter is the driest period in the northwest region. Figure 49 presents the spatial variation of precipitation over the country, overlaid with EGMP components.

139. Wind velocities in the EGMP regions vary with altitude i.e. the wind velocities in low altitude valleys are lower in magnitude than those in the high-altitude valleys and mountain ridges. The extreme wind speed is as high as 46.76 m/s in Kathmandu. The average monthly wind speed in Kathmandu Valley was observed to be 3.74 kilometer per hour (km/h) from March to August and lowest at 2.39 km/h in December. The highest wind speed recorded was at Nagarkot station, 6.1 km/h in April.

[14] Caine, N.; Mool, P.K. 1982, Landslides in Kolpu Khola Drainage, Middle Mountains, Nepal, *Mountain Research and Development*, 2(2):157-173.

[15] Deoja B. B. 2001, Hazards and Risks to and from Linear Infrastructures in Mountainous Regions, Landslide Hazard Mitigation in the Hindu Kush-Himalayas, ICIMOD.

Figure 48: Average Annual Precipitation Map of Nepal and EGMP Components (2003-2019)



140. **Component 1.** The transmission line is situated in the Subtropical Climatic Zone. Based on measurements at Beni Bazar, Myagdi, the annual temperature in 2013 varied between a minimum of 17.43°C and maximum of 28.74°C from ground based metrological station (closest to the project site).[16] A transect along the alignment shows that for 2019 the maximum summer temperature reached 27°C at elevation 1,007 masl, while the minimum winter temperature dropped to -9.8°C at 1,535 masl (Figure 49).[17] Measurements from Department of Hydrology and Meteorology (DHM) stations in the project affected districts show an average annual rainfall of 1,789.5 mm for Kuhun, Myagdi Station.[18] 2019 data in the project affected municipalities shows the mean monthly precipitation varied from 22.9 mm in June to 191.8 mm in August. The maximum and minimum precipitation values for the spatial distribution are shown in Table 25. The Wind Exposition Index (WEI) for the alignment indicated that AP 5 to 7 are in areas experiencing high wind ranging between 1.2 to 1.4m/s.[19]

Figure 49: Seasonal Temperature along Elevation Transect at Dandakhet Rahughat Transmission Line

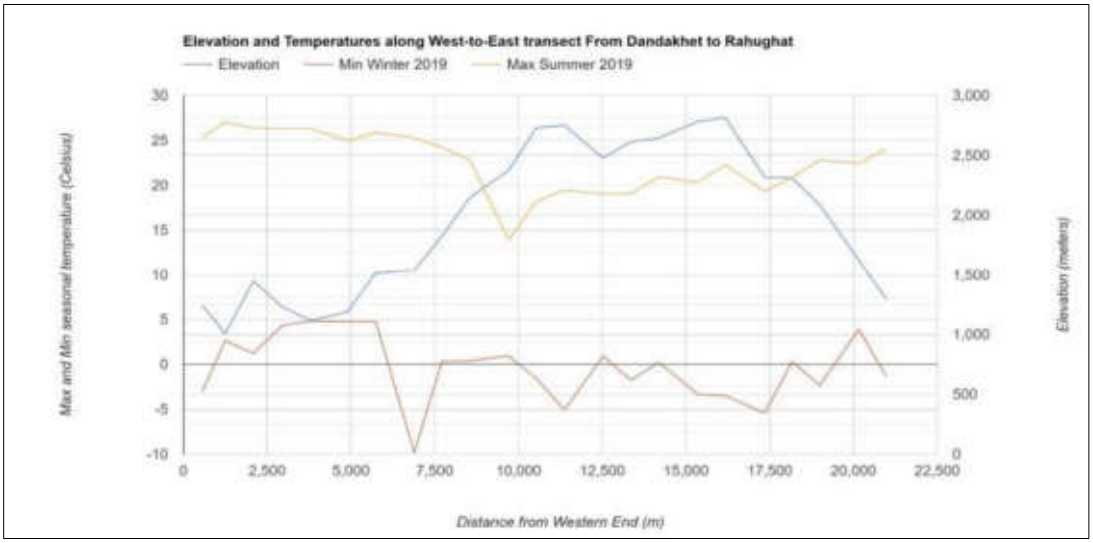


Table 25: Spatial Variation of 2019 Monsoonal Precipitation PAA of Dandakhet Rahughat Transmission Line

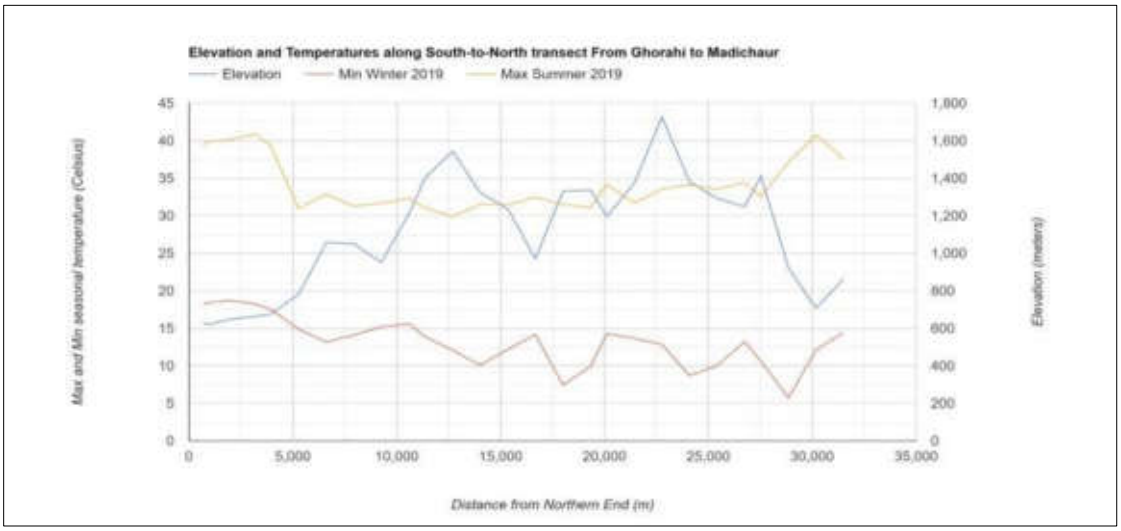
Month	Precipitation in mm		
	Average	Max	Min
June	22.9	61	12
July	26.1	75	7
August	191.8	287	114

[16] IEE for Dhadakhet Rahughat 132kV TL, NEA.
[17] USGS/Google Landsat 8.
[18] IEE for Dhadakhet Rahughat 132kV TL, NEA.
[19] Boehner, J., Antonic, O. (2009): Land-surface parameters specific to topo-climatology. in: Hengl, T., Reuter, H. (Eds.): 'Geomorphometry - Concepts, Software, Applications'. Developments in Soil Science, Volume 33, p.195-226, Elsevier.

September	47	121	12

141. **Component 2.** This transmission line also crosses various Climatic Zones from Subtropical to Upper Tropical. Recorded temperatures vary between a minimum of 5.6°C and a maximum of 34.4°C in the project vicinity according to measurements from ground based metrological station over the period 10 years.[20] However, temperatures vary based on elevation as well. Therefore, a transect along the alignment based on different elevations shows that for 2019 the maximum summer temperature at elevation 664 masl reached 40.9°C, while the minimum winter temperature dropped to 5.8°C at 1,410 masl (Figure 50). Measurements from DHM stations in the project affected districts over the period 10 years highlight a maximum monthly rainfall of 425.9 mm in June 2010 for Dang DHM station.[21] 2019 data for average values over the project municipalities indicate a fluctuation of the mean monthly precipitation from 87.6 mm in September to 311.3 mm in August 2019. The maximum and minimum precipitation for monsoon 2019 over the same area is presented in Table 26. The Wind Exposition Index (WEI) for the alignment has been measured between Angle Point (AP) 6 to 13, AP 15 to AP 20, AP 27 to AP 28, AP 29 to 31 and AP 33 to 35 and was observed to range between 1.2 to 1.4m/s,[22] evidencing wind exposed areas.[23]

Figure 50: Seasonal Temperature along Elevation transect for Ghorahi-Madichaur Transmission Line



[20] IEE for Ghorahi Madichaur 132kV TL, NEA
[21] IEE for Ghorahi Madichaur 132kV TL, NEA
[22] Boehner, J., Antonic, O. (2009): Land-surface parameters specific to topo-climatology. in: Hengl, T., Reuter, H. (Eds.): 'Geomorphometry - Concepts, Software, Applications'. Developments in Soil Science, Volume 33, p.195-226, Elsevier.
[23] A WEI value below 1 indicate wind shadowed areas and WEI above 1 indicates wind exposed area.

Table 26: Spatial Variation of 2019 Monsoonal Precipitation Ghorahi-Madichaur Transmission Line

Month	Precipitation in mm		
	Average	Max	Min
June	114.5	186	60
July	155.2	244	52
August	311.3	393	230
September	87.6	254	20

142. **Component 3**. The transmission line traverses a wide range of climatic zones, from Subtropical to Upper Tropical. Temperatures vary according to seasonality and elevation. Based on measurements from DHM ground-based metrological stations at Dhunibesi and Nuwakot over the period 2008-2017, in the project vicinity, the minimum temperature recorded was 6.3°C in January 2013 in Dhunibesi, while the maximum temperature recorded over that period was 34.3°C in April 2016 still in Dhunibesi.[24] Satellite temperature measurements along a transect along the project alignment show for year 2019 a maximum summer temperature at elevation 867 masl reaching up to 29.3°C, and a minimum winter temperature as low as -5.2°C at 1,819 masl (Figure 51).[25] DHM stations in the project affected districts of Dhading and Nuwakot, measured a peak of rainfall in 2013, reaching a maximum monthly rainfall of 596.1 mm in August 2013 in Dhading and of 1,062.8 mm in July 2013 in Nuwakot.[26] Based on the analysis of 2019 data, in the Component municipalities, the mean monthly precipitation varied from 87.9 mm in June to 263.1 mm in August. The mean monthly precipitation for monsoon 2019 is in Table 27.

[24] IEE for Borang Naubise 220kV TL, NEA
[25] USGS/Google Landsat 8
[26] IEE for Borang Naubise 220kV TL, NEA

Figure 51: Seasonal Temperature along transect for Borang-Lapang-Ratmate Transmission Line

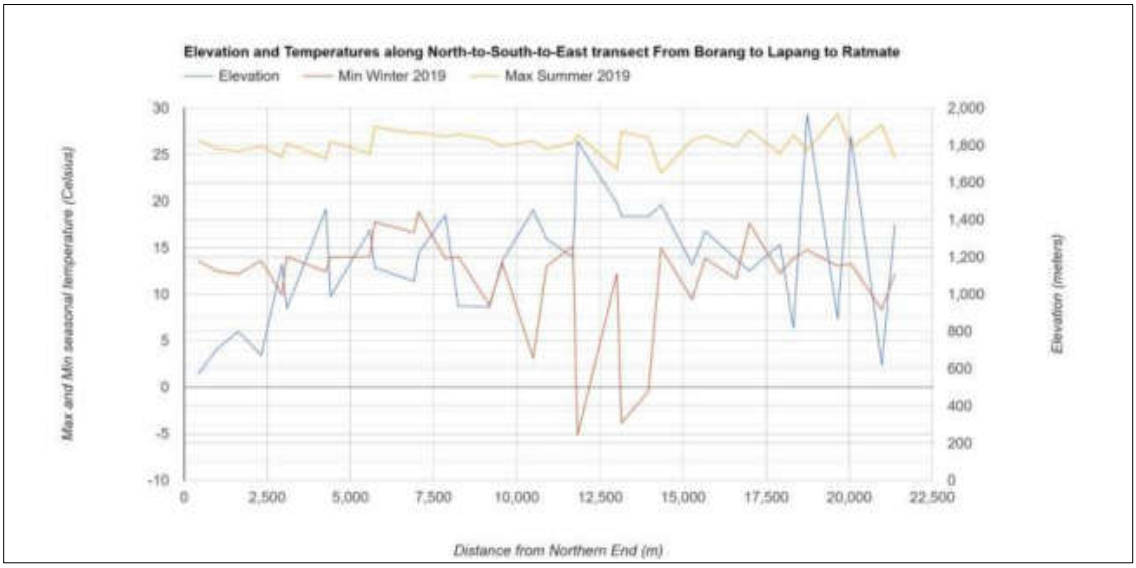


Table 27: Spatial Variation of 2019 Monsoonal Precipitation in PAA of Borang Lapang Ratmate Transmission Line

Month	Precipitation in mm		
	Average	Max	Min
June	87.9	177	34
July	145.7	289	76
August	263.1	463	108
September	97.8	143	61

143. **Component 4.** This lies in Sindhupalchok District in the Subtropical Climatic Zone. On average, minimum temperatures within the catchment range from 0–12 ◦C in winter and 9–24 ◦C in summer, whilst maximum temperatures can be between 9 and 27 ◦C in winter and 21 and 39 ◦C in summer. Average rainfall in the district is 70-500 mm.

144. **Component 5.** Kerung Substation lies in Kanepokhari Rural Municipality in the Subtropical Climatic Zone. The maximum summer monthly mean temperature experienced here is 28.5°C and minimum monthly mean winter temperature is 11.9°C based on observations made in 2019. The precipitation based on 2019 data for average values in the project municipalities varies from 180.4 mm in September to 420 mm in June 2019.[27] Further details of the monthly precipitation in Kerung district for monsoon 2019 are presented in Table 28.

Table 28: Spatial Distribution of Precipitation in PAD of Kerung Substation

Month	Precipitation in mm		
	Average	Max	Min
June	420.0	699	253
July	277.9	393	180
August	318.4	402	163
September	180.4	260	82

145. **Components 7, 8, and 9c.** The Kathmandu Valley area experiences a warm temperate climate with dry winter and warm summer. The average monthly temperature was recorded to a minimum of 6.4^{0}C in winters (between January to March of 2019 close to Shankharapur at 1,819 masl) and a maximum of 30.2^{0}C in summer (between May to July 2019 close to Naya Bazaar Area of the Transect at 1,315 masl)[28] (Figure 52). Average monthly rainfall amounts to 155.24 mm; the monsoon season accounts for about 80% of annual rainfall, with monthly monsoonal rainfall varying from 76.2 mm in September to 212.7 mm in August (Figure 52). The 2019 spatial variation of precipitation in Kathmandu Valley is presented in Table 29.

[27] Center for Hydrometerology and Remote Sensing, Data Portal
[28] USGS/Google Landsat 8

Figure 52: Seasonal Temperature in Relation to Elevation in Kathmandu Valley

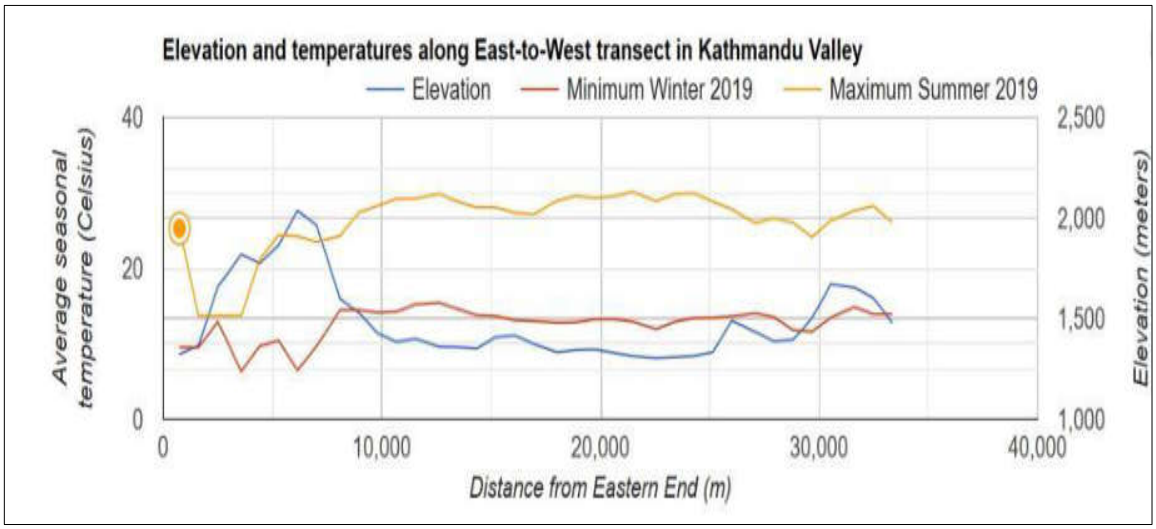


Table 29: Monthly Spatial Pattern Monsoonal Precipitation for 2019 in Kathmandu Valley

Month	Precipitation in mm		
	Average	Max	Min
June	148.7	351.0	87.0
July	128.0	201.0	63.0
August	212.7	351.0	134.0
September	76.2	137.0	20.0

146. **Compontent 9a. Pathlaiya-Dhalkebar:** This is located in an area of humid, tropical climate. The mean annual rainfall is 2,214 mm. More than 80% of the total annual rainfall occurs during the monsoon season from June to September. Average temperatures ranged from 8.08°C in January to 34.91°C in June.

147. **Component 9b.** This lies between maximum 98 masl at Duhabi Municipality to minimum 84 masl (using SRTM data[29]) at Bhokraha Rural Municipality in the Subtropical Climatic Zone (Figure 53). In 2019, the maximum summer mean monthly temperature experienced over the alignment were 30°C and minimum mean monthly winter temperature were 11.2°C.[30] The transect elevation and temperature variation are presented in Figure 53. Based on 2019 average values in the project municipalities, the mean monthly precipitation varied from minimum 14 mm in May to 448 mm in June 2019.[31] Precipitation data for monsoon 2019 are presented in Table 30. A WEI

[29] Jarvis, A., H.I. Reuter, A. Nelson, E. Guevara. 2008. Hole-filled SRTM for the globe Version 4, available from the CGIAR-CSI SRTM 90m Database: http://srtm.csi.cgiar.org.
[30] USGS/Google Landsat 8
[31] Center for Hydrometerology and Remote Sensing, Data Portal

beyond 1.2m/s is observed in Koshi Rural Municipality near tower 15, Bhokraha Rural Municipality between tower 18 to 19, 26, Inaruwa Municipality at tower 52 and at Duhabi Municipality between towers 65 to 66, 74 to 76, 78 and 84.[32]

Figure 53: Elevation and Seasonal Temperature Profile for Duhabi Kushaha 132kV Transmission Line

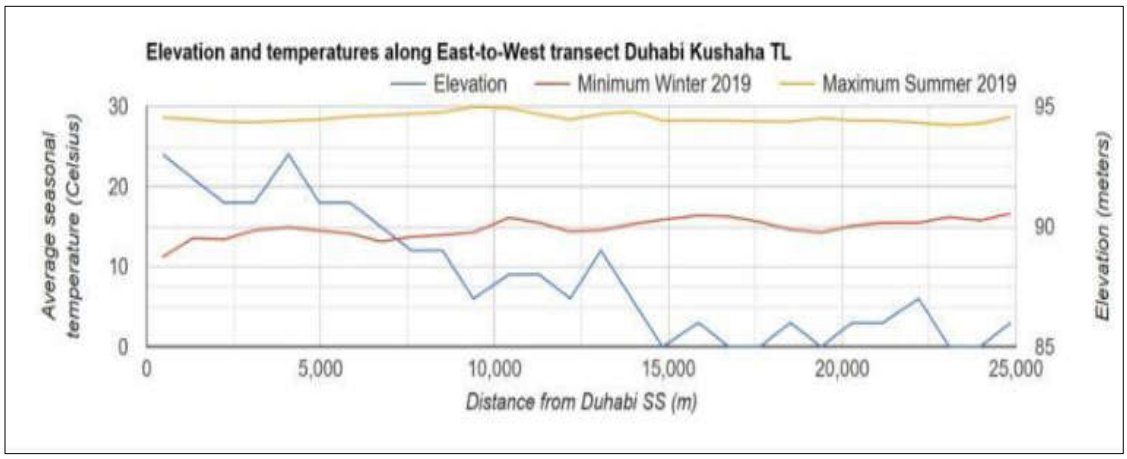


Table 30: Mean Monthly Precipitation for 2019 in PFA of Duhabi Kushaha Transmission Line

Month	Mean Precipitation in mm		
	Average	Max	Min
May	24.2	43	14
June	365.1	448	317
July	179.2	213	147
August	267.6	288	236

(d) Air and Noise Quality

148. Considering that the project components are mostly in remote areas there is no proper documentation available on the air and noise quality at district or province level. Due to the COVID-19 pandemic, in situ measurements have not been possible in the context of this IEE. In order to establish a more robust baseline for the EGMP components, the environmental monitoring plan requires to undertake pre-construction air and noise quality measurements during the detailed design and pre-construction phase at sample locations where sensitive receptors are in close proximity to the ROW of transmission line and substation boundaries. For this IEE, the

[32] Boehner, J., Antonic, O. (2009): Land-surface parameters specific to topo-climatology. in: Hengl, T., Reuter, H. (Eds.): 'Geomorphometry - Concepts, Software, Applications'. Developments in Soil Science, Volume 33, p.195-226, Elsevier.

ambient air quality data was taken from Copernicus[33] using the latest available data of 2018 (Figures 54 to 58) for Particulate Matter (PM2.5), Sulfur Dioxide (SO2), Oxides of Nitrogen (NOx), and Ozone (O_3). It can be seen from the maps that all baseline air quality parameters are generally within the permissible limits of national as well as WHO guideline for the protection of human health although there may be local hotspots of air pollution which can only be determined through monitoring on the ground. Similarly, except some urban centers like Kathmandu, noise levels are generally anticipated to be low and within the permissible limits.

[33] This data was taken by the IEE consultants from COPERNICUS Spatio Temporal Data deriving from https://atmosphere.copernicus.eu/data

Figure 54: PM2.5 Levels Map of Nepal and EGMP Components

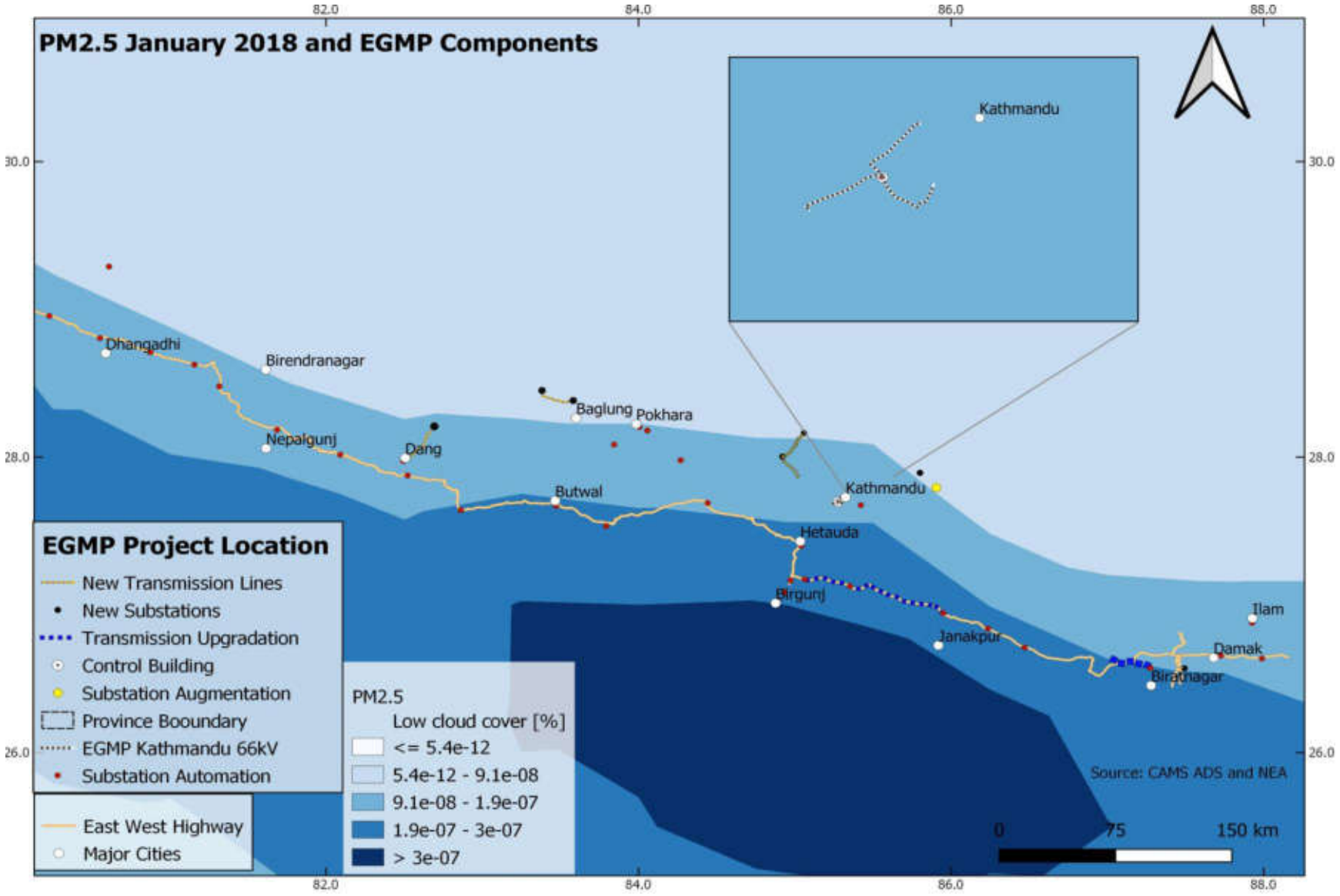


Figure 55: NO2 Levels Map of Nepal and EGMP Components

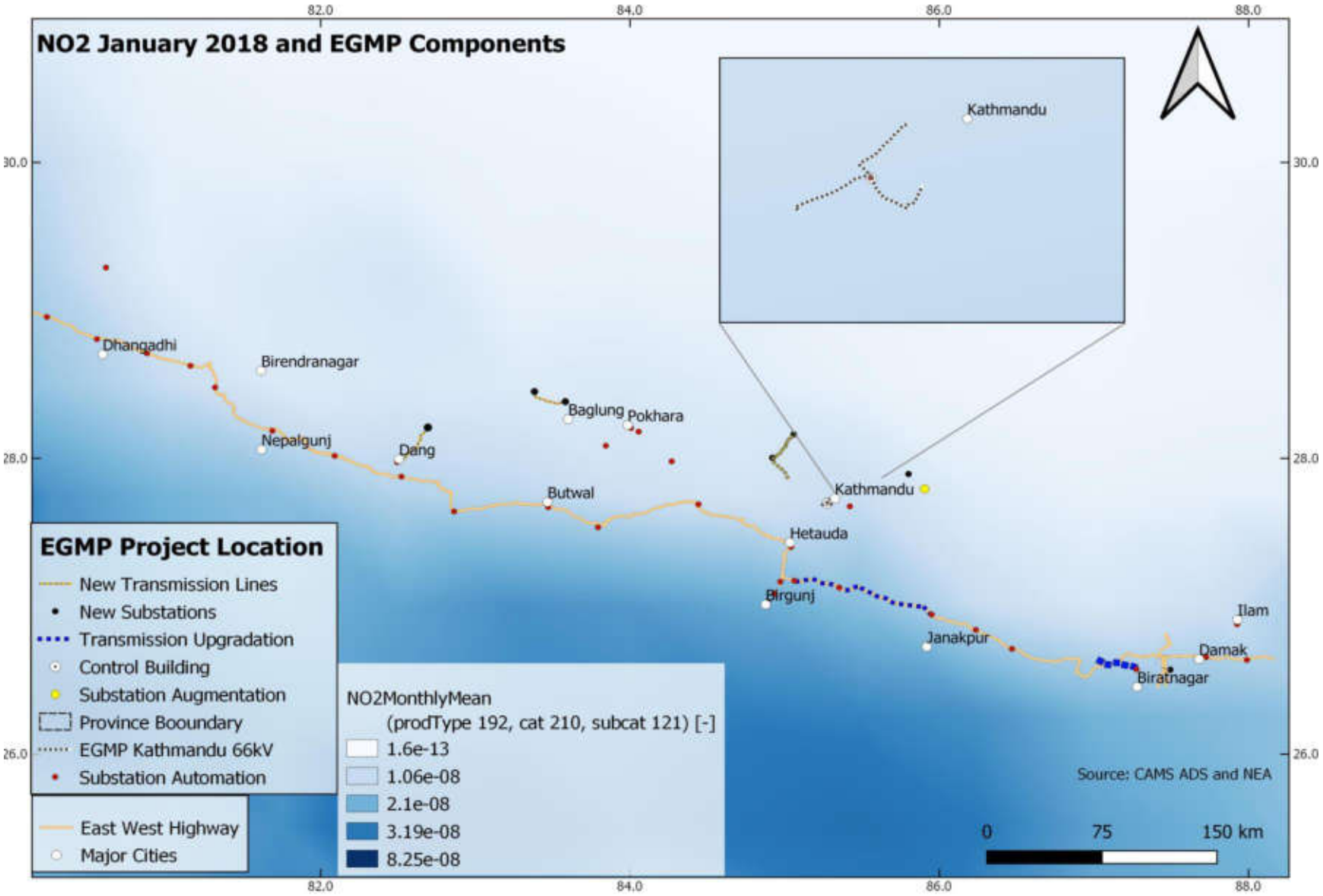


Figure 56: SO2 Level Map of Nepal and EGMP Components

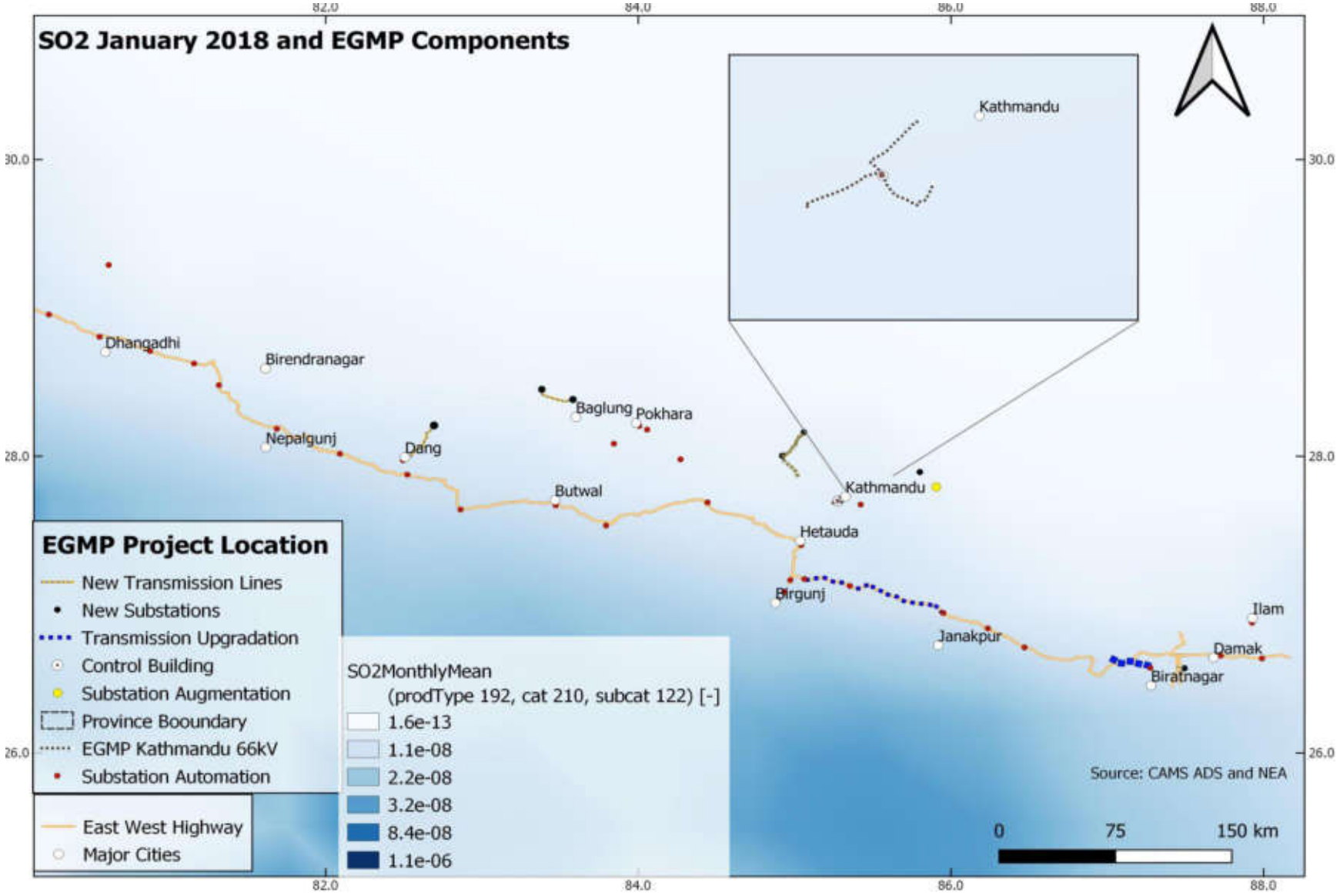
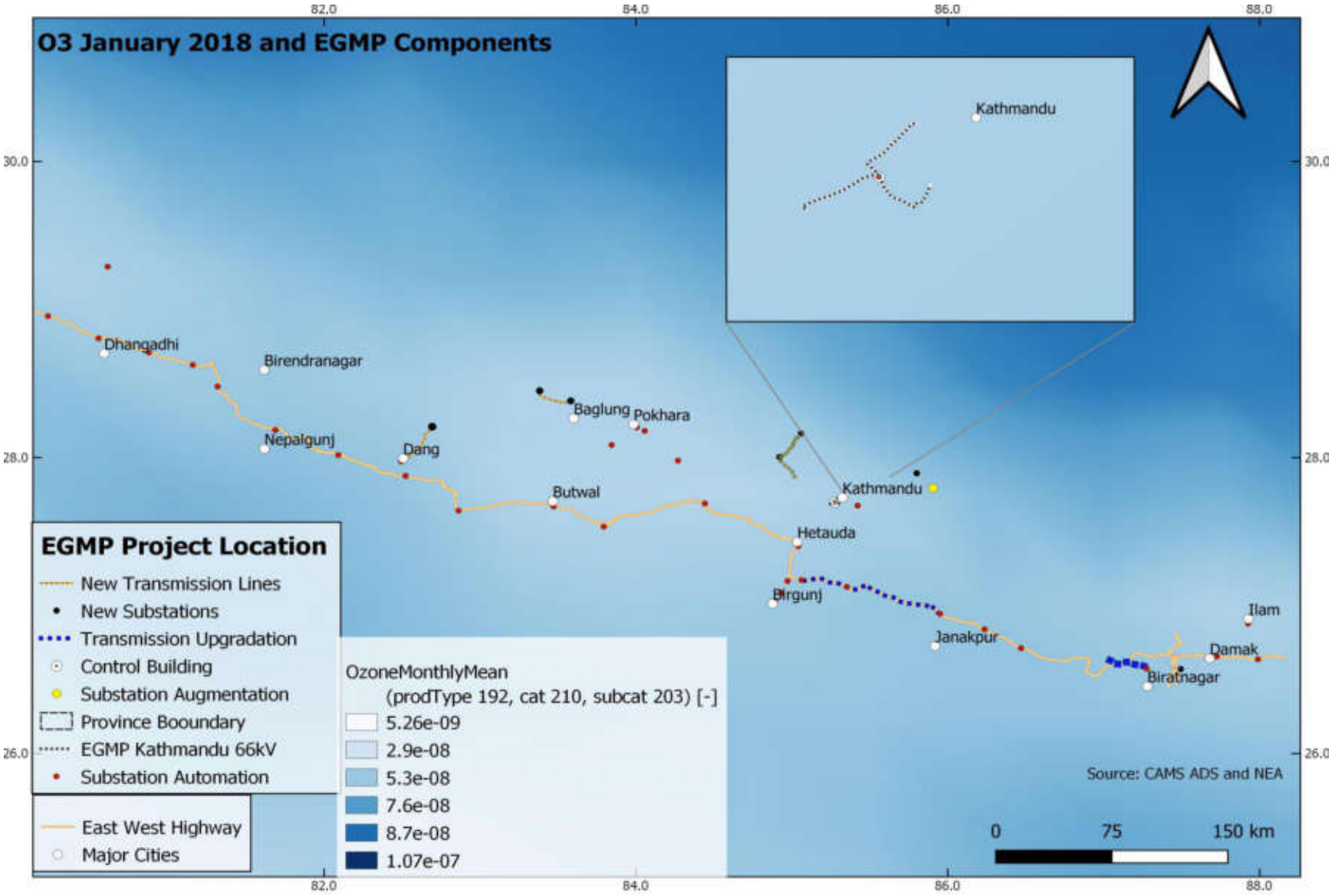


Figure 57: O3 Levels Map of Nepal and EGMP Components



(e) Water Resources and Water Quality

149. The transmission line components of the project crosses over several rivers; their respective flow varies seasonally and depending on precipitation. The seasonal precipitation pattern in Nepal is highly variable. Nearly 75% occurs during the monsoon (June-September), 8% fall in post-monsoon (October-January) and 12% during the pre-monsoon period[34]. The mean, maximum and minimum flow using FLO1K[35] for 55 years along the alignment at the location where the transmission line crosses major rivers from 1960 to 2015 are discussed below with further information in Appendix 6. Water quality monitoring has not been done in the project areas therefore available secondary data has been used to establish the water quality baseline. Table 31 presents water quality data of two main rivers in the EGMP project areas. It can be seen from that table that water quality parameters of the rivers is generally within permissible standards of Government of Nepal.

150. **Component 1.** The transmission line crosses Rahuganga Khola between AP 3 to AP 4 at 28.3773°N, 83.5642°E; the Dhukhu Khola between AP 29 to 30 at 28.4218°N, 83.3846°E, and Myagdi Khola between AP 29 to 35 at 28.4494°N, 83.3828°E. Dhukhu Khola is the major river among these with mean annual flow 50.918m^3/ on average over the period 1962-1999; its maximal annual flow reached 141.3m^3/s in 1962. Overall, the mean river flow of all four rivers has followed a decreasing trend over the period 1960-2015 and so have their respective maximum annual river flows. Water quality of the respective rivers is generally good although water quality monitoring data is not available.

151. **Component 2.** The transmission line crosses Madi River between AP 3 to 4 at 28.1907°N, 82.6822°E; the River Arun between AP 21 to 22 at 28.0749°N, 82.6245°E; and the River Balim at AP 44 at 27.9909°N, 82.5225°E. The Madi River is the major river major river among these with mean annual flow 3.803m^3/ on average over the period 1966-1973; its maximal annual river reached 5.643m^3/s in 2013. The mean river flow of all rivers has followed decreasing trend and so have their respective maximum annual river flows. Water quality of the respective rivers is generally good although water quality monitoring data is not available.

152. **Component 3.** The transmission line crosses the Kitan Khola between AP 26 to 27 at 28.0313°N, 84.9673°E; the Lapan Khola between AP 33 to 33A at 28.0047°N, 84.9259°E; the Thoppal Khola between AP 42 to 43 at 27.9506°N, 84.9546°E; and the Trishuli river between AP 59 to 65 at 27.8513°N, 85.0286°E. The latter is the major one, with a mean annual river flow of 190 m^3/s on average over the period 1960-2015; its maximal annual river flow reached 723 m^3/s in 1990, with 7 peaks above 650 m^3/s over the period 1960-2015, while half of the maximal annual flows over that period were within the range 517-609 m^3/s. Towers AP 60 to 64 are located in the river/on islands. For the three smaller rivers, the towers will be set on each

[34] Chalise S.R. et al. 1996, Hydrology of the Hindu Kush-Himalayas, A Report of the Regional Workshop, March 23-24, Kathmandu, ICIMOD.

[35] Barbarossa, V., Huijbregts, M., Beusen, A. et al. FLO1K, global maps of mean, maximum and minimum annual streamflow at 1 km resolution from 1960 through 2015. Sci Data 5, 180052 (2018). https://doi.org/10.1038/sdata.2018.52

side, well above average river level; however, it is worth noting that their respective maximum annual river flows over the 1960-2015 each peaked at a level 5 times above the average of their mean annual river flows, which has to be taken into account in the detailed design. Overall, the mean river flow of all four rivers has followed a decreasing trend over the period 1960-2015 and so have their respective maximum annual river flows. Water quality of the respective rivers is generally good although water quality monitoring data is not available.

153. **Components 7, 8 and 9c.** Kathmandu Valley lies in the Bagmati Basin. It is drained by River Bagmati with its 8 main tributaries. The main source of its tributary lies in Bagdwar in the Shivapuri Nagarjun National Park and acts as a main source of drinking water supply to Kathmandu, of which 80% gets diverted for drinking supply during dry season. Moreover, the water supply reservoir produces 640 kW power through a mini hydro-power plant. According to a study by the Department of Hydrology and Meteorology's (DHM), the discharge in the river has been decreasing over the last 25 years. Nevertheless, extreme events of rainfall associated with floods have been recorded in 1993, 2002, 2004 and 2018. Major causes have been unplanned settlements and encroachment on river floodplains. Based on studies done by DHM and the High-Powered Committee for Integrated Development of the Bagmati Civilization (HPCIDBC) water quality has been deteriorating even in upstream sections of the river. Urban domestic sewage is currently directly disposed of in the river system in the valley. This has resulted in deterioration of the water quality with dissolved oxygen varying between 1 to 7 mg/l in the upper section after flowing out of Sundarijal while in the lower reaches it drops down to 0 mg/l. Likewise, chemical oxygen demand levels are highest in Bishnumati and Dhobi Khola[36]. This is mainly because of the industrial effluents discharged into the river.

Table 31: Water Quality Data for Rivers Closest to the Project Sites

S.N.	Parameters	Observations from Secondary Data for the Respective Rivers	
		Myagdi Khola 2015[37]	**Trishuli 2014**[38]
1	pH @ 19 C	6.5	7.8
2	Turbidity (NTU)	10	225
3	Electrical Conductivity, (µS/cm)	231	150
4	Total Solids,(mg/L)	258	553
5	Total Suspended Solids (mg/L)	<1	268
6	Total Hardness as CaCO3 (mg/L)	138	76
7	Total Alkalinity as CaCO3 (mg/L)	127	107

[36] EIA Report of BRBIP, 2013 ADB.
[37] EIA of Myagdi Khola Hydro Project, July 2019.
[38] https://www.adb.org/sites/default/files/project-documents/49086/49086-001-eia-en.pdf

S.N.	Parameters	Observations from Secondary Data for the Respective Rivers	
8	Ammoniacal – N, (mg/L)	0.1	0.8
9	Nitrate, (mg/L)	0.15	0.01
10	Chemical Oxygen Demand, (mg/L)	4	32
11	Iron (mg/L)	0.08	6.8
12	Manganese (mg/L)	N.D.(<0.02)	0.11
13	Lead, (mg/L)	N.D. (<0.01)	BDL
14	Zinc, (mg/L)	0.02	0.05

N.D.: Not Detected;
NTU: Nephelometric Turbidity unit;
UV: Ultraviolet
BDL: Below Detection Level

C. Biological Environment

(a) Forest Vegetation

154. In Nepal, forest is defined as an area completely or partially covered with trees or their saplings: specifically an area of land at least 0.5 ha and a minimum width/length of 20m with a tree crown cover of more than 10% and tree heights of 5m at maturity. Land not classified as forest but spanning more than 0.5 ha, having at least 20m width and a tree crown cover between 5% to 10% OR less than 5% but where the combined cover of shrubs, bushes and trees is more than 10% is called other wooded land (OWL). The Forest Act 1993 defines six forest management categories: Government managed forest, protected forest, community forest, leasehold forest, religious forest, and private forest. A community forest is a forest area handed over to a user group of local people pursuant to section 25 of the Forest Act, 1993, for its development, conservation, and utilization for the collective interest. National forest refers to all forests excluding private forest, whether marked or unmarked with forest boundary; the term shall also include wasteland (not suitable for productive or any land use), uncultivated and unregistered lands surrounded by forest or situated near the adjoining forest. In addition, there is also provision for buffer zone forest and buffer zone community forest. A buffer zone is a designated area surrounding national parks to enhance the conservation effort, as per the Buffer Zone Management Rules, 2052. The buffer zone concept has reduced conflict between the parks and local people with the formation and strengthening of community based organizations (CBOs), forest management (especially community forest), conservation activities, income generation and skill development, eco-tourism promotion, conservation education, sustainable community development and alternative energy promotion.

155. The forest area of Nepal is estimated to be 5.5 million ha or 37.4% of the total area of the country. The "other land" category covering another 15.7% has good potential for development into forest or pasture. These lands include shrublands, grasslands and

uncultivated areas. More than a quarter of the forests are degraded (less than 40% crown cover). Almost two-thirds are occupied predominantly by small-sized timber, and one-third by large timber. There is not enough regeneration or pole-sized stands. The total growing stock is 522 million m^3 over-bark up to 10 cm top diameter or an average of 96 m3/ha (MPFS, 1988). Table 32 shows the distribution of Nepal's natural forests. The distribution of natural forests generally follows attitudinal zones. Below 1,000 m there are tropical forest, predominantly of *Shorea robusta. Acacia catechu/Dalbergia sissoo* forests replace Shorea along rivers. In the foothills in western Nepal, Shorea is replaced by *Terminalia/Anogeissus* forests. Sub-tropical forests occur between 1,000-2,000 m which include *Pinus roxburghii, Alnus nepalensis, Schima wallichii* and *Castanopsis sp.* Lower temperate forests (2,000-2,700 m) consists of *Pinus wallichiana* and several species of *Quercus.* Upper temperate forests (2,700-3,000 m) includes *Quercus semecarpifolia* forest along with *Rhododendron arboreum, Acer sp, Pinus wallichiana* etc. Sub-alpine forests are found at around 3,000 m up to 4,200 m. *Abies spectabilis, Betula utilis* and *Rhododendron* forests and *Juniperus Indica* forest represent this category. The alpine zone has no trees, but shrubby *Rhododendron* and *Juniperus* are found up to 4,500 m.

Table 32: The Distribution of Natural Forests of Nepal (' 000 ha.)

Distribution by	Conifer	Hardwoods	Mixed	Total	%
Crown cover					
10 - 40%	230	876	311	1,417	26
40 - 70%	511	1,903	772	3,186	59
70 - 100%	186	428	207	821	15
Maturity					
Poles & regeneration	9	33	10	52	1
Small timber	446	2,356	725	3,527	65
Large timber	472	818	555	1,845	34
Nepal - total	927	3,207	1,290	5,424	100
%	17	59	24	100	-

Adapted from (MPFS, 1988)

156. None of the new substations are located on forest land, but different forest types are observed along the alignments of the transmission lines depending upon their physiographic features. Bio-climatic conditions determine the biodiversity of a particular place. Since the EGMP work area extends from the flat Terai and up and down hills, diversity and composition of flora was observed. Details of forests along the 3 new transmission lines are presented in subsequent section (c).

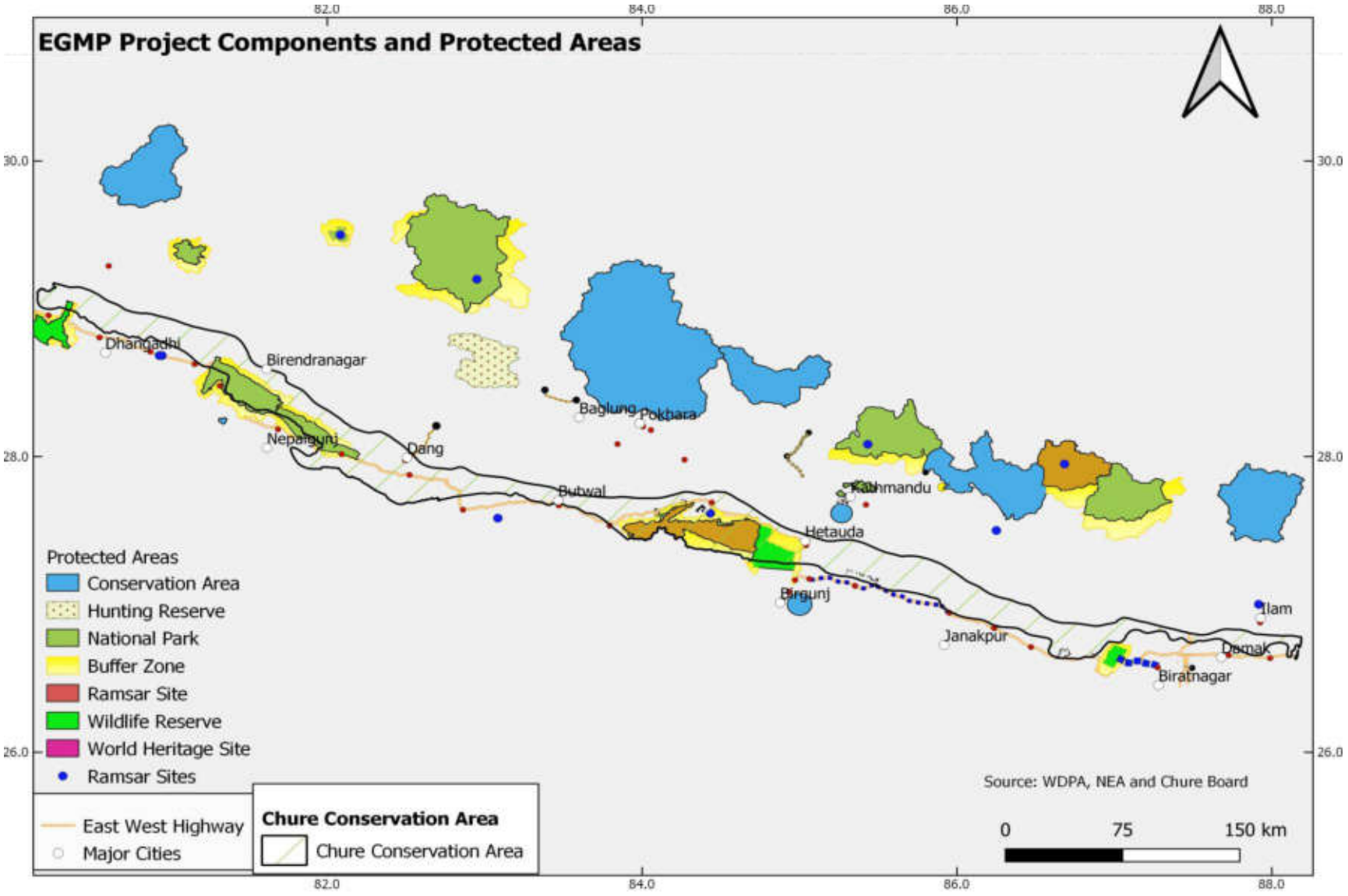
(b) Protected Areas and Forest Management

157. The National Parks and Wildlife Conservation Act, 1973 provides a legal basis for the management of protected areas. Nepal has established a very good network of protected areas

with 12 national parks, 1 wildlife reserve, 1 hunting reserve, 6 conservation areas, and 13 buffer zones extending from lowland Terai to high mountains, covering 23.39 % of the total country's land, which contributes to in-situ conservation of ecosystems and biodiversity across the country. Conservation efforts made by the government of Nepal are popular worldwide and highly recognized by international societies.

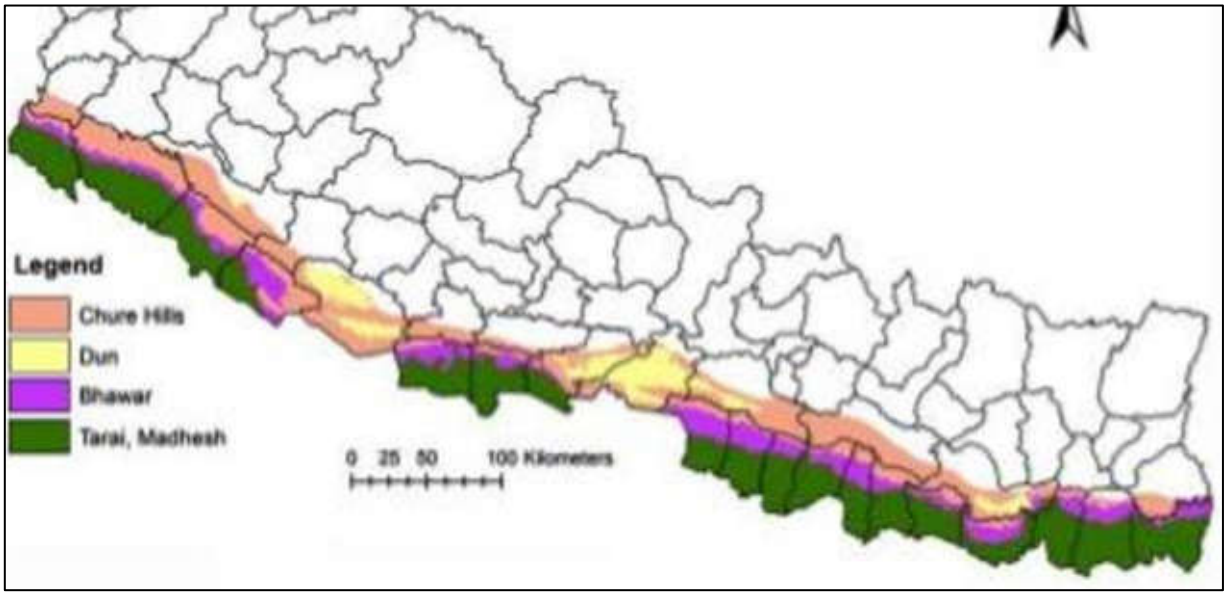
158. Some of the EGMP components are located in designated protected areas. Figure 58 show the locations of the EGMP components on the protected areas map of the country. Of particular note is Chure Conservation Area, Parsa National Park, and the buffer zone of Koshi Tappu Wildlife Reserve which components 2, 9a and 9b pass through. A brief note on these protected areas along with their protection significance is presented in the subsequent paragraphs.

Figure 58: Protected Area Map of Nepal and Location of EGMP Components



159. **Chure Conservation Area:** A 7.4 km section (from Ghorai substation) of the new Ghorahi - Madichaur 132 kV transmission line passes through the Chure Conservation Area and the existing Pathlaiya-Dhalkebar 132 kV line alignment also passes through it at two locations (Figures 7 and 15). 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, government of Nepal has initiated 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 managed by DNPWC. It covers both the Chure Hills (Figure 59, pink area) and the associated Dun (fertile river valleys used for agriculture, Figure 59 yellow area).

Figure 59: Chure-Tarai Madhesh Landscape



160. The Chure Hills range is situated parallel to but further south of the Himalayan range in Nepal. Geographically, it is equally 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-Tarai such as the Dang, Deukhuri Surkhet and Chitwan Valleys lie within the Chure Conservation Area 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.

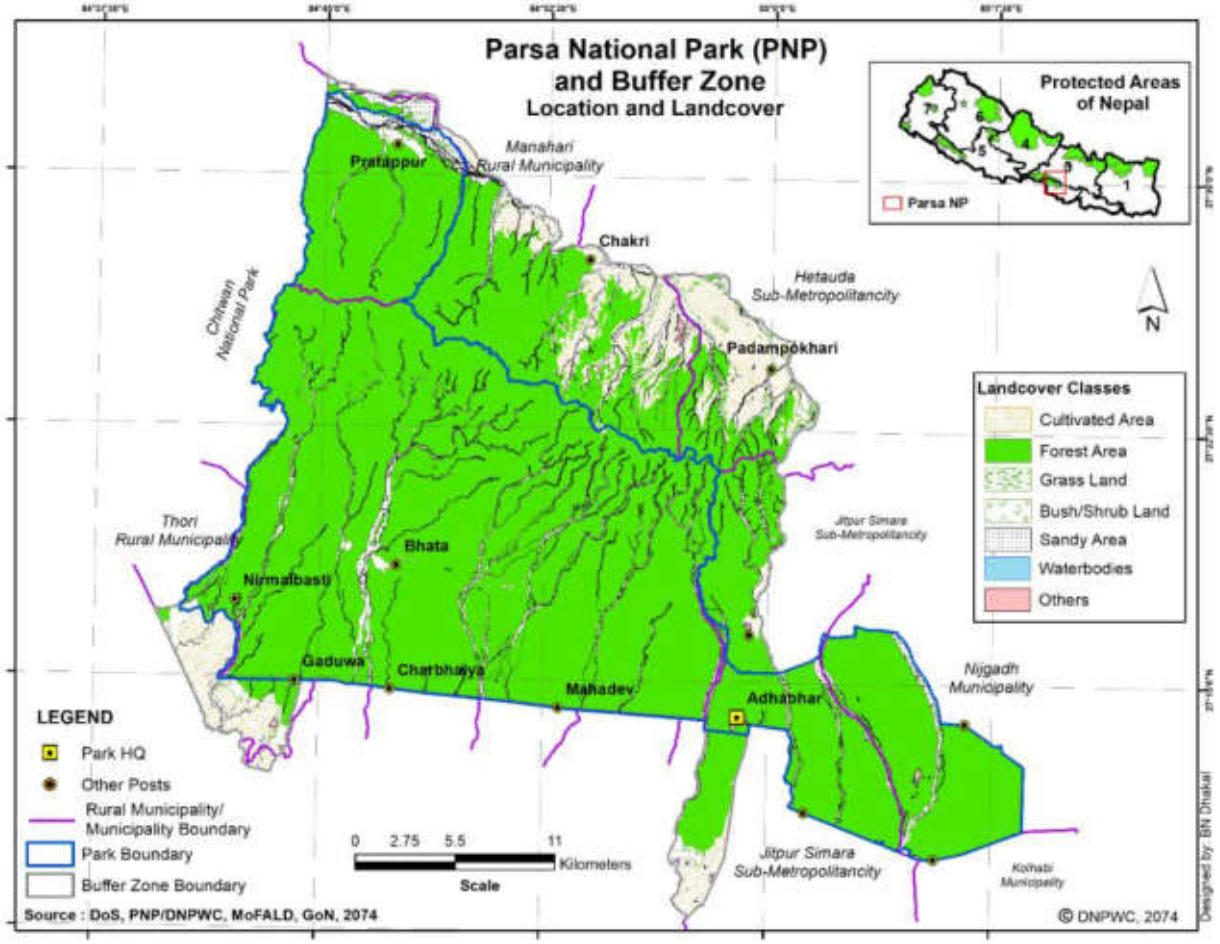
161. About 48.19% of the total area of the Chure-Tarai Madhesh Landscape is covered by agriculture and settlement, 47.16% by forest, shrub-land and grassland, and the rest 4.65% by river and river-bed. Of the total area of the Chure Hills range (including gullies) 83.47% is occupied by forest, shrub and grassland while 13.16% by agriculture and settlement, and the rest 3.37% by river and river-bed. On the contrary, 83.18% of the Tarai Madhesh region is

occupied by agriculture and settlement, 12.59% by forest, shrub and grassland, and the rest 4.23% by river and river-bed. 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 Tarai 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.

162. 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 the Nepal's total 118 ecosystems lie in the Chure Hills.

163. **Parsa National Park:** A section of the existing 132 kV transmission line from Pathlaiya to Dhalkebar is located in the newly extended area of the Parsa National Park boundary (Figure 60). Parsa National Park (an IUCN Category II Protected Area) is located in the south-central lowland Terai of Nepal. In 1984, it was gazetted as a wildlife reserve to preserve the habitat for wild Asian elephant and a variety of other fauna. It is contiguous with Chitwan National Park in the west. In 2017, it was gazetted as National Park and its boundaries extended.

Figure 60: Parsa National Park Boundaries



164. The forests are mainly composed of tropical and subtropical species. Sal forests comprise about 90 percent of its vegetation. Along the banks of the rivers, riverine forests are found containing species like Khair and Silk cotton tree. In the north-eastern part, at higher altitudes, Sal and Pine forests are occurring. On the southern slope of the Siwalik hills, the forests are dominated by pine. Sabai grass is a commercially important species, which grows well on the southern face of the Chure Hills. It supports good populations of various endangered species including wild Asian elephant, Royal Bengal tiger, Sloth bear, and Leopard. Blue bull, Sambar, Chital, Hog deer, Barding deer, Langur, Rhesus macaques, striped hyena, Jungle cat, and Palm civet. It also provides habitat for more than 500 species of birds. For example, white breasted kingfisher, paradise flycatcher, large racquet-tailed drongo, golden backed woodpecker, etc. Giant hornbill, one of the endangered bird species is found in some forest patches. It is also famous for reptiles and different kinds of snakes include common cobra, common and banded karit, python and king cobra.

165. **Koshi Tappu Wildlife Reserve and Ramsar Site**: A section of the 132 kV transmission line from Duhabi to Kusaha is located in the buffer zone of the Koshi Tappu Wildlife Reserve (Figure 17) which is also designated as a Ramsar site. The reserve lies on the floodplains of the Sapta Koshi River in the south-eastern Terai, supporting extensive mudflats, reed beds, and freshwater marshes. The Sapta Koshi is one of the three main tributaries of the Ganges-Rapid and intense flooding of the reserve, occur during the rainy season. Embankments have been constructed parallel to the river to control the flooding. The reserve is rectangular in shape and formed by the Koshi barrage near Nepal/India border on the east-west highway and the eastern and western embankments of the Sapta Koshi River.

166. The reserve was gazetted in 1976 to preserve habitat for Nepal's only remaining population of wild water buffalo (*Bubalus arnee*). The estimated population of wild buffalo is around 159 individuals but is dwindling. They are distinguished from domestic buffalo by their much bigger horns. The reserve is also home to around 20 other animal species such as Hog deer, Wild boar, Spotted deer, Blue bull, and Rock Python. The 176 sq. km. reserve is Nepal's smallest wildlife reserve.

167. The Koshi Tappu Wildlife Reserve was designated as a Ramsar site on 17 December 1987. Around 441 species of birds-many seen nowhere else in Nepal (14 endemic species)-have been recorded, including 20 duck species, 2 ibis species, white tailed stonechat, striated marsh warbler, 30 shore birds, 114 water birds, and the endangered swamp partridge and Bengal florican. It supports several species of notable birds including the large adjutant stork (*Leptoptilos dubius*), Pallas's fish eagle (*Haliaeetus leucoryphus*), common golden-eye (*Bucephala clangula*) and gull-billed tern (*Gelochelidon nilotica*). The Koshi Barrage is an extremely important resting place for many migratory birds, containing 87 winter and trans-Himalayan migratory species. During winter, many of the migratory birds can be seen on the Koshi Barrage and on the river channel. Migration usually peaks around mid-March. Much wildlife visits these areas during dusk and dawn. The Koshi River is home to 80 species of fish. The endangered Gharial crocodile and Gangetic dolphin (*Platanista gangetica*) have been recorded in the river as well. Located in a densely populated area, it is subjected to severe livestock grazing and attempts by local communities to reestablish their roots in the reserve.

168. The vegetation is mainly composed of tall grasslands. Local villagers are permitted to collect thatch grass once a year. These are used for roof thatching and building house walls. There are also small patches of Khair-sissoo scrub forest and deciduous mixed riverine forest.

169. Land use in the surrounding areas includes subsistence fishing and rice cultivation. Government of Nepal has declared the buffer zone (173.5 sq.km) surrounding the reserve in 2004.

(c) Flora and Fauna along the New Transmission Lines

170. **Component 1.** The closest protected area is Annapurna Conservation Area (ACA), which is about 7-9km north east of Rahughat substation, while the Dandakhet substation is 17km east of Dhorpatan Hunting Reserve, both of these protected areas are also important bird areas (Figure 61). Two locations at the edge of ACA are considered as internationally important raptor migration sites.[39] The first site is in Khare which lies at the southern boundary of Annapurna Conservation Area. The second site is located on the upper reaches of Kaligandaki River in its eastern bank.

171. The Dandakhet-Rahughat transmission line ROW has 52.28% of its total area in forest land (12.87km length and 23.17ha area). The alignment crosses over Lower Temperate Oak, Alder and Schima Castonopsis Forests Regions crossing 18 community managed forest and 1 Government Forest. Altogether, 71.97% of the trees are pole size with a tree density of 127 per hectare. Of all the forests the section between Rahughat to AP 4 has the most mature trees (above 30 cm of dbh) compared to other forests along the alignment. The crown cover of forest falling along the alignment from AP 5 to 7 is 75%, near AP 13 the crown cover is 70%, between AP 19 to 20 it is 47%. Based on national IEE report, Chir Pine (*Pinus roxburghii*), Kamala Tree (*Mallotus philippensis*), Mauwa (*Engelhardtia spicata*), Drooping fig (*Ficus semicordata*), Red Cedar (*Toona ciliate*), Fadelo (*Erythrina spp.*), Khirro (*Sapium insigne*), Silk Cotton Tree (*Bombax ceiba*), Chilaune (*Schima wallichii*), Utis (*Alnus nepalensis*), Katus (*Castanopsis indica*), Gurans (*Rhododendron spp.*), Malato (*Macaranga spp.*), Forsa, Kutmero (*Litsea monopetala*), Chiuri (*Aesandra butyracea*), Ghokro, Tiju (*Picrasma javanica*), Ginneri (*Premna spp.*) etc. are observed along the RoW (Appendix 12). Based on the national IEE, altogether 38 different species of plants were identified to have been used by local people for firewood, timber, fodder, animal bedding, building house as fruit/nuts and medicine.

172. Based on the national IEE, wildlife potentially found here includes **Mammals:** Rhesus Monkey (*Macaca mulatta*), Gray Langur (*Semnopithecus entellus*), Leopard (*Panthera pardus*), Indian Muntjac (*Muntiacus muntjak*), Golden Jackal (*Canis aureus*), Wild Cat (*Felis chaus*), Indian Gray Mongoose (*Herpestes edwardsii*), Squirrel (*Funambulus spp.*), Rat (*Ratus spp.*), Wolf (*Canis spp.*), Yellow Throated Marten (*Martes flavigula*), Indian Hare (*Lepus nigricollis*). **Birds:** House Sparrow (*Passer domesticus*), Red-billed Blue Magpie (*Cissa erythrorhyncha*), Kalij Phesant (*Lophura leucomelanos*), Red-vented Bulbul (*Pycnonotus cafer*), Spotted Dove (*Streptopelia chinensis*), Barn Swallow (*Hirundo rustica*), Black Kite (*Milvus migrans*), Vulture (Gyps spp.), Indian Treepie (*Dendrocitta vagabunda*), Crested Serpent-Eagle (*Spilornis cheela*), Baudai, Drongo (Dicrurus spp.), Parakeet (*Psittacula spp.*), Prinia (*Prinia spp.*), Long-tailed Shrike (*Lanius schach*), Forktail (*Enicurus spp.*), Scarlet Minivet (*Pericrocotus flammeus*) etc. **Herpetofauna:** Oriental Rat Snake (*Ptyas mucosa*), Oriental Golden Lizard (*Calotes versicolor*), Wall Lizard (*Hemidactylus frenatus*), Pit viper (*Trimeresurus albolabris*), Kharse Frog, Python (*Python spp.*) etc. Altogether the national IEE, has reported 12 mammals, 19

[39] Baral, H. S., & Inskipp, C. (2005). *Important Bird Area: Key Sites for Conservation.* Kathmandu: Birdlife International, RSPB, Bird Conservation Nepal, Cambridge.

Birds and 5 Herpetofauna found to be in Protected Category of Conservation Status (Table 33) as being found in the wider area.[40]

Table 33: Protected Species Along the Dandakhet-Rahughat Transmission Line

Sl. No.	Local/Common Name	Scientific Name	Conservation Status		
			GoN	CITES Appendix	IUCN
Mammals					
1	Rhesus Monkey	*Macaca mulatta*	-	II	LC
2	Gray Langur	*Semnopithecus entellus*	-	-	LC
3	Leopard	*Panthera pardus*	-	I	VU
4	Indian Muntjac/Barking Deer	*Muntiacus muntjak*	-	-	LC
5	Golden Jackal	*Canis aureus*	-	-	LC
6	Wild Cat	*Felis chaus*	-	II	LC
7	Indian Gray Mongoose	*Herpestes edwarsid*	-	-	LC
8	Squirrel	*Funambulus spp.*	-	-	LC
9	Rat	*Ratus spp.*	-	-	LC
10	Wolf	*Canis spp.*	-	-	LC
11	Yellow Throated Marten	*Martes flavigula*	-	-	LC
12	Indian Hare	*Lepus nigricollis*	-	-	LC
Birds					
1	House Sparrow	*Passer domesticus*	-	-	LC
2	Red-billed Blue Magpie	*Cissa erythrorhyncha*	-	-	LC
3	Kalij Phesant	*Lophura leucomelanos*	-	-	LC
4	Red-vented Bulbul	*Pycnonotus cafer*	-	-	LC
5	Spotted Dove	*Streptopelia chinensis*	-	-	LC
6	Barn Swallow	*Hirundo rustica*	-	-	LC
7	Black Kite	*Milvus migrans*	-	II	LC
8	Vulture	*Gyps spp.*	-	-	CR
10	Indian Treepie	*Dendrocitta vagabunda*	-	-	LC
11	Crested Serpent-Eagle	*Spilornis cheela*	-	II	LC
14	Drongo	*Dicrurus macrocercus*	-	-	LC
15	Alexandrine Parakeet	*Psittacula eupatria*	-	-	NT

[40] NEA 2020, EIA of Dhadakhet Rahughat 132 kV Double Circuit Transmission Line Project, ESSD, Kharipati, Bhaktapur.

Sl. No.	Local/Common Name	Scientific Name	Conservation Status		
			GoN	CITES Appendix	IUCN
16	Brown Prinia	*Prinia polychroa*	-	LC	LC
17	Long-tailed Shrike	*Lanius schach*	-	-	LC
18	Little Forktail	*Enicurus scouleri*	-	-	LC
19	Scarlet Minivet	*Pericrocotus flammeus*	-	-	LC
Herpetofauna					
1	Oriental Rat Snake	*Ptyas mucosa*	-	II	-
2	Oriental Golden Lizard	*Calotes versicolor*	-	-	-
3	Wall Lizard	*Hemidactylus frenatus*	-	-	LC
4	Pit viper	*Trimeresurus albolabris*	-	-	LC
5	Python	*Python bivittatus*	-	-	VU

173. The transmission line starts at proposed Rahughat substation at Rahuganga Rural Municipality, Ward-3 in Ambawang Village on cultivated and barren land.[41] This area is 209 m away from the right bank of Kaligandaki River. Between the substation site and the riverbank is the Beni Jomsom Road. From the substation, AP1, AP2, AP3 and almost till AP4 the transmission line traverses along the Kaligandaki Valley and across the Rahuganga Khola a tributary of the Kaligandaki River. The Kaligandaki Gorge is known to be important for biodiversity as it forms the boundary between the Eastern and Western Himalayas. Kaligandaki Valley (north to south) is a migratory corridor for birds which move south to winter in India. An earlier bird study in ACA recorded approximately 40 migrating bird species migrating along the valley including demoiselle crane and 20 raptors. Documentation of large numbers of birds of prey along the Karne/Lumle saddle was done during autumn and these migrations occurred east to west. In another location (Ghorepani, 11km east of the Rahughat substation site) 54 Steppe Eagles and 1 Imperial Eagle was recorded migrating east to west over the Deorali pass in 20 minutes in November 1986 (the observation area is approximately 2,900 masl while the alignment between substation to AP 4 traverses between 976.96 to 1,067.95 masl, at AP 7 it reaches to 2,023.37 masl).[42]

[41] NEA 2019, IEE of Dadakhet Rahughat 132kV Double Circuit Transmission Line Project, ESSD, Bhaktapur.

[42] Carol, & Inskipp, T. (2003). *Bird Conservation Priorities of the Annapurna Conservation Area.* Lazimpat, Kathmandu: Bird Conservation Nepal.

Figure 61: Map showing location of Annapurna Conservation Area and Dhorpatan Hunting Reserve

174. **Component 2.** The 7.4 km section of the Ghorahi - Madichaur 132 kV transmission line traverses through the Chure Conservation Area in Dang District (all through the cultivated land of the Dun). There is no forest area affected by the project along this section which crisscrosses along the Balim Khola (Balim River) as depicted in Figure 29. The affected forest area is all to the north of the Chure Conservation Area. It will temporarily affect about 13.32 ha (18 m ROW) of area from Chure Conservation Area. Of this 0.36 ha will be affected permanently for tower footings. The next closest protected area is Banke National Park, which is 30km west. However, within the Chure Conservation Area the transmission line also passes through the Dang Dekhuri Foothill Forest and West Rapti Wetlands (Figure 30) for about 400m in proximity to Charinge Community Forest.

175. Outside the Chure Conservation Area, the alignment of transmission line passes through forest area. The alignment covers 49.12% of its total area in forest land (15.39km length and 33.8ha of forest land). The alignment crosses over Chir Pine-Broad Leaved Forest, Lower Temperate Oak Forest and Hill Sal Forest Regions crossing 18 community managed and 3 government forest. Pole size trees occupy 41.94% of the area with a tree density of 138 per hectare with crown cover varying between 20 to 50%. Along this transmission line relatively more mature stands of trees (greater than 30 cm dbh) are observed between APs 5 to 7, 8 to 10, 14 to 24, 28 to 29 and 32 to 34. Forest within the RoW ranges from the temperate hill forest to the sub-tropical forest of Chure region. Sal (*Shorea robusta*), Salla (*Pinus roxburghii*), Jamun (*Syzygium cumini*), Ayer, Cheuri (*Aesandra butyracea*) etc. are dominantly found within the RoW in Pyuthan district. While Sal (*Shorea robusta*), Saj (*Terminalia sp.*), Tilka, Cheuri (*Aesandra butyracea*), are found in the ROW of the Dang district (Appendix 12). There is no

forest area within the RoW in Rolpa district. Based on the national EIA, altogether 38 different species of plants were identified to have been used by local people for firewood, timber, fodder, animal bedding, building house as fruit/nuts and medicine.

176. Based on the national IEE, wildlife potentially found here includes **Mammals:** Ratuwa (*Muntiacus muntijak*), Chauka (*Tetracerus quadricornis*), Wild boar (*Sus scrofa*), Jackal (*Canis aureus*), Rato Badhar (*Macaca mulatta*), Wild cat (*Felis chaus*), Leopard (*Panthera pardus*), Porcupine (*Hystrix indica*), Langur (*Semnopithecus entellus*), Indian hare (*Lepus nigricallis*), Leopard cat (*Felis bengalensis*), Ningalebagh, Wild mouse (*Rattuss sp.*), Yellow-throated Marten (*Martes flavigulas*), Indian Grey Mongoose (*Herpestes edwardisii*), Bat (*Pteropus gigantius*), and Squirrel (*Funambulus sp*). etc. **Birds:** Raj dhanesh (*Buceros bicornis*), Mayur (*Pavo cristatus*), Titra (*Francolinus sp.*), Parrot (*Psittacaula sp.*), Vulture (*Gyps sp.*), Eagle (*Aquila nipalensis*), Baudai (*Falco tinnunculus*), Bhudifor (*Ciconia nigra*), Latokosero (*Athene brama*), Jureli (*Pycnonotus cafer*), Bakulla (*Babulus ibis*), Latokosero, Dove (*Streptopelia sp.*), Koili (*Eudynamys scolopacea*) etc. **Herpetofauna:** Python (*Python molurus molurus*), Cobra (*Naja naja*), Dhaman (*Ptyas mucosus*), Karet (*Bungarus caeruleus*), Hariyo kana (*Trimeresurus sp.*), Suga sarpa, Pani sarpa, Gohoro (*Varanus sp*), Sun Gohoro (*Varanus Flavescens*), Magar and Ghadiyal crocodile (*Crocodylus palustris*), Kachuwa (*Khachuga dhangoka*), Bufa toda, *Rana tigrina* etc. Altogether Government of Nepal EIA has reported 14 mammals, 21 Birds and 7 Herpetofauna found to be in Protected Category of Conservation Status (Table 34) as being found in the wider area.[43]

Table 34: Protected Species Along the Ghorahi-Madichaur Transmission Line

Sl. No.	Local/Common Name	Scientific Name	Conservation Status		
			GoN	CITES Appendix	IUCN
Mammals					
1	Indian Muntjac	*Muntiacus muntijak*	-	-	LC
2	Four Horned Antelope	*Tetracerus quadricornis*	P	III	VU
3	Rhesus Monkey	*Macaca mulatta*	-	II	LC
4	Jungle Cat	*Felis chaus*	-	II	LC
5	Leopard	*Panthera pardus*	-	I	VU
6	Gray Langur	*Semnopithecus entellus*	-	I	LC
7	Leopard cat	*Prionailurus bengalensis*	P	II	LC
8	Wild boar	*Sus scrofa*	-	-	LC
9	Golden Jackal	*Canis aureus*	-	-	LC
10	Indian hare	*Lepus nigricollis*	-	-	LC
11	Yellow-throated Marten	*Martes flavigula*	-	-	LC
12	Indian Grey Mongoose	*Herpestes edwardsii*	-	-	LC

[43] NEA 2020, EIA of Ghorahi Madichaur 132 kV Transmission Line Project, ESSD, Kharipati, Bhaktapur.

Sl. No.	Local/Common Name	Scientific Name	Conservation Status		
			GoN	CITES Appendix	IUCN
13	Squirrel	*Funambulus palmarum*	-	-	LC
14	Porcupine	*Hystrix indica*	-	-	LC
Birds					
1	House Crow	*Corvus splendens*	-	-	LC
2	Great Hornbill	*Buceros bicornis*	P	I	VU
3	Common Peafowl	*Pavo cristatus*	-	III	LC
4	Swamp Francolin	*Francolinus gularis*	-	-	VU
5	Red-Breasted Parakeet	*Psittacula alexandri*	-	II	NT
6	Monk Vulture	*Aegypius monachus*	-	II	NT
7	Indian White-Backed Vulture	*Gyps bengalensis*	-	II	CR
8	Slender-Billed Vulture	*Gyps tenuirostris*	-	II	CR
9	Ferruginous Pochard	*Aythya nyroca*	-	-	NT
10	Brown Fish-Owl	*Ketupa zeylonensis*	-	II	LC
11	Steppe Eagle	*Aquila nipalensis*	-	II	EN
12	Collared Falconet	*Microhierax caerulescens*	-	II	LC
13	Common Kestrel	*Falco tinnunculus*	-	II	LC
14	Great Slaty Woodpecker	*Mulleripicus pulverulentus*	-	-	VU
15	Black Stork	*Ciconia nigra*	P	II	LC
16	Besra	*Accipiter virgatus*	-	II	LC
17	Spotted Owlet	*Athene brama*	-	II	LC
18	Black Drongo	*Dicrurus macrocercus*	-	-	LC
19	Nepal House Martin	*Delichon nipalense*	-	-	LC
20	Rose-Ringed Parakeet	*Psittacula krameri*	-	-	LC
21	Spotted Dove	*Spilopelia chinensis*	-	-	LC
22	Red-Vented Bulbul	*Pycnonotus cafer*	-	-	LC
23	Asian Koel	*Eudynamys scolopaceus*	-	-	LC
24	Common Myna	*Acridotheres tristis*	-	-	LC
Herpetofauna					
1	Common Cobra	*Naja Oxiana*	-	II	DD

Sl. No.	Local/Common Name	Scientific Name	Conservation Status		
			GoN	CITES Appendix	IUCN
2	Indian Python	*Python bivittatus*		I	VU
3	Oriental Rat Snake	*Ptyas mucosa*	-	II	-
4	Bengal lizard	*Varanus bengalensis*		I	LC
5	Golden monitor Lizard	*Varanus flavescens*	P	I	LC
6	Mugger	*Crocodylus palustris*	I	VU	VU
7	Gharial	*Gavialis gangeticus*		I	CR

177. **Component 3.** There are no protected areas crossed by the transmission line. The closest protected area is Langtang National Park, which is located 18km east of the alignment.

178. 25.82% (12.966 km length and 29.7ha area) of the alignment of the Borang Ratmate transmission line traverses forest area. The alignment crosses over Hill Sal and Chir Pine Broad Leaved Forest Regions crossing 15 community managed and 6 Government forests with a tree density of 188 trees per hectare. 93.18% of the trees have DBH varying from 10-30 cm and the forests have crown cover varying between 40 to 60%. Based on national IEE report, Sal (*Shorea robusta*), Mauwa (*Madhuka longifolia*), Simal (*Bombax cieba*), Khote Salla (*Pinus roxburghii*), Tooni (*Toona ciliate*), Uttis (*Alnus nepalensis*), Katus (*Castonopsis indica*), Chilaune (*Schima wallichii*), Jamun (*Eugenia jambolana*), Kafal (*Myreca esculenta*), Bhalayo (*Semecarpus, anacardium*), Khirro, Kyamunu, Angeri (*Lyonia ovifolia*), Saz (*Terminalia sp.*) and Botdayero (*Lagerstromia parviflora*) are observed along the RoW (Appendix 12). Based on the national IEE, altogether 73 different species of plants were identified to have been used by local people for firewood, timber, fodder, animal bedding, as fruit/nuts and medicine. Sal (*Shorea robusta)* is the only tree species found in the project area which is banned for commercial felling, transportation, and export in Nepal.

179. Based on the national IEE, wildlife potentially found here includes **Mammals:** Asian Black Bear (*Ursus thibetanus*), Wild cat (*Felis chaus*), Common Leopard (*Panthera pardus*), Rhesus Monkey (*Macaca mulatta*), Terai Grey Langur (*Semnopithecus entellus*), Porcupine (*Hystrix indica*), Malsapro (*Martin flavigula*), Barking Deer (*Muntiacus muntjak*), Jackal (*Canis aureus*), Squirrel (*Funambulus sp.*) etc. **Birds:** Himalayan Monal (*Lophophorus impejanus*), Black Francolin (*Franscolinus francolinus*), Kalij Pheasant (*Lophura leucomelanos*), House Sparrow (*Passer domesticus*), House Crow (*Corvus spendens*), Red Jungle Fowl (*Gallus gallus*), Spotted Dove (*Streptopelia chinensis*), Himalayan Whistling-Thrush (*Myophonus caeruleus*), Swallow (*Delichon nipalensis*), Drongo cuckoo (*Surniculus sp.*), Lampuchchhre (*Cissa erythrorhyncha*), Red-Vented Bulbul (*Pycononotus cafer*), Drongo Cuckoo (*Surniculus lugubris*), Banjh (*Buteo sp.*) etc. **Herpetofauna:** House Gecko (*Hemidactylus frentus*), Hareu (*Trimeresurus albolabris*), Common frog (*Rana tigrina*), Common Garden Lizard (*Calotis versicolor*) and Wall Lizard (*Hemidactylus sp.*). Altogether national IEE has reported 6 mammals and 3 birds to be in Protected Category of Conservation Status (Table 35) as being found in the wider area.

Table 35: Protected Species Along the Borang-Ratmate Transmission Line

Sl. No.	Local/Common Name	Scientific Name	Conservation Status		
			GoN	CITES Appendix	IUCN
Mammals					
1	Rato Bandhar	*Macaca mulatta*	-	II	LC
2	Dhedu Badhar (Gray Langur)	*Semnopithecus entellus*	-	I	LC
3	Chituwa (Common Leopard)	*Panthera pardus*	-	I	VU
4	Shyal (Jackal)	*Canis aureus*	-	III	LC
5	Wild Cat	*Felis chaus*	-	II	LC
6	Black bear	*Ursus thibetanus*	-	I	VU
Birds					
1	Danfe	*Lophophorus impejanus*	Protected	I	LC
2	Banjh	Buteo auguralis	-	II	LC
3	Kalij	*Lophura leucomelanos*	-	III	LC

180. **Kathmandu Valley Components**: The areas with importance of biodiversity in Kathmandu Valley include Gokarna Forest and Shivapuri Nagarjun National Park (SNNP) to the north of the urban area which was established in 2002 and has importance for conservation of watershed that drains the valley. SNNP (15,900 ha at elevations ranging between 1,366 – 2,732 meters above sea level) and has been categorized as an Important Bird Area. There is also proposed Pulchocki Conservation Area to south and the Godavari Forest to the south east.

(d) Critical Habitat Analysis

181. The areas in which the EGMP project components are located and in which the construction works will take place have been screened to determine presence of threatened species using the Integrated Biodiversity Assessment Tool (IBAT).[44] Screening using IBAT shows that there are 44-66 potential threatened species (within 50 km) listed in the International Union for Conservation of Nature (IUCN) red list potentially coinciding with the area in which in which construction works will take place. Of the 44-66 species, 6-12 are classified as critically endangered and 11-20 as endangered species. Table 36 provide the component wise list of potential threatened species (within 50 km) listed in the International Union for Conservation of Nature (IUCN) red list.

[44] IBAT is a multi-institutional programme of work involving BirdLife International, Conservation International, IUCN and UNEP-WCMC. IBAT provides a basic risk screening on biodiversity. It draws together information on globally recognised biodiversity information drawn from a number of IUCN's Knowledge Products: IUCN Red List of Threatened Species, Key Biodiversity Areas (priority sites for conservation) and Protected Planet/The World Database on Protected Areas (covering nationally and internationally recognised sites, including IUCN management categories I–VI, Ramsar Wetlands of International Importance and World Heritage sites).

Table 36: Component wise list of threatened species (within 50 km) listed in the IUCN red list

Component/ Site Name	Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)	Total
1. Dandakhet-Rahughat	7	11	26	44
2. Ghorahi-Madichaur	10	17	34	61
3. Borang-Ratmate	9	18	36	63
4. Pangtang	6	13	29	48
5.				
5. Keraun	10	20	35	65
7/9c. Kathmandu Valley	10	18	32	60
9a. Pathlaiya- Dhalkebar	12	18	36	66
9b. Duhabi-Kusaha	11	20	35	66

182. A critical habitat analysis for the transmission line components was rapidly developed through a desktop review of existing project documentation and other existing grey and published literature. It aligns with ADB's SPS (2009) and International Finance Corporation Performance Standard 6 and its accompanying Guidance Note (IFC 2012, 2019) critical habitat requirements.

183. Based on available information, and acting on a precautionary basis, Critical Habitat has been identified in the project area, owing to the presence of nine mammals, five birds, four reptiles, five frogs and 11 fishes, all known or suspected to occur at globally significant levels, as well as the presence of six internationally-recognized sites (protected areas and/or Key Biodiversity Areas) (Table 37). However, of these only four of species (Bengal florican and three vultures highlighted in grey) are of concern in the context of project impacts as well as the Dang Deukhuri Foothill Forests and West Rapti Wetlands Key Biodiversity Area and Chure Conservation Area in which new transmission line of Component 2 is located. The critical habitat assessment is included in Appendix 7.

TABLE 37: CRITICAL HABITAT-QUALIFYING BIODIVERSITY IN THE PROJECT AREAS OF ANALYSIS (AOAS) OF TRANSMISSION LINE COMPONENTS

Biodiversity type	Name	Critical Habitat criterion qualified[45]						Justification
		1	2	3	4	5	6	
1.Mammal	Csorba's Mouse-eared Myotis *Myotis csorbai*		✓					>10% of the global population of this restricted-range species is likely to occur in the overall Project area.

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

Biodiversity type	Name	Critical Habitat criterion qualified[45]						Justification
		1	2	3	4	5	6	
2.Mammal	Mandelli's Mouse-eared Myotis *Myotis sicarius*	?						Loss of habitat across the Project AoAs might possibly merit uplisting of this Vulnerable species to Endangered.
3.Mammal	Tiger *Panthera tigris*	✓						>0.5% of the global population of this globally Endangered species is likely to occur in the Project area.
4.Mammal	Red Panda *Ailurus fulgens*	✓						>0.5% of the global population of this globally Endangered species may well occur in the Project area.
5.Mammal	Himalayan Muskdeer *Moschus leucogaster*	?						>0.5% of the global population of this globally Endangered species may well occur in the Project area.
6.Mammal	Gaur *Bos gaurus*	✓						>0.5% of the global population of this globally Endangered species is likely to occur in the Project area.
7.Mammal	Wild Water Buffalo *Bubalus arnee*	✓						>5% of the global population of this globally Endangered species occurs in the Project area
8.Mammal	Nepalese Field Mouse *Apodemus gurkha*		✓					>10% of the global population of this restricted-range species may occur in the overall Project area.
9.Mammal	Hispid Hare *Caprolagus hispidus*	?						>0.5% of the global population of this globally Endangered species might occur in the Project area.
10. Bird	Bengal Florican *Houbaropsis bengalensis*	✓						Duhabi-Kusaha overlaps a KBA which likely supports >0.5% of the global population of this Critically Endangered species.
11. Bird	Red-headed Vulture *Sarcogyps calvus*	?						Dandakhet-Rahughat overlaps a PA/KBA which may support >0.5% of the global population of this Critically Endangered species.
12. Bird	White-rumped Vulture *Gyps bengalensis*	✓						Ghorahi-Madichaur overlaps a KBA which supports >0.5% of the global population of this Critically Endangered species. Duhabi-Kusaha overlaps a PA/KBA which likely also supports globally-significant concentrations. Dandakhet-Rahughat overlaps a PA/KBA which may also support globally-significant concentrations.

Biodiversity type	Name	Critical Habitat criterion qualified[45]						Justification
		1	2	3	4	5	6	
13. Bird	Slender-billed Vulture *Gyps tenuirostris*	✓						Ghorahi-Madichaur overlaps a KBA and PA which are likely to support >0.5% of the global population of this Critically Endangered species. Dandakhet-Rahughat overlaps a PA/KBA which may also support globally-significant concentrations.
14. Bird	Grey crowned Prinia *Prinia cinereocapilla*	✓						Loss of habitat across the Project AoAs could conceivably merit uplisting of this Vulnerable species to Endangered.
15. Reptile	Spotted Pond Turtle *Geoclemys hamiltonii*	?						>0.5% of the global population of this globally Endangered species might occur in the Project area.
16. Reptile	Elongated Tortoise *Indotestudo elongata*	?						>0.5% of the global population of this globally Critically Endangered species might occur in the Project area.
17. Reptile	Three-keeled Land Tortoise *Melanochelys tricarinata*	?						>0.5% of the global population of this globally Endangered species might occur in the Project area.
18. Reptile	Three Keeled Mountain Lizard *Japalura tricarinata*		✓					>10% of the global population of this restricted-range species is likely to occur in the overall Project area.
19. Frog	*Hylarana chitwanensis*		✓					>10% of the global population of this restricted-range species is likely to occur in the overall Project area.
20. Frog	Torrent Paa Frog *Nanorana ercepeae*		?					>10% of the global population of this restricted-range species might possibly occur in the Project area.
21. Frog	Narayanghat Whipping Frog *Polypedates zed*		✓					>10% of the global population of this restricted-range species is likely to occur in the Project area.
22. Frog	*Sphaerotheca maskeyi*		✓					>10% of the global population of this restricted-range species is likely to occur in the overall Project area.
23. Frog	*Sphaerotheca swani*		✓					>10% of the global population of this restricted-range species is likely to occur in the Project area.

Biodiversity type	Name	Critical Habitat criterion qualified[45]						Justification
		1	2	3	4	5	6	
24. Fish	Kalabans *Bangana dero*			?				>1% of the global population of this migratory species might possibly occur in the Project area.
25. Fish	*Chagunius chagunio*			?				>1% of the global population of this migratory species might possibly occur in the Project area.
26. Fish	Annandale Garra *Garra annandalei*			?				>1% of the global population of this migratory species might possibly occur in the Project area.
27. Fish	Large Razorbelly Minnow *Salmostoma bacaila*			?				>1% of the global population of this migratory species might possibly occur in the Project area.
28. Fish	*Tor putitora*	?		?				>1% of the global population of this globally Endangered migratory species might occur in the Project area.
29. Fish	Rainbow Minnow *Psilorhynchus gracilis*			?				>1% of the global population of this migratory species might possibly occur in the Project area.
30. Fish	*Erethistoides ascita*		?					>10% of the global population of this restricted-range species might possibly occur in the overall Project area.
31. Fish	*Pseudecheneis eddsi*		✓					>10% of the global population of this restricted-range species is likely to occur in the overall Project area.
32. Fish	Stone Carp *Psilorhynchus pseudecheneis*			?				>1% of the global population of this migratory species might possibly occur in the Project area.
33. Fish	River Stone Carp *Psilorhynchus sucatio*			?				>1% of the global population of this migratory species might possibly occur in the Project area.
34. Fish	*Sisor rheophilus*		✓					>10% of the global population of this restricted-range species is likely to occur in the overall Project area.
35. Site	Annapurna Conservation Area and Key Biodiversity Area						?	May support >0.5% of the global population of the Critically Endangered Red-headed, White-rumped, and Slender-billed Vultures.

Biodiversity type	Name	Critical Habitat criterion qualified[45]						Justification
		1	2	3	4	5	6	
36. Site	Dang Deukhuri Foothill Forests and West Rapti Wetlands Key Biodiversity Area and Chure Conservation Area						✓	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.
37. Site	Koshi Tappu Wildlife Reserve and Koshi Barrage Key Biodiversity Area						✓	Likely supports >0.5% of the global population of two Critically Endangered bird species (Bengal Florican and White-rumped Vulture), the Endangered Wild Water Buffalo, and possibly also threatened reptiles (Elongated Tortoise and Three-keeled Land Tortoise).
38. Site	Langtang National Park and Key Biodiversity Area						✓	An IUCN Category II protected area of high biodiversity value, which may well support >0.5% of the global population of the Endangered Red Panda.
39. Site	Parsa Wildlife Reserve Key Biodiversity Area						✓	Likely supports >0.5% of the global population of two Endangered mammal species (Gaur and Tiger), and possibly also the Critically Endangered reptiles Elongated Tortoise.
40. Site	Shivapuri-Nagarjun National Park						✓	An IUCN Category II protected area of high biodiversity value.

(e) Physical Cultural Resources

184. Kathmandu Valley is an ancient city of Newari speaking people with numerous temples, stupas and waterspouts moreover it has seven UNESCO Cultural World Heritage Sites (WHS) under the umbrella of the Kathmandu Valley WHS as shown in Figure 62. The rich architectural structures in Kathmandu date back to Kirat and Licchavi era with one waterspout dating back to 650 CE. The city's cultural festivals and religious rituals are mostly celebrated around water. Some important religiously as well as culturally important structures of Kathmandu Valley include in Bhaktapur District (Bhadgau, Durbarchowk, Nayatpoldewal, Bhairavnath Mandir, Datatraya Mandir, Nawadurga Mandir, Pashupatinath of Bhadgau and Siddhapokhari), in Kathmandu District (Taleju Bhawani of Hanuman Dhoka, Hanumandhoka Mandir, Akash Bhairav, Annapurna, Kumari Bahi, Swetakali Nardevi, Sobha Bhagwati, Bhadrakali, Naxal Bhagwati, Kothe Shimbhu, Narayanhiti Narayansthan, Matsyendra Bahal, Jaggannath, Blkranseel Mahabir, Kastamandap, Narayanhiti Durbar, Singhadurbar, Sahid Smarak,

Sundhara, Rani Pokhari, Tudikhel, Pashupatinath, Guheshwori, Baudhanath, Swayambhu, Manjushree Chaitya, Changu Narayan, Dhanju Stup, Charmurti, Budhanilkantha, Bagh Bhairav, Panchakanya Devi and Gokarneshwor Mahadev and in Lalitpur District (Degutale, Krishna Temple of Durbarsquare, Matsyendranath Mandir of Durbar Square, Minnath, Harinarayan Mahabir, Hiranyawarna Mahabir, Mahabaudha, Kumbeshwor and Four Stupa in the four corners of Lalitpur City constructed by King Asoka).[46]

185. Table 38 is a list of monuments of international/national importance as officially recognized by the Department of Archaeological (DOA) of Nepal and listed by UNESCO World Heritage – the first seven fall under the umbrella of the Kathmandu Valley WHS. The Ancient Monument Preservation Act 2013 recognizes any ancient monuments and artistic objects of hundred years old as archeologically important objects which will be preserved by DOA. There are also province and district protected monuments, archaeological sites that have been recognized by the DOA.

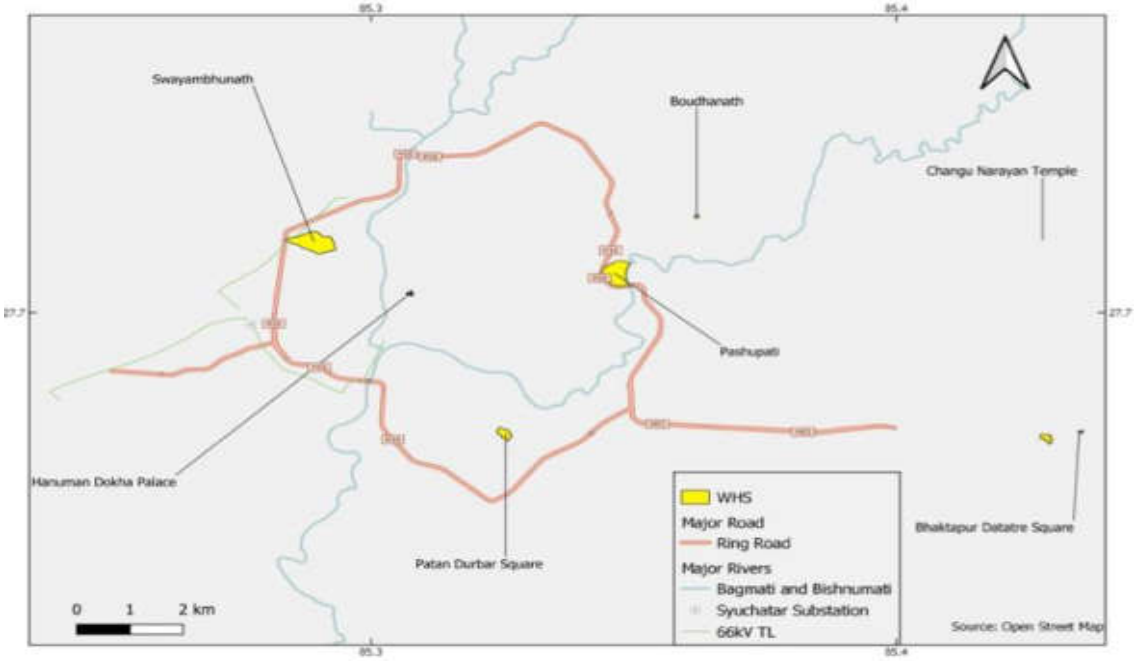
Table 38: World Heritage Sites/National Monuments of Nepal

Sl. No.	Name of Monuments/ sites	Location	District
1	Durbar Square of Hanuman Dhoka	Kathmandu	Kathmandu,
2	Durbar Square of Patan	Patan	Lalitpur
3	Durbar Square of Bhaktapur	Bhaktapur	Bhaktapur
4	Buddhist Stupas of Swayambhu	Swayambhu	Kathmandu
5	Buddhist Stupa of Bauddhanath	Baudha	Kathmandu
6	Hindu Temple of Pashupati	Gaushala	Kathmandu
7	Hindu Temple of Changu Narayan	Changu Narayan	Bhaktapur
8	Lumbini, the Birthplace of the Lord Buddha	Lumbini	Rupandehi

Source: UNESCO.

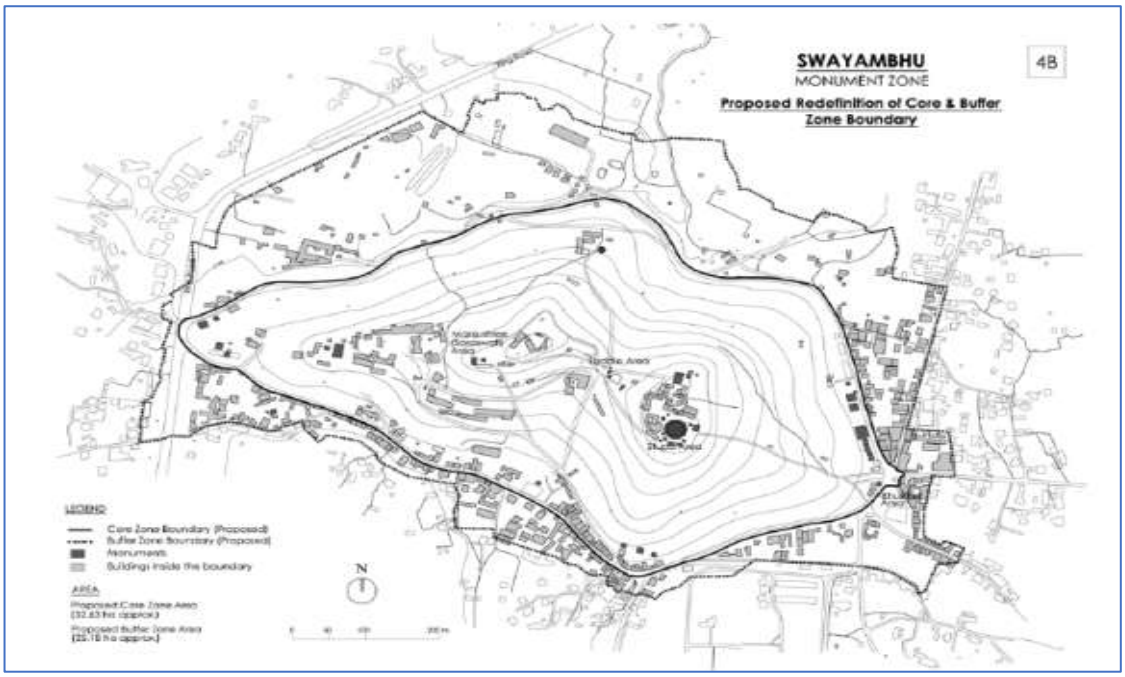
[46] Department of Archeology, Government of Nepal.

Figure 62: Map Showing World Heritage Sites/National Monuments of Kathmandu Valley and EGMP Component 9c



186. It can be seen from Figure 62 that about a 150m length of the Suichatar-Balaju 66kV transmission line of component 9 crosses through the current boundary of the Kathmandu Valley WHS (Swayambhu). Figure 63 shows the current and proposed boundary of the Kathmandu Valley WHS (Swayambhu) and the monuments within it. Whilst the main monument, stupa, is about 500m distant there are 2-4 smaller monuments in close proximity to the alignment.

Figure 63: UNESCO World Heritage Site Boundary



187. Besides above, during consultations it was pointed out that Ghorahi-Madichaur 132 kV Transmission Line may affect the compound wall of Janaki Temple at ward no 1, Kalimati, Dang district due to tower erection (Figure 31). The precise location of the alignment will be finalized during detailed route survey by contractor. However, as suggested by the local communities during the consultation, NEA has allocated funds to rebuild the newly constructed temples boundary wall in case the tower affects their structure. No other local physical cultural resources have been identified within 500m of the ROW at this stage, but this will be confirmed during detailed route surveys.

D. Socio-Economic Resources

188. This section provides as overview of the socioeconomic status and profile of the affected households. Field studies and discussions with households were conducted from 14 August 2019 to 16 August 2019 for new transmission line components. Information presented here is based on preliminary assessments and consultations and discussion with affected households survey jointly undertaken by social and environment team of NEA for the national EIA/IEE.

189. The new transmission lines and associated substations are situated within the Bagmati, Gandaki and Province 5 provinces which are scattered from Central Region to Mid-eastern Region of the country. Within the three provinces there are 6 districts Nuwakot, Dhading (Bagmati Province), Myagdi (Gandaki Province), Dang, Pyuthan and Rolpa districts (Province 5). As per CBS Census Survey 2011, total population of Bagmati Province, Gandaki Province and Province 5 comprises 5,529,452 (male(m) 45.38% and female(f) 54.62%), 2,403,757 (m 49.69% and f 50.31%) and 4,499,27 (m 47.57% and f 52.43%) respectively. Bagmati is the largest province by population (20.87% of Nepal's total population) and Gandaki and province 5 represent 9.07% and 16.98% of the country's population. The male to female ratio among the three provinces are 83.08, 98.77 and 90.73 in Bagmati, Gandaki and Province 5

respectively. Likewise, the average households size in Bagmati, Gandiki and Province 5 is 4.35, 4.16 and 5.08 persons. The average household size of Province 5 is comparatively higher than the national average household size (4.8). The 15-59 years age group is referred to as the economically active population. Below 15 years and above 60 years is referred to as the dependent population. The economically active population in the provinces comprises 62.88% (Bagmati), 56.88% (Gandaki) and 55.8% (Province 5). The economically active age group 15-59 years in Bagmati is almost equivalent to the economically active age group of the country's population (56.96%). Major caste/ethnic groups are Braman, Chhetri, Tamang, Magar, Gurung, Rai, Newar, Thakuri, Tharu, Dalits and others.

(a) Demography Characteristics of Affected Households

190. Out of total 246 (149 Borang Ratmate+40 Ghorahi Madichaur+57 Dandakhet Rahighat Losing Land and Structure) households affected by the 3 new transmission lines, household survey of 205 available households was conducted throughout the alignments. The total population of the surveyed households was 1,295 with 51.27% male and 48.72% female. The average household size was 6.3 which is comparatively higher than the national average of 4.8 (CBS: Census Survey 2011). Table 39 presents details of demography characteristics of surveyed households.

Table 39: Demography Characteristics of Affected Households

Components	Population by sex		Total	Below 15 years	15-59 years	60 years & above	Sex Ratio
	M	F					
1.Dandakhet - Rahughat 132 kV TL & 220/132 kV SS at Rahughat & 132/33 kV SS at Dandakhet.	171	144	315	75	181	59	119
2.Ghorahi-Madichaur 132 kV TL and 132/33/11 kV SS at Madichaur	109	117	226	45	148	33	93.16
3. Ratamate-Lapang 220 kV TL & Borang-Lapang 132 kV TL & 220/132 kV SS at Lapang and 132/33/11 kV SS at Borang	384	370	754	191	453	110	104
Total	664	631	1,295	311	782	202	105
Percent	51.27	48.72	-	24.01	60.38	15.59	-

Source: NEA IEE/EIA Reports, 2019

(b) Population Distribution by Age Group

191. The age-wise distribution of household members is given in Table 39. In terms of age distribution of the affected households, 60.38% falls within the age group of 15-59 years followed by 24.01% below 15 years whereas 15.59% are above 60 years and above. The population below 15 years of age among affected households is far below the provinces average for this age group (38.55%) (Census Survey: 2011, CBS Nepal). Similarly, 15-59 years of age among affected households is higher than the province average for the same age group for Gandaki Province (56.88%) and Province 5 (55.8%) and almost equal for Bagmati Province (62.88%). The population above 60 years and above is almost equal when compared with provincial averages.

(c) Population Distribution by Caste and Ethnicity

192. Throughout the alignment of the 3 new transmission lines, total 10 different caste and ethnic groups are affected. Out of total 205 surveyed households, major castes are Tamang 60 (29.26%) followed by Chhetri 34 (16.58%), Bramin 30 (14.63%) and Thakuri 14 ((6.8%). Newar constitutes 12 (5.8%) and other castes followed by Magar 23 (11.2%), Gurung 10 (4.8%), Dalits 16 (7.8%), Tharu 4 (1.9%) and Sanyasi 2 (.97%). Details of caste/ethnicity of affected households is presented in Table 40.

Table 40: Household distribution by caste and ethnicity

Components	Brahmin	Chhetri	Thakuri	IPs					Dalit	Sanyasi	Total households	Average households size
				Newar	Magar	Gurung	Tamang	Tharu				
1.Dandakhet - Rahughat 132 kV TL & 220/132 kV SS at Rahughat & 132/33 kV SS at Dandakhet.	4	11	11	5	12	7	-	-	3	1	54	5.7
2.Ghorahi-Madichaur 132 kV TL and 132/33/11 kV SS at Madichaur	10	8	3		8	-	-	4	6	1	40	5.7
3. Ratmate-Lapang 220 kV TL & Borang-Lapang 132 kV TL & 220/132 kV SS at Lapang and 132/33/11 kV SS at Borang	16	15	-	7	3	3	60	-	7	-	111	6.3
Total	30	34	14	12	23	10	60	4	16	2	205	6.3
Percent	14.63	16.58	6.8	5.8	11.2	4.8	29.26	1.9	7.8	.97		

Source: NEA IEE/EIA Reports 2019.

(d) Indigenous People

193. Indigenous Peoples of Nepal are officially described as Indigenous Nationalities (Adivasi/Janajati). They make up for 35.81 percent of the country's total population (approximately 8.5 million out of the 26 million Nepalese). As per the 2011 census, Nepal has 126 castes and ethnic groups speaking as many as 123 languages. As many as 59 indigenous communities have been officially and legally recognized by the Nepal Government under the National Foundation for Development of Indigenous Nationalities (NFDIN) Act-2002. They live across the country –18 of them are in mountains, 23 in the hills, 7 in Inner Terai and 10 in Terai. National Foundation for Development of Indigenous Nationalities (NFDIN, 2005) has classified them into five broad categories based on the level of their socioeconomic development status or the degree of marginalization.

Table 41: IPs and their Level of Marginalization

Region	Endangered	Highly Marginalized	Marginalized	Disadvantaged	Advantaged
Mountain	-	Shiyar, Shingsawa (Lhomi), Thudam	Bhote, Dolpo, Larke, Lhopa, Mugali, Topkegola, Walung	Bara Gaunle, Byansi (Sauka), Chhairotan, Marphali Thakali, Sherpa, Tangbe, Tingaule Thakali	Thakali
Hill	Bankariya, Hayu, Kusbadiya, Kusunda, Lepcha, Surel	Baramu, Thami (Thangmi), Chepang	Bhujel, Dura, Pahari, Phree, Sunuwar, Tamang	Chhantyal, Gurung(Tamu), Jirel, Limbu (Yakthung), Magar, Rai, Yakkha,Hyolmo	Newar
Inner Terai	Raji, Raute,	Majhi Bote, Danuwar	Darai, Kumal	-	-
Terai	Kisan, Meche	Dhanuk (Rajbansi), Jhangad, Santhal(Satar)	Dhimal, Gangai, Rajbanshi, Tajpuriya, Tharu	-	-

Source: NFDIN. 2005.

194. Based on the socioeconomic survey result of 205 households for the 3 transmission lines, 108 households belong to different 5 IP caste groups. They are Tamang, Magar, Newar Gurung and Tharu. Among the IPs of Nepal, Newar is considered advantage group. Out of total affected IPs under this project, the Tamang constitute 55.55% (60 households) and Magar represent 20.37% (22 households) followed by Newar, Gurung and Tharu. Details of IPs affected under this project are presented in Table 42.

Table 42: IPs population affected by project

Components	Total households of IP				
	Newar	**Magar**	**Gurung**	**Tamang**	**Tharu**
1.Dandakhet - Rahughat 132 kV TL & 220/132 kV SS at Rahughat & 132/33 kV SS at Dandakhet.	5	11	7		-
2.Ghorahi-Madichaur 132 kV TL and 132/33/11 kV SS at Madichaur		8			4
3.Ratamate-Lapang 220 kV TL & Borang-Lapang 132 kV TL & 220/132 kV SS at Lapang and 132/33/11 kV SS at Borang	7	3	3	60	-
Total	12 (11.11%)	22 20.37%)	10 (9.25%)	60 (55.55%)	4 (3.7%)
Total population of each IP group	69	127	58	348	23
Total population	625				

Source: NEA IEE/EIA Reports, 2019.

(e) Family Structure

195. Average size of the family in Nepal is 4.8 person which is 4.2 in Urban and 4.8 in Rural. There are 17.1% nuclear households (family size 1-2) in Nepal. Nearly half (47.2%) of the household heads are in the age group 30 to 49 years and 25.9% households are headed by female members which must be due to the high proportion of male labor migration (CBS: Annual households survey, 2015/2016). Two types of family structures are found among 205 households -- joint and nuclear families. Joint family is a family that consists of grandfather, father/mother and their children who share a common kitchen in a single roof and household is headed by grandfather or father. A nuclear family where parents and unmarried children are living together and sharing a kitchen in a single roof. The survey findings of 205 households show that about 45.85 % households have nuclear family structure which is nearly about equal to national average and 54.14% affected households have a joint family structure. The average family size of affected households is 6.3 persons which is comparatively higher than the average household size of national (4.6 person) and below the average size of the three provinces. Family structures of surveyed households are given in Table 43.

Table 43: Types of family structures of surveyed households

Components	Households by Family Type				Total households
	Nuclear	%	Joint	%	
Ratmate-Lapang 220 kV TL & Borang-Lapang 132 kV TL & 220/132 kV SS at Lapang and 132/33/11 kV SS at Borang	51	45.95	60	54.05	111
Dandakhet - Rahughat 132 kV TL & 220/132 kV SS at Rahughat & 132/33 kV SS at Dandakhet.	25	47.17	29	52.83	54
Ghorahi-Madichaur 132 kV TL and 132/33/11 kV SS at Madichaur	18	45	22	55	40
Total	94	45.85	111	54.14	205

Source: Field survey, 2019.

(f) Religion and Language

196. Out of 205 households surveyed, majority of households (84.87%) are Hindu religion and then Buddhism and Christian at 10.24% and 4.8%, respectively. The Nepali language can be spoken by all Nepalese people but out of surveyed households 98 (46.8%) households speak only Nepali language and followed by Tamang, Magar, Newar, Gurung and Tharu. Details of language and religion are presented in Table 44.

Table 44: Household by Language and Religion

Components	Households by Language						Households by Religion		
	Nepali only	Newar+ Nepali	Magar+ Nepali	Gurung+ Nepali	Tamang+ Nepali	Tahru+ Nepali	Hindu	Buddhist	Cristian
1.Dandakhet - Rahughat 132 kV TL & 220/132 kV SS at Rahughat & 132/33 kV SS at Dandakhet.	30	5	12	7	-	-	51	1	2
2.Ghorahi-Madichaur 132 kV TL and 132/33/11 kV SS at Madichaur	28	-	8	-	-	4	38	-	2
3.Ratamate-Lapang 220 kV TL & Borang-Lapang 132 kV TL & 220/132 kV SS at Lapang and 132/33/11 kV SS at Borang	38	7	3	3	60	-	85	20	6
Total	96	12	23	10	60	4	174	21	10
Percent	46.8	5.8	11.2	4.8	29.26	1.9	84.87	10.24	4.8

Source: NEA IEE/EIA Reports, 2019.

(g) Literacy Status of Affected Households

197. For the 3 transmission lines, total 205 households were interviewed and total 1,235 population were counted for measuring the literacy status of affected population. Among the population, literate population is 16.84% (male 50.48% and female 49.51%) and illiterate is 14.41%. The literate population of affected households is far below the national literate population (65.94%). The country's male literacy rate is 74.2% and the female literacy rate is 58.2% (CBS: Census Survey 2011) whereas among the affected population there is no gap between male and female literacy rate. Likewise, the educational status of project affected districts is better than the affected households. As per Census Survey 2011, the literate percentage in Dhading, Nuwakot, Myagdi, Dang, Pyuthan and Rolpa is 62.86%, 59.8%, 71.87%, 70.32%, 67.5%, and 60.0%, and also at provincial level there is no big gap with district level literate population, but compared with project affected households level education status is found very poor. The educational status in the three provinces are 74.81% (Gandaki), 74.85% (Bagmati) and 66.43% (Province 5). The level of education completed by the population is presented in Table 45.

Table 45: Literacy Statues of surveyed households of age 5 years and above

S. No	Level of education	Male	Female	Total	
				No	%
1	Illiterate	76	102	178	14.41
	Literate only	105	103	208	16.84
2	1-8 class	223	185	408	33.03
3	9-12 class/secondary level	243	148	391	31.65
4	Bachelors and above	31	19	50	4.04
Total		**678**	**557**	**1,235**	**100**

Source: Household Survey, 2019.

(h) Occupation of Surveyed Households

198. The main occupation in rural Nepal is agriculture. The main occupation of surveyed household is agriculture (29.17%) followed by foreign job (9.22%), job (8.43%), business and labor work. Women are engaged mainly in household works including agriculture, business, job and in small unit women are found in all sector as men.

Table 46: Occupation of the affected population

Occupation	Male	Female	Total	
			No	%
Agriculture	141	191	332	29.17
Business	68	21	89	7.2
Job	78	18	96	8.43
Foreign job	95	10	105	9.22
Household work	40	133	173	15.20
Pension	39	6	45	3.95
Labor	61	23	84	7.38
Student	109	105	214	18.80
Total	631	507	1,138	100
Percent	(55.45%)	(44.55%)		

Source: NEA IEE/EIA Reports2019

(i) Annual Income

199. The overall livelihood strategy of the affected households is characterized by a mixture of farm and nonfarm activities. The majority of households carried out agricultural activities for food supply and as a source of income for other requirements. Out of total income of 205 surveyed households, 25.2% income comes from service which is followed by business (9.1%), agricultural (23.4%) and remittance (26.0%), However, majority of surveyed population is depending on agriculture sector for fulfillment of their foods and income and livelihoods but households annual income indicates that remittance is in the top rank and agricultural and service are also is good position in terms of source of income of households. Pension and old age allowances also cover about 11% of source of income. Source of income of surveyed population is varied depending on location, caste and ethnicity and level of poverty within the districts but overall source of income is mixed types of activities such as business, employment in private sector as well as in government sector, foreign job, pension and labor work within district and outside district. Project component wise source of annual income is presented in Table 47.

Table 47: Annual income surveyed households.

Components	Annual income from different sources						
	Agriculture and animal husbandry income	**Business**	**Remittance**	**Pension and Old aged pension**	**Service**	**Wages labor**	**Total Annual Income**
1.Dandakhet – Rahughat 132 kV TL and SS at Dandakhet	55,000	10,519	100,000	60,000	108,033	5,651	339,203
2.Ghorahi-Madichaur 132/33 kV TL and SS at Madichaur	62,766	33,964	45,920	20,922	65,755	23,454	252,781
3.Ratamate-Lapang 220 kV Double Circuit TL, & Lapang-Borang 132 kV DC TL & SS at Lapang and Borang	97,369	39,459	93,153	19,910	57,775	28,919	336,585
Total	215,135	83,942	239,074	100,832	231,563	58,024	918,569
%	23.4	9.1	26.0	11.0	25.2	6.3	100

Source: NEA IEE/EIA Reports, 2019.

(j) Annual Expenditure of Affected Households

200. Survey data suggest that affected households spend their income mainly in food, agricultural or farming, festivals, education, clothing medicine, communication and energy and transport. Project component wise households expenditure details is presented in Table 48.

Table 48: Annual Expenditure of surveyed households

Components	HHs Average annual expenditures in different items								
	Food items	Festival	Education	Clothing	Medicine	Transportation	Communication, electricity, fuel	Agriculture	Total
1.Dandakhet – Rahughat 132 kV TL and SS at Dandakhet	430,184	151,232	93,391	89,535	55,771	45,426	74,957	350,000	940,496
2.Ghorahi-Madichaur 132/33 kV TL and SS at Madichaur	45,188	26,277	49,369	25,082	18,155	8,759	6,171	20,106	199,107
3.Ratamate-Lapang 220 kV Double Circuit TL, & Lapang-Borang 132 kV DC TL & SS at Lapang and Borang	158,392	33,750	27,756	29,877	21,332	11,772	24,498	20,000	307,377
Total	633,764	211,259	170,516	119,412	95,258	65,957	105,626	390,106	1,791,898
%	35.37	11.79	9.52	6.66	5.32	3.68	5.89	21.77	35.37

Source: Households survey, 2019.

(k) Access to Water, Sanitation and Electricity

201. Nepal has been declared Open Defecation Free (ODF) on 30 September 2019 but quality of toilets and adequate water supply system still need to be improved in rural as well as in urban areas. From the Nepal Demographic and Health Survey (NDHS) 2016, overall 62% of households (63% in rural areas and 61% in urban areas) use improved toilet facilities but data show that about 15% of households have no toilet facility (21% in rural areas and 11% in urban areas) (NDHS: 2016). Except Kathmandu there are no wastewater treatment facilities available in the project areas.

202. Under this project, out of total surveyed households, 61.46% households are using piped water for drinking and other uses and remaining are using tube well or well. About 98.53% households have their own toilets and 1.4% households have no toilet facility. The households survey report also stated that 96.5% households are connected with national grid and using electricity mainly for lighting and operating small industries and remaining households are still using solar energy or kerosene for lighting. Details of water supply system, toilet facilities and access and connection to electricity with national grid is presented in Table 49.

Table 49: Access to water, sanitation and electricity

Sub-projects	Total households	Water supply			Toilet facility		Electricity	
		Piped water	Public tap	Well/ tube well	Own toilet	No toilet	Connected with National grid	Not connected
1.Dandakhet – Rahughat 132 kV TL and SS at Dandakhet and Rahughat	54	32 (59.26%)	12 (22.22%)	-	54 (100%)		54 (100%)	
2.Ghorahi-Madichaur 132/33 kV TL and SS at Madichaur	40	23 (57.5%)	15 (37.5%)	2 (5%)	39 (97.5%)	1 (2.5%)	33 (82.5%)	7 (17.5%)
3.Lapang-Ratmate 220 kV & Lapang-Borang 132 kV TL & SS at Lapang and Borang	111	71 (63.96%)	38 (34.23%)	2 (1.8%)	109 (98.2%)	2 (1.8%)	111 100%	
Total	205	126	65	4	202	3	198	7
Percent		61.46	31.70	1.90	98.53	1.4	96.50	3.40

Source: NEA IEE/EIA reports, 2019.

(l) Waste Management

203. Solid waste management in Nepal is limited to major towns and environmentally sound practices are generally lacking in the rural areas. Based on a study conducted by ADB[47] average municipal solid waste collection efficiency in Nepal was 62.2% but the disposal rate was merely 37%. About 30% of households in rural municipalities practice segregation of waste at source and composting using traditional methods i.e. dumping in the open trenches. Besides household composting, community or municipal composting plants are found in some municipalities and more are being planned. The collection efficiency ranges between 70% and 90% in major towns, and is below 50% in several smaller towns, giving an average of 62%. Only 6 municipalities (Kathmandu, Lalitpur, Pokhara, Ghorahi, Dhankuta, and Tansen) use sanitary landfill sites for final disposal, and 45 are practicing open dumping, including riverside and roadside dumping. In total, 37% of municipal solid waste in Nepal is disposed of in sanitary landfill sites, which will need to be used by contractors for the project, although not necessarily in a sanitary manner. While the majority of municipalities have a separate section or unit responsible for solid waste management, 17 municipalities do not have a designated section or unit.

204. There are no designated facilities available in Nepal for the treatment and disposal of hazardous waste and so the project will need to use third-party collectors from neighboring countries, e.g. India to ensure waste is disposed of in an environmentally sound manner. Medical waste incineration is generally practiced by hospitals in most municipalities, although this essentially involves merely burning the waste in a chamber or open burning in the hospital compound. In Kathmandu, Bir and a few other hospitals have started managing all types of hospital waste in a safe manner.

205. At present NEA does not has facilities to treat and dispose the waste generated from its operations. Old transformers and conductors are stored in a central store in Kathmandu where initial filtration of the transformer oil is done. The used oil and scrap metals (conductors etc.) are generally sold to venders for recycling or reuse. For PCBs, there is no facility available and it is taken care of by manufactures or third-party collectors from neighboring countries, mostly from India.

[47] Solid Waste Management in Nepal, Current Practices and Policy Recommendations (ADB, 2013).

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Introduction

206. Impact assessment for all the EGMP components was carried out. Potential environmental impacts have been identified with reference to the locations selected for the new or extended substations and alignment of the new or existing transmission and distribution lines proposed by NEA, and with reference to field surveys undertaken for the 3 new transmission lines and associated substations, as well as secondary data collated, and consultations with affected persons and other concerned stakeholders. This section summarizes the impacts identified, mitigation to address those impacts, which is incorporated into the project level environmental management plan (EMP), and the residual impacts which will remain post-mitigation.

B. Analysis of the Impacts

(a) Impact Categorization

207. Impacts have been categorized in this assessment with reference of DON guidance based on the predicted magnitude of change (or for risks the consequences) which will be experienced being either major, moderate, minor or minimal in nature; the impact categorization also takes into consideration parameters such as: (i) duration of the impact; (ii) spatial extent of the impact; (iii) reversibility; (iv) likelihood; (v) regularity; and (vi) legal standards and established professional criteria (Table 50).

Table 50: Parameters for Determining Impact Category

Magnitude of Change/ Consequence	Major	Moderate	Minor	Minimal (negligible; no detectable potential impact)
Duration	Long-term (more than 5 years)	Medium-term (1-5 years)	Short-term (<1 year) or temporarily limited during construction period at concerned location (>1 month)	Temporarily limited during construction period at concerned location (< 1month)
Spatial extent	Widespread, far beyond project components' site boundaries or ROWs (>500m)	Beyond project components' site boundaries or ROWs (<500m)	Only immediately adjacent to project components' site boundaries or ROWs	Only within project components' site boundaries or ROWs
Reversibility	Potential impact is effectively permanent, cannot return to baseline (irreversible)	Potential impact requires a year or so with interventions to return to baseline	Baseline returns naturally or with limited intervention in less than a year	Baseline remains almost constant
Likelihood of occurrence	Certain	Likely	Unlikely	Improbable

Frequency of occurrence	Occurs under typical operating or construction conditions (Frequent)	Occurs under worst case operating conditions (Occasional)	Occurs only under abnormal, exceptional, or emergency conditions (Infrequent)	Rare
Legal standards and established professional criteria	Breaches national standards and/or international good practice guidelines/ obligations	Complies with limits given in national standards but breaches international good practice guidelines	Meets minimum national standards and/or international good practice guidelines/ obligations	Not applicable

208. ***Sensitivity of Receptor*.** An environmental receptor is a resource such as a habitat, species, individual or community that may be impacted by the project. Criteria for determining the sensitivity of the receiving environment or environmental receptor are given in Table 51.

Table 51: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very High	International importance No capacity to absorb proposed changes Far below average vulnerability Minimal opportunities for mitigation
High	National/State importance Minimal capacity to absorb proposed changes Below average vulnerability Few opportunities for mitigation
Medium	District/Local Community importance Some capacity to absorb proposed changes Average vulnerability Several opportunities for mitigation
Low	Individual importance Capacity to absorb proposed changes Above average vulnerability Several opportunities for mitigation

209. ***Assigning Significance.*** Following the assessment of magnitude, and the sensitivity of the receiving environment or environmental receptor has been determined, the significance of each potential impact is established using the impact significance matrix shown in Table 52*.*

Table 52: Significance of Impact Criteria

Magnitude of Impact		**Sensitivity of Receptors**			
		Very High	**High**	**Medium**	**Low**
Major		Critical	Major	Moderate	Moderate
Moderate		Major	Major	Moderate	Minor
Minor		Major	Moderate	Minor	Minor
Minimal		Moderate	Moderate	Minor	Minimal

(b) Impact Matrix

210. Potential environmental impacts and risks in relation to various environmental components during the design and pre-construction, construction, and operation & maintenance phases of the project pre-mitigation, but including standard design features which would be incorporated by NEA, for example, lightening protection, were scoped and are presented in a matrix form in Table 53.

211. Impacts which were considered to be of major-critical significance prior to mitigation being adopted were scoped into detailed assessment as detailed in the following section. For other impacts, mitigation measures may still be required to reduce adverse/increase beneficial residual impacts to an acceptable level, then where major adverse impacts still remain compensation (offsets) will be required e.g. to ensure no net loss of biodiversity as a result of the project.

Table 53: Impact Matrix

Environment Component	Potential Impacts	Main Phases Impact Occurs	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation Required in EMP	Residual Significance Post-Mitigation
Physical-Chemical Environment							
Land use	Change in land use at substation sites from agriculture to developed	Construction, location results from project design	Low	Minor	Minor Adverse	Yes	Minor Adverse
Topography / terrain	Change in topography/ terrain as a result of earthworks, primarily at substations due to cut and fill to create level construction platform	Construction, extent of cut and fill results from project design	Low – flat land Medium – hilly land	Minor – flat land Moderate – hilly land	Minor Adverse – flat land Moderate Adverse – hilly land	Yes	Minor Adverse – flat land Moderate Adverse – hilly land
Ambient air quality	Changes in ambient air quality - dust and suspended particulate matter from land clearance and earthworks	Construction	Medium – human and ecological receptors	Moderate where receptors <500m	Moderate Adverse	Yes	Minor Adverse
	Changes in ambient air quality - emissions from use of construction vehicles and plant	Construction, and to lesser extent during O&M (ROW maintenance)	Medium – human and ecological receptors	Minor where receptors <500m	Minor Adverse	Yes	Minor Adverse
Ambient noise and vibration	Changes in ambient noise and vibration levels - mobilization of heavy equipment and machinery, potential for water pumps, drilling and blasting for foundations, pile driving, transport of materials, use	Construction, and to lesser extent during O&M (ROW maintenance)	Medium – human and ecological receptors	Moderate where receptors <500m	Moderate Adverse	Yes	Minor Adverse

Environment Component	Potential Impacts	Main Phases Impact Occurs	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation Required in EMP	Residual Significance Post-Mitigation
	of construction vehicles, construction activities; and the presence of temporary worker camps						
	Changes in ambient noise levels - noise in the form of buzzing or humming can often be heard around transformers or power lines producing corona.	O&M, pollution prevention needs to be considered during detailed design	Medium – human and ecological receptors	Moderate where receptors <500m	Moderate Adverse	Yes	Minor Adverse
Water resources: quantity of surface and groundwater	Use of local water resources to provide for drinking water of workers and other purposes	Construction and to lesser extent during O&M	Medium – especially if used for drinking water/ support sensitive aquatic ecology	Minor	Minor Adverse	Yes	Minor Adverse
Water resources: quality of surface and groundwater	Changes in quality of surface water/siltation – due to sediment laden runoff in proximity surface waterbodies	Construction and to lesser extent during O&M, location chosen as a result of	Medium – especially if used for drinking water/ support sensitive	Moderate where receptors <500m	Moderate Adverse		Minor Adverse

Environment Component	Potential Impacts	Main Phases Impact Occurs	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation Required in EMP	Residual Significance Post-Mitigation
		detailed design	aquatic ecology				
	Changes in quality of surface and groundwater – due to spill/leak of fuel, oil, or chemical near rivers or other surface waterbodies or springs/wells and other groundwater sources	Construction and to lesser extent during O&M, location chosen as a result of detailed design	Medium – especially if used for drinking water/ support sensitive aquatic ecology	Moderate where receptors <500m	Moderate Adverse	Yes	Minor Adverse
	Discharge of untreated sanitary wastewater from the temporary worker camps to surface water or ground resulting in water pollution	Construction	Medium – especially if used for drinking water/ support sensitive aquatic ecology	Moderate where receptors <500m	Moderate Adverse	Yes	Minor Adverse
	Fuel, oil, or chemical leaks and spills from operational substations including transformer oils with risk of transformers containing PCBs	O&M, pollution prevention needs to be considered during detailed design	Medium – especially if used for drinking water/ support sensitive aquatic ecology	Moderate where receptors <500m	Moderate Adverse	Yes, no new PCB-containing material will be allowed.	Minor Adverse

Environment Component	Potential Impacts	Main Phases Impact Occurs	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation Required in EMP	Residual Significance Post-Mitigation
	Discharge of untreated sanitary wastewater from operational substations to surface water or ground	O&M, pollution prevention needs to be considered during detailed design	Medium – especially if used for drinking water/ support sensitive aquatic ecology	Moderate where receptors <500m	Moderate Adverse	Yes	Minor Adverse
Water resources: drainage and flood risk	Erosion of riverbanks due to works and location of infrastructure close to riverbank, requiring river training works etc.	Construction, O&M	Medium	Major where receptors <500m	Moderate Adverse	Yes	Moderate Adverse
	Changes in greenfield runoff rates exacerbating waterlogging or flood risk on adjacent land	O&M, location chosen as a result of detailed design	Medium	Minor	Minor Adverse	Yes	Minor Adverse
Soils	Loss of topsoil and subsoils during land clearance and earthworks	Construction	Low	Minor	Minor Adverse	Yes	Minor Adverse
	Change in soil structure as a result of earthworks, primarily at substations due to cut and fill to create level construction platform	Construction, extent of cut and fill results from project design	Low	Minor	Minor Adverse	Yes	Minor Adverse
	Changes in quality of soil – due to sediment laden runoff or	Construction and to lesser	Low	Minor	Minor Adverse	Yes	Minor Adverse

Environment Component	Potential Impacts	Main Phases Impact Occurs	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation Required in EMP	Residual Significance Post-Mitigation
	spills/leaks of fuel, oil and chemicals	extent during O&M					
	Fuel, oil, or chemical leaks and spills from operational substations including transformer oils with risk of transformers containing PCBs	O&M, pollution prevention needs to be considered during detailed design	Low	Minor	Minor Adverse	Yes, no new PCB-containing material will be allowed.	Minor Adverse
Natural resources	Use of raw materials (sand etc.)	Construction, and to lesser extent during O&M (ROW maintenance)	Low	Minor	Minor Adverse	Yes	Minor Adverse
Waste management	Generation and inappropriate disposal of inert spoil, solid and hazardous waste from construction wastes like metal scraps and wooden packing material, polythene as well as domestic wastes from temporary worker camp)	Construction	Medium (a district/ community concern)	Moderate	Moderate Adverse	Yes	Minor Adverse
	Generation and inappropriate disposal of solid and hazardous waste from substations including transformer oil	O&M	Medium (a district/ community concern)	Moderate	Moderate Adverse	Yes	Minor Adverse

Environment Component	Potential Impacts	Main Phases Impact Occurs	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation Required in EMP	Residual Significance Post-Mitigation
Climate change	Fugitive emission of CFC and SF6 (potent greenhouse gas)	O&M, CGC and SF6 use needs to be considered during detailed design	Very High (a global concern)	Minimal (at a global scale)	Moderate Adverse	Yes	Moderate Adverse
Biological Environment (Flora and Fauna)							
Flora and Fauna	Loss of vegetation supported by new substations on modified, agricultural habitat	Construction, location results from project design	Low	Minor	Minor Adverse	Yes	Minor Adverse
	Vegetation control within grounds of substations.	O&M	Low	Minimal	Minimal Adverse	Yes	Minimal Adverse
	Disturbance to terrestrial fauna supported by new substations on modified, agricultural habitat	Construction, and to lesser extent during O&M due to impacts on physical environment	Medium	Minor	Minor Adverse	Yes	Minor Adverse
	Loss of area of modified and natural habitat (forest) beneath ROWs	Construction, location results from project design	Low – modified habitat High – protected and forest areas	Minor – in modified, agricultural habitat Major – in natural	Minor Adverse – in modified, agricultural habitat Major Adverse – in	Yes	Minor Adverse – in modified, agricultural habitat Major Adverse – in natural habitat (forest)

Environment Component	Potential Impacts	Main Phases Impact Occurs	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation Required in EMP	Residual Significance Post-Mitigation
				habitat (forest)	natural habitat (forest)		therefore although magnitude reduced to moderate provide compensatory reforestation
	Loss of vegetation (including trees) supported by ROWs including within Parsa National Park, Koshi Tappu Wildlife Reserve buffer zone, Chure Conservation Area, and designated forest land - vegetation clearing/ tree cutting is required at the tower footings and RoW	Construction, location results from project design	Low – passing through agricultural land High – in protected and forest areas	Minor – in agricultural land, Major – in protected and forest areas	Minor Adverse – in agricultural land, Major Adverse – in protected and forest areas	Yes	Minor Adverse – in agricultural land, Major Adverse – in protected and forest areas therefore although magnitude reduced to moderate provide compensatory reforestation
	Regular trimming (alternate years) of tall trees growing in RoW during operation to maintain safety distances, only small shrubs and trees can establish up to 5m	O&M (ROW maintenance)	Low – passing through agricultural land High – in protected	Minimal – in agricultural land, Minor in protected and forest areas	Minimal Adverse – in agricultural land, Moderate Adverse - in protected	Yes	Minimal Adverse – in agricultural land, Moderate Adverse - in protected and forest areas

Environment Component	Potential Impacts	Main Phases Impact Occurs	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation Required in EMP	Residual Significance Post-Mitigation
			and forest areas		and forest areas		
	Disturbance to terrestrial fauna supported by ROWs including within Parsa National Park, Koshi Tappu Wildlife Reserve buffer zone, Chure Conservation Area, and designated forest land due to human presence, construction activities, and vegetation cutting	Construction, and to lesser extent during O&M (ROW maintenance)	Low – passing through agricultural land High – in protected and forest areas	Minor – in agricultural land, Moderate – in protected and forest areas	Minor Adverse – in agricultural land, Major Adverse – in protected and forest areas	Yes	Minor Adverse – in agricultural land, Moderate Adverse – in protected and forest areas
	Forest habitat fragmentation and restrictions on faunal movement patterns due to presence of new transmission lines, especially through protected and forest areas	O&M, extent of impact results from project design	Low – passing through agricultural land High – in protected and forest areas	Minor – in agricultural land, Major – in protected and forest areas	Minor Adverse – in agricultural land, Major Adverse – in protected and forest areas	Yes	Minor Adverse – in agricultural land, Major Adverse – in protected and forest areas therefore although magnitude reduced to moderate provide compensatory reforestation
	Mammal, specifically primate (e.g. langur) electrocution	O&M, extent of impact results from	Medium	Moderate	Minor Adverse – outside	Yes	Minor Adverse – outside and

Environment Component	Potential Impacts	Main Phases Impact Occurs	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation Required in EMP	Residual Significance Post-Mitigation
		project design			protected and forest areas, Moderate Adverse – inside protected and forest areas		within protected and forest areas
	Use of firewood/timber/non-timber forest products (NTFPs)/hunting or poaching of fauna by the workers (no commercially important NTFPs found)	Construction, and to lesser extent during O&M (ROW maintenance)	High	Minor	Moderate Adverse	Yes	Moderate Adverse
	Risk of forest fires in dry season	Construction, O&M	High	Minor	Moderate Adverse	Yes	Moderate Adverse
	Bird electrocution and collision	O&M, extent of impact results from project design	Medium, most species High, critical habitat bird species	Major	Moderate Adverse – most species, Major Adverse – critical habitat species	Yes	Moderate Adverse – most species, Major Adverse – critical habitat species, therefore although magnitude reduced to moderate adopt offset to ensure no net loss of

Environment Component	Potential Impacts	Main Phases Impact Occurs	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation Required in EMP	Residual Significance Post-Mitigation
							biodiversity in relation to critical habitat bird species (Appendix 7)
	Requires associated facility of Pantang Substation to be constructed, no protected area or key biodiversity area directly impacted	O&M	Low – High as per above	Minimal – major as per above	Minimal - Major Adverse as per above	Yes, NEA to apply project EMP to associated facility	Minimal - Major Adverse as per above
Socioeconomic Environment							
Landowners	Permanent loss of land (including agricultural and community forests) under tower footprint and at new substation sites – see RIPP for further assessment	Construction, extent of land take results from project design	Low – agricultural Medium – community forests	Minor	Minor Adverse	Yes	Minor Adverse (apply RIIP for land acquisition)
	Loss of crop within project footprint, standing crops in RoW may be damaged – see RIPP for further assessment	Construction and to lesser extent O&M (ROW maintenance)	Low – agricultural Medium – community forests	Minor	Minor Adverse	Yes	Minor Adverse (apply RIIP for compensation)
	Restrictions on land use beneath ROW of transmission lines (limitations on structures within security clearance of ROW; etc.)	O&M	Low – agricultural Medium – community forests	Minor	Minor Adverse	Yes	Minor Adverse

Environment Component	Potential Impacts	Main Phases Impact Occurs	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation Required in EMP	Residual Significance Post-Mitigation
	which may also affect the land price						
	Structures within the ROW and/or safety clearance require relocation	O&M	Low	Minor	Minor Adverse	Yes	Minor Adverse (apply RIIP)
	Land price, may be reduced near RoW and substation sites, although at other locations may be increased due to better availability of electricity	O&M, location results from project design	Low	Minimal	Minimal Adverse/ Beneficial	Yes (ensuring O&M impacts at adjacent properties acceptable)	Minimal Adverse/ Beneficial
Construction workers	Human health and safety including: - Hazards created during the construction period, e.g. movement of heavy equipment, vehicles, and machineries, working conditions, etc. Hazards relating to working with electricity and working at height, as well as from handling PCBs or asbestos in upgrade works at existing substations. Change in ambient air quality with impacts on the health of workers Exposure to high levels of ambient noise may affect hearing of workers	Construction, O&M	Medium, on average although some may be more vulnerable that others due to gender, education level, existing health etc.	Major, in worst case risk of death	Moderate adverse, but pay attention to vulnerable groups who may be at greater risk	Yes	Moderate adverse, but less likely worst case will occur
Local communities	Employment opportunities, both skilled and non-skilled laborers will be required, temporary	Construction	Low	Minor	Minor Beneficial	Yes	Minor Beneficial

Environment Component	Potential Impacts	Main Phases Impact Occurs	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation Required in EMP	Residual Significance Post-Mitigation
	opportunities available and business opportunities in relation to presence of construction workers						
	Employment opportunities, both skilled and non-skilled laborers will be required, minimal opportunities available for staffing new substations	O&M	Low	Minimal	Minimal Beneficial	Yes	Minimal Beneficial
	Human health and safety including: - Communicable diseases as workers coming into contact with communities from elsewhere, including COVID-19 Social disturbances related to workers camps, construction traffic on roads Inappropriate disposal of wastes like metal scraps etc. Presence of electricity infrastructure within local communities and EMF Changes in ambient air quality with impacts on the health of community Exposure to high levels of ambient noise may cause anxiety and disturbance to community	Construction O&M	Medium, on average although some may be more vulnerable that others due to gender, education level, existing health etc.	Major, in worst case risk of death	Moderate adverse, but pay attention to vulnerable groups who may be at greater risk	Yes	Moderate adverse, but less likely worst case will occur

Environment Component	Potential Impacts	Main Phases Impact Occurs	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation Required in EMP	Residual Significance Post-Mitigation
	Health and safety in relation to school compounds notably school within 50m at Dabjong village of Netrawati RM, ward no 1, Dhading district.	Construction O&M (ROW maintenance)	High, due to their age school children are a more vulnerable group	Minor, given anticipated distance to its boundary	Moderate Adverse	Yes	Moderate Adverse
	Impairment of visual aesthetics due to transmission towers partially visible on the skyline	O&M, and to lesser extent temporary impairment during construction	Medium	Moderate	Moderate Adverse	Yes	Moderate Adverse
	Damage to property due to construction haulage; roads, in particular rural and dirt roads may suffer from the passage of traffic, banks of rivers/drains may suffer from collapse due to passage heavy vehicles	Construction, and to lesser extent during O&M (ROW maintenance)	Medium	Moderate	Moderate Adverse	Yes	Minor Adverse, contractor to repair any damage caused
	Damage to property along ROW due to mechanical damage or increased vibration from drilling or blasting which may cause damage to neighboring structures, etc.	Construction, and to lesser extent during O&M (ROW maintenance)	Medium, although structures previously fragilized by earlier earthquake may be	Major, in worst case risk of death if structure occupied	Moderate Adverse	Yes	Moderate Adverse, but less likely to occur, contractor to repair any damage caused

Environment Component	Potential Impacts	Main Phases Impact Occurs	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation Required in EMP	Residual Significance Post-Mitigation
			more vulnerable				
	Damage to life or property along ROW due to the unlikely event of a tower failure.	O&M	Medium	Major, in worst case risk of death	Moderate Adverse, but is unlikely to occur	Yes	Moderate Adverse, but is unlikely to occur
Physical cultural resources	Loss of unknown physical cultural resources (historical cultural elements/ fossils) outside Kathmandu Valley World Heritage Site (Swayambhu) boundaries	Construction	Unknown, but likely to be medium sensitivity	Major, loss of resource	Moderate Adverse, depending on sensitivity	Yes, chance find procedures to be adopted to address this risk	Moderate Adverse, depending on sensitivity
	Loss or damage to physical cultural resources Janaki temple from transmission line works	Construction O&M (ROW maintenance)	Medium	Minor, given anticipated distance to its boundary	Minor Adverse	Yes	Minor Adverse
	Loss or damage to physical cultural resources of Kathmandu Valley World Heritage Site (Swayambhu)	Construction O&M (ROW maintenance)	High – as 500m away from main monument	Major, damage to monument in worst case event of accident	Major Adverse	Yes	Major Adverse, but less likely worst case would occur, contractor to repair any damage caused
	Anticipation of more stable power supply may create economic	O&M	Medium – district level	Moderate	Moderate Beneficial	N/A	Moderate Beneficial

Environment Component	Potential Impacts	Main Phases Impact Occurs	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation Required in EMP	Residual Significance Post-Mitigation
	development opportunities for districts, resulting in improved productivity and job creation						
Regional and national development	May result in expansion of transmission lines, hydropower or other development from presence of extended national grid in project area (cumulative and induced impacts)	O&M	High – national level	Major	Major Adverse re environment, Major Beneficial re energy supply	N/A as independent of project, but GoN need to ensure all hydropower projects are approved following national regulations for EIA/IEE	Major Adverse re environment, Major Beneficial re energy supply

C. Impact Assessment, Mitigation and Compensation (Offset) Measures

212. Potential environmental impacts and risks and associated mitigation and compensation measures on different environmental and socioeconomic components during the on-site pre-construction, construction, and the operation & maintenance (O&M) phases are discussed in detail below with further assessment for those which were considered to be of major-critical significance prior to mitigation being adopted. Mitigation measures for these impacts will often need to first be implemented during the detailed design and pre-construction preparatory phases of the project, this phase in itself will have minimal or no adverse impact but sets the stage for subsequent phases.

(a) Land Use, Topography/Terrain, Landowners, and Property Damage

213. **On-site Pre-construction, Construction and O&M.** Impacts are related to land take during tower foundation and substation construction, and for any access tracks required to access new substations off existing road access, and then restrictions to use of the ROW during O&M. The project will also require cut and fill including ground leveling for tower foundations and substation sites in hilly terrains. Slope stabilization work will be needed to protect structures in hilly terrains from erosion and landslide. Such impacts are unavoidable but can be minimized.

214. The impact on the land use changes under the RoW and land take for the towers and substations will be permanent. The EGMP components will require about 256.73 ha of land in total (Table 55). Land changes will permanently occur for 37.24 ha of land for towers and substations while 219.5 ha beneath ROWs will have land restrictions. Of this area, the Borang-Ratmate Transmission Line (Component 3) alone occupies 43.69% of land requirements, Dandakhet-Rahughat Transmission Line (Component 1) 24.80%, and Ghorahi-Madichaur Transmission Line (Component 2) 16.99%, the rest being related to the new substations (Components 4, 5). Table 56 shows private land take for the project. Based on the Resettlement and Indigenous Peoples Plan (RIPP), private land to be permanently acquired by the project for towers and substations of the 3 new transmission lines is 20.65 ha with 119.14 ha within the RoW under restricted use, affecting a total of 253 households (1,295 persons). In addition, land will be temporarily rented for worker camps or storage areas and will be temporarily required during construction nearby the tower sites for construction machinery and equipment maneuver etc. Land for storage areas etc. will be taken on lease by the Contractor at the prevailing market price based on the production loss. Of the three new transmission lines components, 66% of private land to be acquired is along the Borang-Ratmate Transmission Line (Component 3), 20% for Ghorahi-Madichaur Transmission Line (Component 2), and, 14% for Dandakhet-Rahughat Transmission Line (Component 1).

215. Private land acquisition for substations grounds is under finalization by NEA and was or is being carried out on a willing-buyer willing-seller basis therefore impacts on landowners are anticipated to be minor adverse.

216. The number of structures affected along the new ROW and/or safety corridor of the 3 new transmission lines is 32 (of which 15 are houses, 7 are cowshed, 3 are kitchens, 7 are toilets) belonging to 15 households. The 15 households losing their place of residence will be relocated in accordance with the RIPP. Relocation of regularly occupied properties in the ROW

will ensure the project complies with the IFC EHS Guidelines on Electric Power T&D requirement "*transmission 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*" also addressing operational community health and safety risks. Other structures may remain in use provided not situated in the safety clearance.

217. Currently, rice crops are being cultivated along some part of the ROWs of the 3 new transmission lines. The standing crops will be partially affected during the construction of tower bases and stringing of conductors. Temporary loss of crops during the construction of the 3 new transmission lines and substations will be about 302.45 MT. Total number of 8,358 trees will also be lost in private land for the three new transmission lines. Once the towers are constructed, paddy and other seasonal crops can be re-planted between the footings of the tower, therefore impacts on landowners during O&M are anticipated to be temporary and minor adverse. Land under the RoWs will not be significantly restricted with regards to its current use except for a prohibition to construct any new structure or relocate any existing structures within the safety clearance and for trees and vegetation within the ROW to be less than 5m in height. The restriction on the erection of any type of structure of land under the RoW and plantation of tall tree species cannot be avoided. However, farmers will be allowed to cultivate crops in the ROW under restricted use.

218. The value of land may be affected by the proximity of overhead transmission lines. On the other hand, land values in the general area are likely to increase because of the availability of additional power supply also resulting in induced changes in land use from agriculture to commercial or industrial uses.

219. The transmission lines will cross various major roads in many districts and some minor roads will be crossed as well (126 nos.) (Table 54). The selected transmission line alignment is never far from the local road network and various existing access roads and tracks will be used during the construction. Some access roads and road crossing locations will be temporarily blocked during the process of accessing transmission tower locations for erection of towers and stringing conductors between towers at the end of the construction phase so traffic management will be required (see health and safety section).

220. The alignment of the transmission lines will also cross several utility lines and network such as power lines (45 nos.) and telecommunication lines (Table 54). Construction work across these utilities can cause temporary utilities disturbances. If construction activities are not properly handled, an accident could also cause the interruption of a utility service, yet the likelihood of such occurrence is very low.

Table 54: Details of Crossing Along the Project Components

Project Component	Rivers	Rivulet	Roads	Power Lines (220, 132, 66, 33, 11 kV
1.Dandakhet-Rahughat Transmission Line	6	27	39	14
2.Ghorahi-Madichaur Transmission Line	24	64	4	11
3.Borang-Ratmate Transmission Line	6	82	83	20
Total	**36**	**173**	**126**	**45**

221. There will be no such impacts from Components 6-8 as these will be undertaken within existing substations/premises. For Component 9 these works will be undertaken within the existing ROWs of transmission lines etc. There will however be temporary loss of 132 MT crops during restringing of the conductors. Further, given the dense urban setting for Component 9c it needs to be ensure that the ROW and/or safety corridor is being maintained before construction.

Table 55: Extent of Total Land Take for Project Components

Project Component	Total Land Loss (ha)		%
	Permanent	Land Restriction under new ROW	
Component 1			
Dandakhet-Rahughat Transmission Line	0.9788	43.63	2.63
New Rahughat Substation	4.6097	-	12.38
New Dandakhet Substation	2.6045	-	6.99
Component 2			
Ghorahi-Madichaur Transmission Line	2.7386	63.6873	7.35
New Madichaur Substation	2.407	-	6.46
Component 3			
Borang-Ratmate Transmission Line	4.336	112.164	11.64
New Lapang Substation	5.689	-	15.27
New Borang Substation	7.702	-	20.68
Component 4			
New Pangtang Substation	2.65	-	7.12
Component 5			
New Keraun Substation	3.52	-	9.45
33kV Distribution Line	0.009	-	0.02
Total (ha)	37.24	219.48	**100%**
	256.73		

Table 56: Extent of Private Land Required for Project Components 1-3

Project Component	Private Land Loss (ha)		Total
	Permanent	Under RoW	
Component 1 Dandakhet-Rahughat Transmission Line and associated substations	0.78	18.40	19.18
Component 2 Ghorahi-Madichaur Transmission Line and new Madichaur substation	28.004	3.48	24.524
Component 3 Borang-Ratmate Transmission Line and associated substations	16.395	76.22	92.615
Total (ha)	**20.65**	**119.14**	**139.79**

Source: RIPP (draft 12 August 2020).

222. **Mitigation.** Impacts on land use, topography and landowners will be mitigated through appropriate detailed design and pre-construction preparations followed by good construction management, including:

- During detailed route survey identify presence of any unstable land, steep slopes, etc.
- Detailed design will avoid locating any project components on unstable land and/or steep slopes.
- For project components that are fully or partially located on slopes or in hilly terrain, detailed design to incorporate slope stability measures e.g. bioengineering such as planting grass and trees combined with retaining walls and adequate drainage, designs to be checked by an independent expert to confirm international good practice for slope stability design is followed.
- Select an appropriate foundation design for substations and towers considering climatic factors such as wind, and geological factors such as seismic risk in the project component locations.
- Contractor to examine stability of tower locations before excavation.
- Natural slope disturbances will be minimized, as much as possible, during the construction of tower foundations and in the excavations done to open the track of access roads to new substations across agricultural land.
- Balance cut and fill in the areas where leveling of sites is required.
- Carry out landscaping at each tower location, including bioengineering and slope protection work.
- Erection of foundation in unstable land and/or in steep slopes will be avoided by adjusting the layout.
- On completion of works re-vegetate disturbed areas to avoid soil erosion.

- Contractor to schedule works affecting agricultural land outside the cropping season to allow farmers to harvest standing crops.
- Except for new substations as noted in Table 23 no construction of new access track is allowed, especially in forest land. Use will be made of existing access roads and tracks for transporting tower materials and machinery, in locations where access is restricted use of manual labor to transport, install and string the towers and lines traversing uncultivated land (not natural habitat) as much as possible to avoid damage to crops
- Contractor to maximize use of existing substation compounds for temporary construction facilities (e.g. laydown and storage areas, workers facilities etc.)
- Contractor to locate temporary construction facilities as much as possible on uncultivated land (not natural habitat) to minimize disturbance to cultivated lands, at least 500m away from residential areas/villages, at least 500m from surface waterbodies/groundwater wells due to pollution risk, and 100m from other sensitive receptors (e.g. individual houses, schools, clinics, temples, etc.) avoiding land which is steeply sloping or waterlogged
- Contractor to consult with and seek the agreement of local communities on their proposed locations for any temporary construction workers camps, site offices, storage areas, and areas for waste management, etc.
- Restore temporarily used sites to at least their pre-project condition following works.
- Establish applicable right of way and safety clearance corridor in accordance with the Electricity Rule. If it is not possible to avoid regularly occupied structures in the safety clearance corridor such properties must be relocated. Consider grounding roofs and other metallic surfaces on any properties remaining within ROW to avoid induced current and electricity related accidents.
- Construction methods to be selected to minimize risk of damage to roads, utilities, structures, drains etc.
- Contractor to plan for using appropriate scaffolding or overhead bamboo frames during stringing works crossing roads, utilities, structures, or drains to minimize traffic disruption, accident risk, and property damage.
- Safe access to property will be maintained and alternative signed routes and access will be provided where there are temporary diversions or blockages.
- Locate stockpiles away from properties and only in designated areas where no access will be blocked.
- During detailed route survey identify presence of any existing utilities such as power lines, communications, streetlights, as well as through consultation with service providers (electric, water, gas, telecoms etc.)
- In cases where excavation works may be needed underground utility scans using a Cable Avoidance Tool (CAT) or equivalent must be undertaken by the Contractor to identify any services.
- Contractor to coordinate with operators where ROW crosses existing utilities to obtain no objection.
- Detailed design to consider the risk of damage to utilities and allow for sufficient vertical and horizontal safety clearances to minimize health and safety risks as per the Electricity Rules, and crossings for communications as per Electricity Regulation 1993.
- For existing roads, utilities, structures, drains etc. photographic and/or structural pre-condition surveys are to be completed by the Contractor and agreed with NEA

and property owners prior to any works, including enabling works. These must be documented in a pre-project condition report submitted to NEA, which will serve as baseline in case any damage to property occurs

- Contractor will be required to restore any property damage that is caused by their works to at least pre-project condition at their own cost.
- On completion of works restore all temporarily used sites to at least their pre-project condition following works; this will involve cleaning site of any debris or wastes, left over material and soil/rocks/sand, contaminated soil although this should have been avoided through EMP measures; revegetation if required; drainage if required; local topographical adjustments; addition of good quality soil if the latter was eroded/removed by construction works; etc.

223. Private land required for the project and structures that need to be relocated from the ROW and/or safety corridor will be compensated through land acquisition or rental in agreement with the landowners. Residual impacts from permanent land take and temporary crop loss during construction will be compensated in accordance with the entitlement matrix agreed and presented in the RIPP prepared in conjunction with this IEE to identify the land ownership, affected structures, trees, and crops to determine the compensation. A large number of households were originally identified within the chosen alignments and deviations to the routes were selected by NEA to reduce the number of affected houses. The RIPP provides details on compensation.

(b) Physical-Chemical Environment

(i) Ambient Air Quality

224. **On-site Pre-construction, Construction and O&M.** Construction activities, such as site clearance, excavation, and the movement of vehicles are likely to cause moderate increases in fugitive dust and suspended particulate matter. Exhaust emissions are likely to be generated by the operation of construction vehicles, equipment, and machinery although the resulting increase in air pollution is likely to be minor. Such impacts may temporarily affect the air quality around the project sites with dust travelling for up to 500m around substations requiring earthworks and be of greatest significance when sensitive receptors are located within the project area of impact and where vulnerable groups e.g. residents with poor existing respiratory health are present. However, the new project components involving earthworks are mostly located in rural locations so relatively few individual human receptors will be moderately affected and in the main impacts on ambient air quality will be minor adverse. New substations involving extensive earthworks are located away from the protected and forest areas with only excavations for tower foundations needed here so dust impacts on ecological receptors will only be minor adverse.

225. Similar impacts but to a much lesser extent may also occur during maintenance works during the O&M phase.

226. **Mitigation.** Impacts on ambient air quality will be mitigated through appropriate detailed design and pre-construction preparations followed by good construction management as set out in the IFC EHS General Guidelines for Construction and Demolition. Mitigation will include:

- Detailed design of substations to minimize cut and fill in order to reduce the extent of earthworks and thus dust generation during construction.
- Detailed design to balance cut and fill in areas where leveling required to minimize generation of spoil requiring disposal.
- Contractor to undertake air quality monitoring per the EMoP (Appendix 10, Table 10.B) to confirm current background levels in the project area at least one week prior to the commencement of any actively on-site.
- Contractor will prepare for NEA approval a construction pollution prevention plan (CPPP) as part of a Construction Environment Management Plan (CEMP) covering dust and emissions to air management in accordance with national laws and regulations and the EHS General Guidelines prior to the commencement of any works.
- Require construction equipment and vehicles to meet national emissions standards, see Appendix 2 of IEE.
- Perform regular checks, upkeep and maintenance of construction equipment and vehicles to keep them in good working order as per the manufacturer's specifications to meet emission standards.
- Sprinkle water during earthworks to avoid dust being dispersed by wind, cover with materials like gravel to minimize re-suspension of dust.
- Stockpiles of spoil and other dust generating materials to be kept to a minimum necessary to undertake works for the day
- Cover stockpiles with tarpaulin. Locate stockpiles at least 500m from residential property to avoid inconvenience from fugitive dust and ensure they are enclosed by a fence or similar to minimize windblown dust. Minimize double handling and drop loads.
- Position any stationary emission sources (e.g. diesel generators, compressors, etc.) as far as practical from sensitive receptors (houses, schools, clinics, temples, etc.)
- Impose speed limits on construction vehicles to minimize exhaust and dust emissions along areas where sensitive receptors are located (houses, schools, clinics, temples, etc.).
- Trucks importing fill material must be covered, all trucks used to be serviced and meet Nepal emission standards, belching of black smoke to be prohibited.
- Trucks transporting any loose spoil being removed from substation sites to local approved disposal sites will be covered to reduce dust.
- Limit engine idling to maximum 5 minutes.
- Sprinkle excavations, earthen access road and material stockpiles with water during the construction period to mitigate dust related issues due to frequent movement of construction vehicles as necessary i.e. 2-3 times per day but more often if needed during excavations, dry and windy conditions that enable dust to be easily mobilized and the dust to be visible. Clean dust from the access road after construction work is completed.
- Strictly prohibit the burning of wastes generated by project-related activities.
- Ensure workers working in close proximity to or having long exposure to vehicle exhausts and earthworks are provided with clean N95 dust masks to avoid inhalation or particulate matter and other pollutants.
- Construction air quality monitoring will be carried out per the EMoP (Appendix 10, Table 10.B)

(ii) Noise and Vibration

227. **On-site Pre-construction and Construction**: Noise will be generated during land clearance and/or the cutting of trees in the ROWs. It will also occur during the construction of tower foundations, substations, and the DCC center. New project components involving noisy activities are mostly located in rural locations or in the dense urban environment of Kathmandu Valley were background noise levels are already high, so relatively few individual human receptors will be moderately affected and in the main impacts on ambient noise levels will be minor adverse unless water pumps, drilling and blasting for foundations and pile driving is needed (depending on geology) and there are sensitive receptors in proximity to the works. In protected and 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.

228. According to WHO guidelines, noise levels should not exceed 55 dBA (day time) and 45 dBA (night time) in residential settings and 70 dBA in both day and night time in industrial and commercial areas.[48] Nepal standards (Appendix 2) which are more stringent in some locations will also be complied with.

229. **Mitigation:** Impacts on ambient noise will be mitigated through appropriate detailed design and pre-construction preparations followed by good construction management as set out in the IFC EHS General Guidelines for Construction and Demolition. Mitigation will include:

- Contractor to undertake noise monitoring per the EMoP (Appendix 10, Table 10.B) to confirm current background noise levels in the project area at least one week prior to the commencement of any actively on-site.
- Construction methods must be selected to ensure construction noise is limited to the following as 1 hour LAeq: (i) 70 dB(A) at the site boundary of substations; (ii) at residential properties, 55 (day) and 45 (night) dB(A) in urban areas and 45 (day) and 40 (night) dB(A) in rural areas as defined by Nepal regulations; and (iii) at “peace areas” such as schools as defined by Nepal regulations, 50 (day) and 40 (night) dB(A) – if these levels are exceeded, the Contractor will be required to implement additional noise mitigation such as placing temporary acoustic barriers around either the noise source and/or site boundary to ensure that the noise standards are met and/or the construction works do not result in an increase of 3dB(A) above background levels.
- For any sites where blasting may be necessary for substation or tower foundations, Contractor to identify properties at risk of vibration damage, undertake a through structural survey, supported by photographic evidence of any properties at risk, and determine whether such buildings may require the installation of vibration monitors during construction to monitor movement.
- Contractor will prepare for NEA approval a construction pollution prevention plan (CPPP) as part of a Construction Environment Management Plan (CEMP) covering

[48] World Health Organization (WHO). 1999. Guidelines values are for noise levels measured outdoors.

noise management in accordance with national laws and regulations and the EHS General Guidelines prior to the commencement of any works.[49]

- Schedule construction activities so as to minimize nuisance to sensitive receptors (houses, schools, clinics, temples, etc.) i.e. avoid works at night, on weekend, during holidays, school exam periods, etc.
- Noisy construction activity (especially piling works) will take place between 6 am to 6 pm. Residents will be informed will in advance of the construction schedule for noisy activities.
- Select construction techniques and low noise generating machinery and equipment e.g. less than 55dBA sound pressure level at 1m, and stage noisy works to limit their duration to minimize noise and vibration
- Use of blasting and other vibration inducing activities are to be avoided. In locations where this is unavoidable Contractor to identify properties within the zone of influence and undertake pre-construction structural surveys to identify level of risk. Risk may be high if structures previously damaged during earthquake and not repaired. If risk of structural damage to properties identified due to current condition, consider alternative construction method or temporary relocation of occupants during works if at risk. Consider need to install monitors during construction to monitor structural movement.
- Structural or cosmetic damage caused by vibration to be repaired by Contractor to at least pre-project condition at their own cost.
- Require construction equipment and vehicles to meet national standards, see Appendix 2 of IEE – all trucks should carry fitness certificates issued by the Nepal Road Traffic Authority and renewed annually under the applicable regulations of Nepal.
- Fit all vehicles, machinery and equipment used in construction with exhaust silencers where the manufacturer's design allows this
- Perform regular checks and maintenance of construction equipment and vehicles to keep them in good working order as per the manufacturer's specifications to meet emission standards.
- Position any stationary emission sources (e.g. diesel generators, compressors, etc.) as far as practical from sensitive receptors (houses, schools, clinics, temples, etc.)
- Prohibit use of horn by construction vehicles
- Limit vehicle movement and offloading of construction materials to daytime in areas where sensitive receptors are located (houses, schools, clinics, temples, etc.) – transport of materials and spoil by truck will be limited to the daytime without hooting.
- Impose speed limits on construction vehicles to minimize noise emissions along areas where sensitive receptors are located (houses, schools, clinics, temples, etc.).
- Limit engine idling to maximum 5 minutes.
- Provide appropriate PPE (acoustic ear plugs or earphones capable of reducing noise levels to 80dB(A) for hearing protection) to any workers subjected to noise levels of 80dBA for more than 8hours per day and ensure they wear it e.g. if using breakers. No unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dB(C) or average maximum sound levels of

[49] To inform development of the CPPP in relation to noise management, the Contractor will be required to measure and confirm the distance from their construction works to sensitive receptors during the detailed design, to confirm if the noise standards can be met based on their construction methods or temporary acoustic barriers are required.

110dB(A). Periodic medical hearing checks should be performed on workers exposed to high noise levels.
- Construction noise monitoring will be carried out per the EMoP (Appendix 10, Table 10.B)

230. **Operation Phase:** Similar to construction relatively few individual human receptors will be moderately affected and in the main impacts on ambient noise levels will be minor adverse. However, transformer noise is generally in the range 60-80 dBA, thus where there are sensitive receptors in proximity to the new and extended substations noise impacts may be experienced, particularly low frequency noise from the transformer hum.

231. **Mitigation.** Impacts on ambient noise will be mitigated through appropriate detailed design followed by regular O&M including:
- Detailed design of substations to ensure operation noise will be limited to the following as 1 hour LAeq: (i) 70 dB(A) at the substation site boundary; (ii) at residential properties, 55 (day) and 45 (night) dB(A) in urban areas and 45 (day) and 40 (night) dB(A) in rural areas as defined by Nepal regulations; and (iii) at "peace areas" such as schools as defined by Nepal regulations, 50 (day) and 40 (night) dB(A) – if these levels are already exceeded by the background, the Contractor will ensure that the noise standards are met by the project design alone and/that substation operation will not result in an increase of 3dB(A) above background levels.
- Detailed design of transformers and other noise sources to locate them as far as practical from the substation site boundary since noise diminishes with distance, at minimum given transformer noise is generally in the range 60-80 dBA they are to be located at least 10m from substation site boundary – if this is not possible Contractor must carry out noise calculations (modelling) to demonstrate that site boundary levels can be met.
- If any properties are within 100m of the substation site boundary then baseline measurements must be carried out during detailed design and noise calculations (modelling) considering low frequencies associated with transformer hum undertaken by the Contractor to demonstrate that these noise levels will be met.
- If noise levels cannot be met through siting alone detailed design to incorporate acoustic barrier designed to international good practice around either the noise source and/or substation site boundary to attenuate noise to level such that noise levels will be met.
- Carry out periodic safety related awareness raising in neighboring communities including information to the community regarding potential corona noise heard during operation.
- Maintain transformers and other noise generating equipment to ensure noise to be limited as above.
- Operational noise monitoring will be carried out per the EMoP (Appendix 10, Table 10.B)

(iii) Water Resources

232. The water resources of the project area can be affected by changes in quantity and quality with knock on effect on human health if used for drinking water or similar, and aquatic

ecology where sensitive flora and fauna are supported. Drainage and flood risk can also be affected by changes in impermeable surface area etc. There are no tube wells or other ground water resources identified in the project areas, although this is subject to reconfirmation on site.

Table 57: Details of River and Rivulets Crossing Along the Project Components

Project Component	Rivers	Rivulet
1.Dandakhet-Rahughat Transmission Line	6	27
2.Ghorahi-Madichaur Transmission Line	24	64
3.Borang-Ratmate Transmission Line	6	82
Total	**36**	**173**

233. There are 36 river and 173 rivulets (Table 57) crossing along the alignment of the 3 new transmission lines. The Dandakhet-Rahughat transmission line (Component 1) crosses Rahunganga Khola and Myagdi Khola rivers; it crosses the latter five times as well as small rivulets, including Dhukhu Khola, 27 times along its length. For Dandakhet substation, Myagdi Khola flows at 50m to the west with river training works being required due to proximity to the substation site to prevent bank erosion posing a risk to the substation site. The Ghorahi-Madichaur transmission line (component 2) crosses Madi Khola, Arun Khola, Tyan Tyan Khola, Sisne Khola, Balim Khola 18 times, and Babai Khola 2 times and small rivulets 64 times along its length. The crossing of Balim Khola 18 times occurs between AP 38 to 52 and the towers will be situated within 100m of the riverbank so river training structures along Balim Khola are required. Based on the national EIA report this is not a perennial river and receives flows only during monsoon period so works can be conducted in dry season. The Borang-Ratmate transmission line (Component 3) includes 6 river crossings of Kintan Khola, Lapan Khola, Thoppal Khola and Trishuli River 3 times. Lapang substation is close to a floodway and bank erosion may pose a risk to the substation site such that river training structure will be required.

234. **On-site Pre-Construction and Construction Phase:** Water supply to the workers during construction will most likely be sourced from local resources by the contractors. During the wet season there will be no impact, but during the dry season Nepal suffers from water stress. Thus, use of water by the contractor although minor may conflict with local community users.

235. Presence of workers will also result in the generation of sanitary wastewater, if this is disposed of untreated to surface water or ground it may result in the contamination of water resources. Depending on the number of workers in any one location impacts will be moderately adverse where surface water (rivers, drains, canals, ponds etc.) or groundwater sources (springs, groundwater wells, pumps, etc.) are located within 500m with significance reducing as distance increases.

236. Construction activities, such as site clearance, excavation, and the movement of vehicles along earthen roads are likely result in sediment laden runoff as a result of water sprinkling for dust management or during rainstorm. If water is encountered during excavation, pumps will be used to remove the sediment laden water which could be inappropriately disposed of to surface water. On entering surface water this can cause reduction in water

quality and siltation, leading to smothering of benthic habitat. Impacts will be moderately adverse where surface water (rivers, drains, canals, ponds etc.) is located within 500m with significance reducing as distance from surface water increases. Impacts will be temporary during construction works but greatest at new and extended substation sites where extensive cut and fill is needed to create a level construction platform and in hilly areas where there is greatest risk of slope instability and collapse occurring during the works. Some of the angle points of transmission lines and substation locations in hilly terrain are vulnerable to landslide. There is also a risk of some erosion due to construction of river training works where structures are too close to the riverbank, this risk is expected to be major particularly where the minimum distance from the riverbank is less than 100m – e.g. Balim Khola (component 2), Dandakhet substation (component 1) and Lapang substation (component 3) where river training works are anticipated.

237. During construction there will be use and storage of fuel, oil and chemicals including transformer oil. Storage will be within substations or on temporarily rented land. If spills or leaks accidentally occur e.g. during refueling activities these can be picked up in surface water runoff or percolate through the soil to groundwater. Impacts will be moderately adverse where surface water receptors (rivers, drains, canals, ponds etc.) or groundwater sources (springs, groundwater wells, pumps, etc.) are located within 500m with significance reducing as distance increases. The risks will increase during the rainy season as pollution will be picked up in rainwater.

238. PCB will not be used in new substation transformers or other project equipment and is therefore not a risk within the scope of this project. Nevertheless, special attention will be paid to transformer oil when handling old equipment unless possibility it contains PCBs can be ruled out through documentary evidence.

239. **Mitigation.** Impacts on water resources will be mitigated through appropriate detailed design and pre-construction preparations followed by good construction management as set out in the IFC EHS General Guidelines for Construction and Demolition. Mitigation will include:

- During detailed route survey identify presence of any surface waterbodies including rivers/ponds and groundwater sources including springs/wells/pumps and confirm if any are used by local communities for drinking water.
- Contractor to consult with and seek the agreement of local communities to temporarily use any community resources (e.g. water supplies) during construction to identify any potential conflict, if additional demand may place stress on community resources plan for alternative sourcing for these resources for project needs.
- Contractor will prepare for NEA approval a construction pollution prevention plan (CPPP) as part of a Construction Environment Management Plan (CEMP) 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 in accordance with national laws and regulations and the EHS General Guidelines prior to the commencement of any works.
- Plan construction works in the vicinity of waterbodies, considering erosion issues and surface water pollution risk.
- If any surface waterbodies or groundwater sources within 100m, Contractor is to undertake a baseline water quality sampling per EMoP (Table 10.B) to confirm their

current water quality status at least one week prior to the commencement of any actively on-site.

- Contractor to schedule, as far as practical, earthworks at substation sites and installation of towers during the dry season to minimize exposed areas subject to erosion by surface water runoff.
- Establish dedicated fuel, oil, and chemicals stores on impermeable bunded area of 110% volume to avoid spills and leaks contaminating soil and affecting water quality
- Avoid storage of fuel, oil, and chemicals in areas ideally within 500m to water sources (surface water and groundwater wells, springs etc.) to avoid direct contamination or contamination through run off, if this is not possible minimum distance is to be 100m.
- Place all equipment that may leak fuel or oil on drip trays it not sited on impermeable surface with 110% bunded capacity.
- Undertake refueling only on areas of hard protected soil, preferably bunded, ideally 500m from water sources (surface water and groundwater wells, springs etc.) but if this is not possible minimum distance to be 100m, with all drainage directed through oil interceptors.
- Provide spill response kit with sufficient absorbent materials (e.g. sorbents, dry sand, sandbags) on-site for soaking up any fuel, oil, or chemical leaks/spills.
- For transformers, follow the Spill Prevention Control and Countermeasures (SPCC) plan as recommended by United States Institute of Electrical and Electronics Engineer Inc. (IEEE) standard 908.
- Undertake construction during the dry season as much as possible to minimize exposed areas subject to erosion by surface water runoff.
- Undertake all construction 100m either side of river crossings and in floodplain during the dry season to avoid flood risk, leading to accidents and/or water contamination.
- Implement measures to prevent landslides to avoid contamination of rivers by soil.
- Works over or near watercourses will adopt protection measures to guard against loss of soil that would result in the turbidity of water.
- Minimize soil erosion and surface water runoff by reducing the extent of earthworks, revegetating earthworks on completion, and covering stores of sand and spoil with tarpaulin.
- Ensure sediment laden runoff shall not discharge directly to surface water but shall be discharged through sedimentation basin and oil interceptor.
- If water from excavations is pumped it must either be disposed of to an adjacent defined area of ground for percolation, or to waiting tanker trucks for proper disposal, it must not be disposed of to surface water.
- Do not allow washing of equipment or vehicles in surface water and ensure all washing water is discharged to sedimentation basin and oil interceptor instead of directly to surface water.
- Cement will be stored in rented private storage facilities; enclosed and not exposed to the elements.
- Do not undertake any concrete mixing ideally within 500m of surface water, if this is not possible minimum distance is to be 100m.

- Provide portable sanitary facilities/toilets and washing facilities for construction workers, so as to avoid surface and ground water pollution.[50] Locate these at least 500m away from surface waterbodies including rivers/ponds and groundwater sources including springs/wells/pumps, away from waterlogged land and shallow groundwater.
- Strict prohibition on open defecation and urination by construction workers; use of pit latrines for worker camps.
- Toilets and washing facilities to be connected to existing sewerage system, septic tank (with soak pit) or as portable self-contained units for disposal of wastewater off site to sewage treatment works. No untreated wastewater is to be discharged direct to surface water or the ground.

240. **Operation**: Similar to construction, a water supply will be required for substation workers and there will be sanitary wastewater generated from new substations although the magnitude of impact will be less as a lot few workers will be on-site the impacts will be permanent.

241. For the substations there will be also use and storage of fuel, oil and chemicals during operation including transformer oil. If spills or leaks accidentally occur e.g. from oil from poorly maintained transformers or poorly stored drums of new or used oil, these can be picked up in surface water runoff or percolate through the soil to groundwater with impacts being moderately adverse where surface water receptors (rivers, drains, canals, ponds etc.) or groundwater sources (springs, groundwater wells, pumps, etc.) are located within 500m of the substations. These risks will increase during the rainy season as any pollution will be picked up in rainwater.

242. In addition, drainage and flood risk will be impacted by the presence of new project infrastructure at previously greenfield locations and changes in the extent of impermeable surface. For new transmission lines the tower base area is expected to be approximately 400m^2 for each 220kV tower and 144m^2 for each 132kV tower totaling about 8.05 ha of land. Given the small footprint of the tower foundations and their scattered location over the landscape they are expected to have only minor adverse impacts on changes in drainage hydrology and flood risk. There is also a risk of some erosion or changes in flood flows primarily due to presence of river training works if structures are too close to the riverbank, this risk is expected to be major particularly where the minimum distance from the riverbank to a tower footing is less than 100m – particularly in relation to Balim Khola on the Ghorahi-Madichaur transmission line (component 2) where river training works are anticipated. However, the substations occupy a larger footprint (about 31.91 ha for substations) changing the land use from agriculture to developed which may increase the risk of waterlogging on adjacent land and of increased downstream flood risk from additional surface water runoff. Further, Dandakhet substation (component 1) and Lapang substation (component 3) will require river training works.

[50] Numbers to be decided by EPC contractors based on number of workers and EBRD guidance note on workers' accommodation: https://www.ebrd.com/documents/environment/workers-accommodation-guidance-note.pdf?blobnocache=true. Other international good practice guidance includes; https://www.hse.gov.uk/pubns/indg293.pdf

243. **Mitigation.** Impacts on water resources will be mitigated through appropriate detailed design followed by good operational pollution management and regular O&M of transformers including:

- Pit latrines and disposal of untreated sanitary wastewater to surface or groundwater is prohibited. Detailed design of substations to include adequate number of indoor toilets/washrooms with a hot and cold running water supply which are connected to either existing sewerage system or to septic tank with soakaway. [51]
- For all new substations requiring permanent water supply etc. NEA to consult with and seek the agreement of local communities to use any community resources to identify any potential conflict. If additional demand may place stress on community resources plan for alternative sourcing for these resources for project needs.
- Use of PCBs will be prohibited in all new transformers and any other project facilities or equipment provided by the project.
- Equipment purchased by NEA or Contractor for use on the project is to be accompanied by letter from the manufacturer stating that it is guaranteed PCB free and to be labelled as PCB free before its installation.
- Contractor to provide NEA with material data sheets for insulating oil meeting technical specifications for use in new transformers.
- In the absence of NEA records to confirm transformers are PCB free (ones installed post-1990 should have records, NEA to facilitate access to data archive) all existing transformers already in-situ must be assumed by the Contractor for health and safety purposes to contain PCBs and if needing to be disturbed by them the oil must be sampled and analyzed following UNEP Guidelines for the Identification of PCB and Materials Containing PCB and a health and safety risk assessment and plan prepared referring to the measures in UNEP (2002) PCB Transformers and Capacitors: From Management to Reclassification and Disposal. Provide workers with training on PCBs and their safe handling and disposal. Label any equipment or container containing PCBs found in existing transformers and other project equipment and unless being retained in-situ replace it with new PCB free equipment under the project.
- NEA must ensure appropriate transport, storage, decontamination, and disposal of redundant contaminated units; disposal should involve facilities capable of safely transporting and disposing of hazardous waste containing PCBs. A hazardous waste management plan to be prepared for handling PCBs. Assess surrounding soil exposed to PCB leakage from equipment removed or retained in-situ and implement appropriate removal and / or remediation.
- Contractor to coordinate with Department of Water Resources and Irrigation where ROW crosses rivers and water channels to obtain their no objection.
- Detailed design of substations to locate new transformers; storage areas; and septic tanks/soakaways ideally 500m but at least 100m from any surface waterbodies and groundwater sources to reduce pollution risk. If closer placement is required due to substation's proximity to surface waterbodies and groundwater sources, further assessment to be carried out by Contractor to demonstrate using source-pathway-

[51] Numbers to be decided by EPC contractors based on number of workers and EBRD guidance note on workers' accommodation: https://www.ebrd.com/documents/environment/workers-accommodation-guidance-note.pdf?blobnocache=true. Other international good practice guidance includes; https://www.hse.gov.uk/pubns/indg293.pdf

receptor model that there will be no adverse impact on aquatic ecology or human health.

- Detailed design of transformers and fuel, oil chemical, and waste storage areas to incorporate impermeable concrete surface bunded to 110% volume which is not connected to the drainage system to collect spills and leaks; ideally storage areas to be 500m to water sources (surface water and groundwater wells, springs etc.) but if this is not possible minimum distance is to be 100m.
- Detailed design of fuel, oil chemical, and waste storage areas to provide for a covered storage area of sufficient size to accommodate all anticipated storage requirements, ensure storage areas have the ability to be locked, are well-ventilated and will not reach extreme temperatures.
- Substation detailed design to incorporate adequate drainage; no drainage water will be permitted to discharge direct to surface water, oil interceptors are to be fitted on all drainage to catch oil spill.
- During detailed route survey identify presence of any floodplain etc.
- Substation and tower foundations to be located above maximum flood level (allowing for climate change) and incorporate adequate drainage design to avoid waterlogging during the wet season.
- Consider placement of equipment within substations to avoid water logging in O&M.
- Drainage will be designed so that discharge from substation site is no more than greenfield runoff rates; so as not to exacerbate flooding on land which is outside of the substation/downstream.
- Consider use of gabion wall and embankments (dykes) at substations may be at risk of flooding -- for Dandakhet, Lapang and existing Lahan substations provide flood protection measures e.g. embankment (dyke) or floodwall or heightening the grounds of the substation as well as improving the drainage system to drain surface water runoff.
- Detailed design to avoid locating any towers in riverbed, at wider rivers using special span arrangement and tower design at crossing locations (single wire spans) to keep tower footing away from the riverbanks.
- If towers must be located in floodplain foundation must be 2m about the maximum flood level of the river crossing and detailed design to incorporate appropriate measures to avoid foundation or tower itself being washed away during peak flow events (allowing for climate change) -- designs to be checked by an independent expert to confirm that international good practice is being followed.
- Consider use of gabion wall and embankments (dykes) including bioengineering options at locations where transmission lines cross or run parallel to rivers to protect riverbanks e.g. Balim Khola on the Ghorahi-Madichaur transmission line (component 2).
- Transformers to be routinely inspected and maintained to avoid spills and leakage. Regular visual and technical inspection of condition and maintenance as required to be carried out by NEA daily at substations to check any leaking oil from transformers which are to be immediately addressed.
- Keep track of any maintenance activities carried out with regards to transformers (in particular each time transformer oil is changed) on a maintenance logbook kept on the premises.

- Ensure transformers have a label indicating it contains PCB (polychlorinated biphenyl) or is PCB free. Obtain and keep evidence to confirm transformers are PCB free, for future reference.
- Perform visual checks of any evidence of oil leaking or having previously leaked from transformers, and if identified, address immediately - maintenance of and handling of transformer oil is to be carried out only by trained workers using appropriate PPE.
- Label all containers with its content and potential risk signs (e.g. flammable, corrosive, toxic, etc.)
- Ensure liquids (fuel, oil, and chemicals, empty drums, old transformers, etc.) are stored in area with impermeable floor with spill containment bund of 110% capacity.
- Ensure liquids storage areas are locked at all times.
- Keep spill prevention equipment available on site at all times.

(iv) Soils, Natural Resources and Waste Management

244. **On-site Pre-Construction and Construction:** On about 8.05 ha of land for the construction of tower footings of transmission lines and 31.91 ha for substations, top and sub-soils and the soil structure will be affected when the land is disturbed to make foundations. This is particularly so at substations on hilly terrain where cut and fill will be needed. On the other hand, these soils will usually be backfilled around the foundations, so will remain in a contained area. However, if there is excess spoil improper disposal will have a moderate adverse impact on the environment.

245. During construction there will be use and storage of fuel, oil and chemicals including transformer oil. Storage will be within substations or on temporarily rented land. If spills or leaks accidentally occur e.g. during refueling activities these enter the soil leading to contamination.

246. Use of raw materials such as sand will be required during construction depleting natural resources with associated environmental impacts of extraction – to minimize environmental impacts only existing licensed sources of raw materials will be used. Construction wastes (such as solid wastes: electric wire, pipes, stones, woods, rods etc., and liquid waste: paint, oil, bitumen, etc.) will be generated from the construction sites and general wastes (solid wastes: papers, containers, residues of food, fruits etc., and liquid waste: wastewater from bathroom and kitchen, etc.) from the workers' and their camps which if not collected up and/or inappropriately stored and disposed of could impact on the environment, health and safety as well as on the aesthetic beauty of the project area. Domestic waste will primarily consist of organic food waste which is easily biodegradable and non-hazardous and can be managed on-site by composting but all other domestic waste (plastic containers, bottles, etc.) will need to be collected and disposed of off-site at a suitably licensed and engineered landfill site. For solid waste this is only available in Kathmandu, so waste will need to be transported by the contractor for environmentally sound disposal retaining transfer notes etc. For hazardous waste, no such facilities exist in Nepal so the contractor will need to arrange for disposal by third party to neighboring country e.g. India retaining transfer notes etc. Some items (cement bag, plastic drum etc.) can be sold in the markets in order to be re-used or recycled and such opportunities are to be maximized.

247. PCB will not be used in new substation transformers or other project equipment and is therefore not a risk within the scope of this project.[52] Nevertheless, special attention will be paid to transformer oil when disposing old equipment unless possibility it contains PCBs can be ruled out through documentary evidence.

248. **Mitigation.** Impacts on soil, natural resources and waste management will be mitigated through appropriate detailed design and pre-construction preparations followed by good construction management as set out in the IFC EHS General Guidelines for Construction and Demolition. Mitigation which is applicable to both construction sites and workers camps will include:

- The Contractor will prepare for NEA approval a Construction Waste Management Plan (CWMP) as part of the CEMP for dealing with all solid and hazardous waste generated in an environmentally sound and safe manner in accordance with national laws and regulations and the EHS General Guidelines section on Waste Management prior to the start of any works.
- Prior to the start of works the contractor will ensure the waste management system is established at the construction sites and workers camps.
- Import all materials from existing licensed sources and keep records of all materials used, and sources.
- Sensitize workers on good housekeeping and the environmentally sound storage and disposal of construction and wastes, and importantly not to leave garbage lying around.
- Separate waste containers (drums, bins, skips or bags) will be provided for different types of waste.
- Collect and segregate wastes including scrap metal, oil, and solid waste; ensure all workers are familiar with this segregation and arrange garbage bins to collect these wastes so they are not thrown on the floor
- Store all the wastes produced in an environmentally sound manner in designated, labelled area with separate waste containers (drums, bins, skips or bags) for each distinct type of waste.
- Store solid waste in enclosed bins to contain leachate and avoid vermin.
- Storage yards will be fenced.
- Encourage recovery of recyclable wastes that could be reused or sold to recyclers, rather than disposing of it.
- Prohibit use of waste (e.g. empty cement bags and containers, plastic, wooden planks) for backfilling – only inert spoil may be used for backfilling to avoid need for off-site disposal (any excess inert spoil is to be disposed of at suitably licensed waste facilities).
- Prohibit burning of construction wastes.
- Prohibit dumping of construction wastes into drains, rivers, in agricultural fields etc.
- Provide weekly toolbox talk to remind of the importance of waste disposal, prohibition of disposal on the road, in drains etc., prohibition on burning of wastes, and open defecation and urination. Develop a procedure/system to penalize through escalating fines or similar any construction workers who breach these requirements.

[52] Transformer oil without PCBs will be used, most likely mineral oil. Since this is flammable fire safety measures to be in place at the substations.

- Contractor may compost biodegradable kitchen scraps on site if of small volume in enclosed composting facilities (enclosed to avoid attraction of vermin etc.) located ideally 500m but at least 100m from water sources (surface water and groundwater wells, springs etc.)
- Document all wastes removed off site using transfer notes, to be taken by licensed waste contractors who should reuse/recycle or dispose of the waste to suitably licensed and engineered waste management facilities according to type – for solid waste disposal this will need to be to Kathmandu, and for hazardous waste this will need to be to a neighboring country since no such facilities currently exist in Nepal.
- Excavated spoil that cannot be reused to a licensed disposal site as suitable for accepting inert wastes ensuring no solid or hazardous wastes are comingled with the inert excavated spoil
- Collect solid waste and dispose of it to suitably engineered and licensed sanitary waste facilities – in Kathmandu as no such facilities are existing in rural municipalities.
- Ensure any hazardous waste such as oily rags or old drums disposed of in suitably licensed hazardous waste facilities – out of country since no such facilities in Nepal.

249. **Operation:** During operation there will be use and storage of fuel, oil and chemicals including transformer oil at the substations. If spills or leaks accidentally occur e.g. during refueling activities these enter the soil leading to contamination. Further, operational wastes (such as solid wastes: electric wire, pipes, stones, woods, rods etc., and liquid waste: paint, oil, bitumen, etc.) will be generated from the substations and any maintenance works and general wastes (solid wastes: papers, containers, residues of food, fruits etc., and liquid waste: wastewater from bathroom and kitchen, etc.) from the workers' which if inappropriately disposed of could impact on the environment, health and safety as well as on the aesthetic beauty of the project area.

250. **Mitigation:** Impacts on soil, natural resources and waste management will be mitigated through appropriate detailed design followed by good operational waste management including:

- Disposal of worker generated waste (e.g. plastic bottles) on-site is prohibited and adequate waste storage areas to be incorporated into the detailed design. Composting of food waste may be permitted on-site if detailed design incorporates enclosed composting facilities located away from accommodation and any properties outside the site boundary.
- Incineration may be permitted on-site if detailed design incorporates an enclosed, small volume solid waste incinerator with stack and pollution control that is designed for residence time and temperatures that minimize incomplete combustion for waste disposal at substation, to reduce the volume of solid waste to be removed off-site given lack of suitably engineered and licensed sanitary waste facilities in rural municipalities.
- Collect and segregate O&M wastes including scrap metal, oil, and solid waste; ensure all workers are familiar with this segregation.
- Store all the wastes produced in an environmentally sound manner in designated, labelled area with separate waste containers (drums, bins, skips or bags) for each distinct type of waste.
- Store solid waste in enclosed bins to contain leachate and avoid vermin.

- Encourage recovery of recyclable wastes that could be reused or sold to recyclers, rather than disposing of it.
- Prohibit open/uncontrolled burning of wastes.
- Prohibit dumping of O&M wastes on-site, into drains, rivers, in agricultural fields etc.
- NEA may compost biodegradable kitchen scraps on site if of small volume in enclosed composting facilities located ideally 500m but at least 100m from water sources (surface water and groundwater wells, springs etc.) – resulting compost to be used in landscaping works.
- Document all wastes removed off site using transfer notes, to be taken by licensed waste contractors who should reuse/recycle or dispose of the waste to suitably licensed and engineered waste management facilities according to type – for solid waste disposal this will need to be to Kathmandu, and for hazardous waste this will need to be to a neighboring country since no such facilities currently exist in Nepal.
- Collect solid waste and dispose of it to suitably engineered and licensed sanitary waste facilities – in Kathmandu as no such facilities are existing in rural municipalities.
- Ensure any hazardous waste such as oily rags or old drums disposed of in suitably licensed hazardous waste facilities – out of country since no such facilities in Nepal.
- Store end-of-life or unused equipment in designated areas on site, ensure these are not left lying around.
- Store equipment in the dedicated, covered, labelled storage area (tools, machinery, material, equipment, and spare parts)
- Ensure liquids (fuel, oil, and chemicals, empty drums, old transformers, etc.) are stored in area with impermeable floor with spill containment bund of 110% capacity.
- Ensure liquids storage areas are locked at all times.

(v) Climate Change

251. **Operation:** During operation SF6 will be used in GIS which is a potent greenhouse gas contributing to climate change.

252. **Mitigation:** Impacts on climate change will be mitigated through appropriate detailed design followed by good operational SF6 management and regular O&M including:

- Training of all PMD and O&M staff on the climate change impact of SF6, alternatives, H&S risks during O&M due to presence of toxic byproducts, leakage minimization, and environmentally sound and safe disposal of old RMUs with SF6
- Use of chlorofluorocarbons (CFCs) including halon is prohibited.
- Detailed design of GIS substations will comply with international norms and standards for handling, storage, and management of SF6.
- SF6 insulated equipment will be tested and guaranteed by the supplier at less than 0.1% leakage rate.
- Keep record of all gas insulated switchgear and gas insulated transformers, including presence, if any, and quantity of SF6 in these.
- Provide SF6 leakage detection kit at each substation.
- Regular visual and technical inspection of condition and maintenance as required to be carried out by NEA daily at substations to check any SF6 leak which will be immediately addressed.

- NEA to monitor SF6 emissions through inventory control and accounting per the requirements set out in the EMoP.
- Proper handling and storage procedures to be implemented in accordance with equipment suppliers' specifications and best practices. Check for SF6 gas leakage in every shift of the operation.
- Maintain SF6 leakage records in every substation and report in periodic monitoring reports to ADB.
- Define a safe SF6 retrieval arrangement, with appropriate handling, storage, disposal process for end of life equipment in accordance international good practice.

(c) Biological Environment (Flora and Fauna)

253. Implementation of the project will affect the existing ecosystems in the project area. The major impacts on the biological environment during all phases of the project include impacts on:

(i) protected and key biodiversity areas;
(ii) loss of habitat, vegetation cover, due to site clearance including trees;
(iii) disturbance to fauna, as well as habitat fragmentation and restrictions on movement because of change of vegetation cover and disturbances on-site;
(iv) increased use of fuel wood, timber, non-timber forest products (NTFPs) and hunting and poaching by workers;
(v) risk of forest fire; and
(vi) bird electrocution and collision.

254. Due to the potential for critical habitat assessment, a critical habitat assessment has been undertaken for Components 1-3 and 9a and 9b (Appendix 7) with mitigation measures proposed as a result incorporated into this section. Further for all transmission line components a site-specific biodiversity management plan (BMP) will be developed detailing mitigation and monitoring measures as required for approval by NEA and clearance by ADB prior to the commencement of any works, including enabling works. The BMP will elaborate on how impacts on biodiversity discussed below will be minimized through the detailed design, construction methods, siting of temporary construction facilities, restrictions on construction workers etc.

(i) Protected and Key Biodiversity Areas

255. The impact on flora and fauna is of greatest impact in relation to works directly affecting protected and key biodiversity areas specifically (i) the construction of a new 132 kV transmission line from Ghorahi to Madichaur under Component 2 (7.4 km of which passes through the Chure Conservation Area, although all within the agricultural landscape of the Dun river valley) including 400m through the Dang Deukhuri Foothill Forests and West Rapti Wetlands, an IBA); and (ii) the upgrading of the conductors on two existing 132 kV transmission lines under Component 9 -- the 132 kV transmission lines from Pathlaiya to Dhalkebar (part falls within the newly extended buffer zone of the Parsa National Park with two sections in Chure Conservation Area) and Duhabi to Kusaha (part lies in the buffer zone of the Koshi Tappu Wildlife Reserve).

256. For Component 2, a total of 13.32 ha of modified habitat within Chure Conservation Area is to be impacted, of which 0.54 ha land is required for 24 tower pads. The habitat impacted is modified habitat. As per a joint field inspection between NEA and Chure Conservation Area field officers, there are no wildlife passages within the section of protected area impacted. The extent of impacts from the new Ghorahi-Madichaur transmission line on the Dang Deukhuri Foothill Forests and West Rapti Wetlands KBA is 0.072ha but on non-forest land.

257. For Component 9, these transmission lines are already existing within a protected and only restringing works (no change in arrangement of conductors, only the type) will take place; the ROW of these transmission lines are already regularly maintained by NEA although re-clearance of forest land located within the protected areas may be needed for stringing works.

258. **Chure Conservation Area**. There is a President Chure-Tarai Madhesh Conservation and Management Master Plan date 2074. Its vision is to "achieve economic prosperity along with the protected as well as naturally balanced Chure-Tarai Madhesh and Dun Landscape, and the continuous flow of environmental goods and services." It is recognized conservation of the Chure region is only possible through a multi-stakeholder, multidisciplinary, interdisciplinary as well as multidimensional effort. It therefore focuses on watershed conservation, improvement in agriculture system, management of animal husbandry, river control, wetland management, water conservation and so on along with forest management, including avoiding forest encroachment. Specific to this project is the objective to "maintain accessibility in the household use of energy, and to increase the accessibility of the residents living far from the national forests, especially from the Tarai region, in the use of timber, wood and other energy resources" including through "extension of access to national electricity power transmission" as well as mini-hydro which the project will help to deliver. For transmission lines it is recognized that "if the environmental aspect is not taken into consideration while constructing or operating such transmission lines, there will be imbalance in the environment first, eventually causing damage to the structure" therefore it is important that the project EMP is followed during project implementation. Permission received from the protected management is attached as Appendix 1a. In addition, to improving energy access the management plan identifies many other opportunities which NEA could support to promote and enhance the conservation aims of the protected area. Support for vulture conservation in particular will help support the Dang Deukhuri Foothill Forests and West Rapti Wetlands KBA, which is located within Chure Conservation Area.

259. **Parsa National Park.** The Pathlaiya to Dhalkebar transmission line was constructed before the national park boundary was extended, and now falls within it. Per the Parsa National Park and its Buffer Zone Management Plan FY 2075/76-2079/80 whose objectives are: to restore, improve and manage habitat for wild elephant, tiger, rhino, gaur and other species; to ensure maintenance of a viable population of wild elephant and tiger including all flora and fauna by restoring corridors to ensure connectivity, reduce illegal killing and illegal trade; to develop tourism infrastructure in order to promote sustainable tourism by involving private entrepreneur so that locals benefit from increased socio-economic opportunities while minimizing and mitigating negative impacts to maintain ecological integrity and cultural heritage; to enhance participatory biodiversity conservation by institutional strengthening of key stakeholders to take stewardship on conservation by increasing awareness at the same time improving livelihood of local people; and to strengthen institutional capacity through research,

capacity building, coordination and collaboration. Most relevant to the project is the need to control forest fires, as the extremely dry environment due to its physiographic location and experiences forest fires every year during dry season. More than 95% of the fire cases are caused by peoples' carelessness during the cooking of meal by timber smugglers, poachers, NTFP collectors or throwing of burning matchstick, bidi or cigarette by the local people while walking along the fire line. To ensure works are in accordance with this management plan, strict attention will need to be paid to forest fire mitigation (see following section) as well as poaching etc. for this section of transmission line. The management plan identifies many opportunities which NEA could support to promote and enhance the conservation aims of the national park.

260. **Koshi Tappu Wildlife Reserve.** Per the Koshi Tappu Wildlife Reserve and It's Buffer Zone Management Plan (2074/2075 – 2078/2079) the objectives are: to safeguard and restore the unique and characteristic wildlife species and habitats of the reserve; to conserve the rare, threatened, endemic and common wildlife species of the reserve; to build and strengthen the capacity of the reserve and buffer zone institutions; to improve livelihood of local communities and enhance their ownership of reserve and buffer zone; to enhance climate resilience of the area with specific focus on local communities and species of significance; to develop biological corridor for wildlife movement; and to develop nature based tourism with focused on avitourism. Most relevant to this project is that only 1.58 km^2 of buffer zone is designated as sustainable use zone, remaining 171.42 km^2 has settlement, private land, agriculture, development infrastructure and is intensive use. To ensure works are in accordance with this management plan, strict attention will need to be paid to poaching etc. (see following section) for this section of transmission line. The management plan identifies many opportunities which NEA could support to promote and enhance the conservation aims of the wildlife reserve with the local communities e.g. awareness raising on sustainable livestock grazing and opportunities for alternative tourism-orientated (e.g. bird watching activities) livelihoods to help promote biodiversity conservation and for better ownership of conservation efforts within the wildlife reserve itself.

261. Besides these transmission line works, existing substation components are also located in protected and key biodiversity areas, whilst in protected or key biodiversity areas all these works will be undertaken within the boundaries of existing substations inside existing buildings so there will be minimal biodiversity impacts:

- Bharatpur, Ghorahi, Hetauda, Kamane, and Lamahi – Chure Conservation Area
- Bhurigaun –Bardiya National Park BZ/Bardiya National Park IBA
- Godak – Mai Valley Forests
- Kusum – Banke National Park/Dang Deukhuri Foothill Forests and West Rapti Wetlands IBA
- Lakhanatri – Lake Cluster of Pokhara Valley Ramsar Site
- Lamahi – Dang Deukhuri Foothills Forest and West Raptai Wetlands IBA
- Mahendranagar - Suklaphanta Wildlife Reserve BZ/Suklaphanta Wildlife Reserve IBA
- Pokhara – Lake Cluster of Pokhara Valley Ramsar Site
- Simra –Parsa National Park BZ/Parsa Wildlife Reserve IBA

262. **Mitigation/Enhancement.** For the above project components, the following mitigation measures will be adopted:

- NEA will ensure that except for components 3, 9a and 9b, and existing substations mentioned above all other project components will be situated outside the boundaries and buffer zones of current or proposed protected areas and/or key biodiversity areas.
- NEA to continue to consult with protected area management of buffer zones in which existing substations are located to secure written confirmation they have no concerns about the proposed works given that these are all internal to the existing substations.
- NEA to continue to consult with and secure written confirmation from the protected area management of Parsa National Park, Koshi Tappu Wildlife Reserve buffer zone, and Chure Conservation Area as to (i) actions required to ensure works are in accordance with their management plans and (ii) measures NEA can support to promote and enhance their conservation aims.
- Contractor to strictly locate all temporary construction facilities outside of forest areas as well as outside of boundaries and buffer zones of current or proposed protected areas and/or key biodiversity areas, all temporary workers camps are to be located at least 500m for protected, key biodiversity or forest area. Location of related project facilities is to be identified by contractor, PSC international biodiversity expert to review if locations are suitable prior to NEA approval – specifically for Pathlaiya to Dhalkebar transmission line the Contractor may use existing Pathlaiya substation as a site office and storage area but all other temporary facilities will be at least 500m away from protected area and from the forest's external edge.
- Contractor to undertake alignment review during detailed route survey for the Ghorahi-Madichaur transmission line, to consider re-siting of angle point towers such that routing within Chure Conservation Area falls entirely to the west of the river and entirely outside Dang Deukhuri Foothill Forests and West Rapti Wetlands Key Biodiversity Area – specifically for this transmission line minimize cutting of the tall species of trees used by vulture as far as practical with pre-construction and post-construction surveys of the breeding vulture population in Dang district. In this location reforestation will focus on trees, such as, *Bombax cebia, Acacia sp*. etc., which provide suitable nesting habitat for vultures.
- NEA will implement the promotion/enhancement measures agreed with the protected area management in parallel with construction works. A lump sum of $50,000 is allocated for the program.
- NEA and the Contractor will continuously liaise with the protected area management to keep them informed of progress on construction.
- In forest areas and protected areas, the Contractor will act in accordance with the agreed site-specific BMP as well as in manner consistent with the protected area management plan.
- Contractor's biodiversity officer to oversee all activities in protected, key biodiversity and forest areas with Contractor engaging security to ensure workers do not engage in prohibited activities.
- Unnecessary use of machinery to be avoided in protected, key biodiversity and forest areas to minimize disturbance to fauna.

- In protected, key biodiversity and forest areas and within 500m of their respective boundaries,
- Contractor will not allow any works to be undertaken from 1 hour before sunset to 1 hour after sunrise to avoid disturbance to the fauna – specifically for Ghorahi-Madichaur transmission line avoid all construction during vultures breeding season (Jan-March) and for Duhabi to Kusaha transmission line avoid all construction within Koshi Tappu Wildlife Reserve buffer zone to be outside bird migratory period in order to minimize disturbance to birds.
- No lighting is to be used in protected areas or forest areas.

263. In relation to measures NEA can support to promote and enhance the conservation aims or protected areas and key biodiversity areas (as well as forest areas) in relation to new and upgraded transmission lines:

- NEA to support awareness raising program in association with the Department of National Parks and Wildlife Conservation (DNPWC) for Community Forest Groups within the ROW of transmission and distribution lines on sustainable use of non-timber forest products and biodiversity conservation, to commence pre construction and continue for 3 years into operation.
- NEA in association with Bird Conservation Nepal (BCN) or similar organization specialized in bird conservation to support vulture conservation awareness raising activities for local communities, particularly those within 500m, to commence preconstruction and continue for 3 years into operation.
- NEA to support habitat conservation plan for vultures which the project area is critical habitat namely White-rumped Vulture (*Gyps bengalensis),* Red-headed Vulture (*Sarcogyps calvus),* Slender-billed Vulture (*Gyps tenuirostris)* with an emphasis on Dang Dekhuri Foothill Forest and West Rapti Wetland and nearby Charinge Community Forest e.g. construction of artificial wetland and other habitat elements needed by vulture, strengthening the Vulture Safe Zone Program, to commence preconstruction and continue for 3 years into operation. This was also a recommendation from the Bird Conservation Nepal. It will be developed in coordination with key agencies in Nepal involving DNPWLC as well as Bird Conservation Nepal.

264. In addition to above, any other measures as envisaged by the DNPWC and as per provisions of National Parks and Wildlife Conservation Act, 2029 (1973, Amended in 2016) as well as other EMP measures (in relation to noise, dust etc.) will be strictly adhered to during execution of the project.

(ii) Loss of habitat, vegetation cover, including trees

265. Prior to starting construction, the tower sites need to be cleared and as a result, standing vegetation (e.g. crops, grass, bushes, trees etc.) will be lost. Table 58 presents the details of the forest area lost. About 41.23 km length of the 3 new transmission lines is located in forest areas. The total estimated forest area falling under these alignments (including tower-pads) is 86.67 ha. This area is inclusive of areas of community forest and government managed forest. This represents 35.6% of the total land area required for the 3 new transmission lines (243.44 ha). Out of the total forest area, 26.48 ha is registered community forest (CF) area managed

by community forest user groups (CFUG) and 7.33 ha is government managed forest. Forest is considered to be a natural habitat.

Table 58: Extent of Forest Land Required for The Project Components

Project Component	Forest Area		Total Land Area
	Length of Line (km)	Forest Area (ha)	
1.Dandakhet-Rahughat Transmission Line	12.87	23.166	41.844
2.Ghorahi-Madichaur Transmission Line	15.39	33.811	59.4158
3.Borang-Ratmate Transmission Line	12.966	29.699	109.27
Total	**41.226**	**86.676**	**243.442**

266. Based on the available detailed route survey reports of the 3 transmission line alignments, about 35-40% angle points are located in forest land. Based on the topography and assumption of every suspension tower falling at an interval of 300m, it is estimated that 137 numbers of towers will be located in forest land. Construction of 137 towers (angle and suspension) would require approximately 2.9465 ha of forest area which shall be permanently acquired by the project. This permanent land take area is small in comparison to the forest area restricted as ROW of the project. However, since trees in the ROW area will need to be removed it will reduce the crown cover of the forest along the transmission line corridors. As far as standing trees are concerned, based on the field study and total enumeration taken for the national EIA/IEEs, a total of 12,950 number of trees from forest land (Table 60) comprising of 50 different species are estimated to be clear felled from forest areas (community forest and government managed forest) during the project construction period. In addition, a further 8,358 number of trees on private land are estimated to the lost, totally a loss of 21,308 trees from the 3 new transmission lines.

267. During the operation phase of the project, trees which grow under the RoW after some years might need to be trimmed and cut down to maintain conductor clearance. The project will use Electricity Regulation, 1993 for the minimum clearance required, which is 18 meter for 132kV transmission line (9 meter on either side of the center line) and 30 meter for 220kV transmission line (15 meter on either side of the center line). Regular trimming of tall trees every two years and only allowing growing shrubs and short trees will change the vegetation cover.

268. The impact due to the loss of trees during project implementation is expected to be major in magnitude and long-term since to maintain safety clearances trees will only be able to grow up to 5m during operation. Construction of transmission lines in forest area will bring create habitat fragmentation in the forest area unless the cleared area is allowed to naturally regenerate with short vegetation cover of herb, shrub and short trees regenerating in the ROW within 6-12 months or is actively replanted with the short tree species to encourage faster reestablishment.

Table 59: Extent of Forest Loss (Temporary and Permanent) for Each Project Components

Project Component	Forest Area (ha)	
	Restricted by ROW	Permanent by Tower Pads
1.Dandakhet-Rahughat Transmission Line	23.166	0.403
2.Ghorahi-Madichaur Transmission Line	33.811	1.5525
3.Borang-Ratmate Transmission Line	29.699	0.991
Total	**86.676**	**2.9465**

Table 60: Extent of Trees Loss from Project Components

Project Component	Total Trees		Total
	Forest	Private	
1.Dandakhet-Rahughat Transmission Line	2,936	3,742	6,678
2.Ghorahi-Madichaur Transmission Line	4,674	435	5,109
3.Borang-Ratmate Transmission Line	5,340	4,181	9,521
Total	**12,950**	**8,358**	**21,308**

269. **Component 1, Dandakhet-Rahughat Transmission Line**: Out of the total length of the alignment of 25 km, 12.87 km passes through the forest area. The total estimated forest area falling under the alignment (including tower-pads and substations) is 23.166ha. This area includes both CF and government managed forest, the majority is managed by CFUGs. It represents 44.7% of the total land area required for the project (51.823 ha). Out of 69 tower pads, 28 are located in forestland (13 AP and 15 ST). Since each tower covers area of 12x12m, construction of 28 number of towers requires 0.403ha forest area which shall be permanently acquired by the project.

270. Total of about 2,936 trees of are estimated to be clear felled from forest land during construction. 71.97% of the trees are pole size (Appendix 12). About 3,742 number of trees are estimated to be lost from private land (both private agricultural and barren land). Totaling a loss of 6,678 trees along the alignment.

271. **Component 2, Ghorahi-Madichaur Transmission Line**: Out of the total length of the alignment of 40 km, 15 km passes through the forest area. The total estimated forest area falling under the alignment (including tower-pads) is 33.8112 ha. This area includes both CF and government managed forest, 26.4765ha is registered CF area and 7.3347 ha is government managed forest. It represents 49.12% of the total land area required for the project

(68.8329 ha). The majority of the forest loss is from Pyuthan district which is about 64% (21.8504 ha) of the total forest land required. The remaining forest land is required from Dang district, but outside Chure Conservation Area. Out of 53 APs, 21 APs are located in the forestland. Based on the topography and assumption of every suspension tower falling at an interval of 300m, it is estimated that 48 numbers of suspension towers will be located at forest land. Since each angle tower covers area of 15x15m, construction of 69 number of towers (angle and suspension towers) require 1.5525 ha forest area which shall be permanently acquired by the project.

272. Total of 4,674 number of trees of 39 different species are estimated to be clear felled during construction from forest land (Appendix 12). The contribution of pole sized trees is 45.93% whereas tree sized is 54.07%. Khote Salla (*Pinus roxburghii*) was found to be the dominant tree species throughout the line alignment. The total number of *Pinus roxburghii* trees to be felled is estimated to be 1,444 which is 30.89% of the total trees to be clear felled. This is followed by Saal (*Shorea robusta*) (1157), Saj (*Terminalia sp.*) (218), Sadan (*Desmodium oojenense*) (183), Cheuri (*Aesandra butyracea*) (173), Jamun (*Syzygium cumini*) (171), and others. About 435 number of additional trees are estimated to be lost from private land. Totaling a loss of 5,109 trees along the alignment.

273. **Component 3, Borang-Ratmate Transmission Line**: Out of the total length of the alignment of 48 km, 12.966 km passes through the forest area. The total estimated forest area falling under the alignment (including tower-pads) is 29.699 ha. This area is inclusive of area of CF, and government managed forest, 17.787 ha is registered CF area and 11.787 ha is government managed forest. It represents 22.86% of the total land area required for the project (129.891 ha). Out of 69 tower pads, 28 are located in forestland (11 AP and 24 ST). Construction of 69 number of towers requires 0.9910 ha forest area which shall be permanently acquired by the project.

274. Total of 5,340 number of trees of 32 different species are estimated to be clear felled during construction from forest land (Appendix 12). 93.18% of the trees are pole size. Sal (*Shorea robusta*) is found to be the dominant tree species throughout the line alignment. The total number of sal trees to be felled down is estimated to be 2,992 which is 56.03% of the total trees. This is followed by Chilaune (*Schima wallichi*) (1083), Salla (*Pinus roxburghii*) (720), Utis (A*lnus nepalensis*) (133), etc. About 4,181 number of additional trees are estimated to be lost from private land. Totaling a loss of 9,521 trees along the alignment.

275. **Mitigation/Compensation.** For loss of habitat and vegetation cover due to site clearance including trees the following mitigation will be adopted:

- NEA to ensure required national Forest Clearance is obtained prior to the start of any works where forest areas cannot be avoided.
- Contractor will employ field ecologists under supervision of their biodiversity officers during detailed route surveys of components 1-3, 10a and 10b.
- Perform a habitat survey in order to confirm area and type of modified and natural habitat situated beneath the towers and right of ways.
- Perform a detailed survey of the number and species of trees and the quality of forest cover lost, to calculate the compensatory reforestation required for the detailed design.

- Specific attention will be paid to identifying tall trees of value to vultures for which the project area is critical habitat and are to be retained where possible.
- During the detailed route surveys the ecologist will also record any fauna observed in the project area.
- If tall trees of value to vultures, high quality forest habitat (>200 trees/ha) or other natural habitat is identified as impacted during the detailed route surveys, Contractor to identify means by which tree and habitat loss can be minimized through detailed design e.g. realignment, and/or construction methods.
- Contractor to minimize the need to cut trees within the RoW including by placing towers on hilltops and ridges as far as possible to avoid the felling trees in the gullies and valleys, increasing conductor height etc.
- Cutting trees in ROW outside tower footprints will be kept to an absolute minimum and only be permitted when it is required for laying and stringing of conductors, to meet safety clearance requirements under the Electricity Rules and manage risk of forest fire.
- In preference to being cut, trees in ROW that can survive it will be pruned in preference to being cut, such that they might reestablish quicker following works.
- Trees to be selectively felled are to be identified, species and location confirmed, counted, marked, and harvested manually (i.e. with hand-held equipment) using appropriate forestry techniques to minimize impacts on adjacent vegetation and limit habitat fragmentation with involvement of local District Forest Office (DFO) and Community Forest Groups. Details to be reported in periodic monitoring reports.
- Important tree species to retain as identified by DFO will be marked separately and protected during the construction.
- Felled trees and any NTFPs recovered during works will be handed over for use by the community forest groups according to the national laws and regulations.
- NEA to purchase land in coordination with respective DFOs and Community Forest Groups prior to reforested areas being handed over aforementioned entity.
- Ensure clear demarcation of the working area and avoid encroachment outside the agreed corridor of impact.
- For existing transmission line components, Contractor will strictly restrict all works to the existing RoW in protected and forest areas.
- For new transmission line components, Contractor will strictly restrict all works to the proposed RoW within protected and forest areas.
- No construction of access road is allowed, use will be made of existing access roads and tracks for transporting tower materials and machinery, in locations where access is restricted use of manual labor to transport, install and string the towers and lines
- Remove and dispose of any identified invasive plant species in an ecologically sound manner.
- Revegetate any disturbed areas beyond footprint of substation and tower foundations to at least original condition through revegetation using native species etc.
- Prohibit the use of herbicides, pesticides or burning to control any vegetation growth or to manage vegetation waste, in substations and along ROW.
- Regularly trim trees located within the RoW that are above 5 m high, at least once every two years, following maximum clearance as per Electricity Regulation, 1993.

276. The cost of harvesting, logging, and transporting of the trees from ROW and other forest products will be provided as per the district norms to the concerned agency following the provision in Forest Rule, 2051 (1995).

277. Since residual impacts will still be major adverse to ensure “no net loss of biodiversity” as a compensatory measure for the loss of forest habitat and trees, establishment of replacement plantations at ratio 1:25 will be undertaken.

278. In addition, as per the “Working Procedure and Standards for the Use of National Forest Land for National Priority Project, 2076”, forest land replacement will be done. 3 new transmission lines under the EGMP will permanently acquire 3 ha of forest so the project will purchase the same area of land in another place for reforestation. The cost of purchasing this land is estimated at around NRs27,924,107 ($231,371). The land will be purchased by NEA in coordination with respective DFOs and CFUG and plantation will be done prior to being handed over the aforementioned entity.

279. Compensatory plantation will be done for 12,950 estimated trees and poles. In total 326,840 seedlings will be planted as compensatory measure and 4,928 seedlings will be planted on 3 ha land at 1,600 trees/ha as a replacement for forest land (Table 61). So, in total 331,768 saplings will be planted (subject to reverification on site).

280. As per the *Working Procedure for the Use of National Forest Land for National Priority Project, 2076*, the plantation sites will be managed by NEA for five years or required cost for such management must be paid to Department of Forest/DFO. In order to comply with this requirement, NEA will either manage the plantation site for five years or the estimated cost for entire management work will be provided to the respective DFOs and/or the concerned CFUGs.

TABLE 61: COMPENSATORY PLANTATION COSTS FOR TREES FELLED IN FOREST FOR EGMP

Project Component	Seedlings	Cost (NPR)	Cost ($)	Purchased Land Area for Reforestation (ha)	Land Cost ($)
1.Dandakhet-Rahughat Transmission Line	74,045	16,234,300	134,512	0.5	26,249
2.Ghorahi-Madichaur Transmission Line	119,295	47,039,942	389,758	1.5	124,447
3.Borang-Ratmate Transmission Line	133,500	36,966,575	306,294	1.0	80,674
Total	**326,840**	**100,240,817**	**830,564**	**3.0**	**231,371**

281. The following detail how the compensation measures will be undertaken:

- NEA and Contractor to develop reforestation plan using ratio of at least 1:25 trees and acquisition and reforestation of land equivalent to forest land lost beneath the project footprint to enable the project components to demonstrate “no net loss of biodiversity” – reforestation plan to be included in the site-specific biodiversity management plan, and will inform tree nursery establishment and reforestation implementation.
- Tree nursery establishment will need to be upon loan effectiveness allowing time for seedling growth, planting, and management for a period of 5-years (unless it is determined seedings can be purchased from the existing nurseries for the entire project).
- If it is decided to establish a nursery then nursery sites will be selected in consultation with the respective Division Forest Offices and affected Community Forest Groups. NEA to train Community Forest Groups for micro-nursery establishment, procure improved tree seeds and provide required technical support for nursery set-up and operation.
- NEA will determine the number and species of seedlings to be produced by the micro-nurseries for the project, plan to grow at least 120% of seedlings required under the project so as to replace any trees that do not survive transplantation.
- Reforestation implementation to be undertaken in accordance with agreed reforestation plan at standard ratio of 1,600 seedlings per ha, unless otherwise indicated by DFOs and Community Forest Groups due to local site conditions or species requirements.
- Reforestation sites will be selected in consultation with the respective Division Forest Offices and affected Community Forest Groups, to be in similar climate range and soil type as deforested section as much as possible; proximity to existing protected or forest areas will be preferred to extend species habitat range.
- Plantation designs for each specific reforestation site identified will be developed after consultation with the respective Division Forest Offices and affected Community Forest Groups.
- Species composition will be locally native and follow the composition of corresponding forest section deforested under the project; Community Forest Groups’ preferences will also be considered in selection of species as well as species which contribute to habitat for fauna, especially tree providing suitable vulture habitat.
- NEA will purchase the seedlings raised from the micro-nurseries for the project's reforestation program.
- NEA to nurture revegetated areas in disturbed hilly terrains during 5 years after construction.
- NEA to take care of planted sites for period of 5 years and subsequently handover to the concerned DFO and Community Forest Group. NEA is responsible for taking care of the reforestation areas; alternatively, NEA may choose to delegate the management of the plantation areas to the local DFO / Community Forest Group with support from the project for 5 years.
- Project will continue to perform regular monitoring of these sites, which is to be included in the semi-annual safeguards monitoring reports (template provided in Appendix 11) submitted to ADB.
- Tree losses are to be immediately replaced with new saplings.

- During maintenance activities, tree trimming and ROW vegetation clearance in general to be carried out manually (by human labor and using hand-held equipment) and in protected and forest areas to be cut/trimmed are to be selected in presence and with approval of concerned protected area management, DFO and Community Forest Group representative.
- Promote if protected area management and forest officials in concurrence ecofriendly vegetation removal methods, while ensuring no disturbance to pre-existing habitat, for instance through the use of goats for clearing overgrown bushes and small trees (under strict supervision) around high voltage power lines is known to be more effective as it is faster, cheaper and more ecofriendly. These animals can reach difficult places that are challenging for people to access and can eliminate the need of fuel for cutting devices.
- Schedule tree clearance/trimming in ROW in protected and forest area outside bird breeding season (in particular, vultures breeding season is Jan-March). In such areas, trimming of trees to be carried out in presence of and under supervision of ecologist.

(iii) Disturbance of Fauna, Habitat Fragmentation and Restrictions on Movement

282. Loss of habitat is considered a direct long-term impact to wildlife of the project areas. Transmission line corridors are known to affect many different wildlife groups, predominantly birds. These impacts are largely associated with fragmentation and degradation of wildlife habitats along the transmission line corridor ROW (18 m for 132 kV, 30m for 220 kV in Nepal). Clearance of trees along the ROW will create open linear stretches in the forest. That would further divide small patches of forest into smaller fragments. Fragmentation of the forest would also fragment the existing habitat, which in turn, affects flora and fauna in a number of ways. Some wild animals are reluctant to pass through open stretches in the forest. Likewise, an open stretch in the forest may be a barrier for propagation of plants. 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 18m/30m wide ROW will be maintained during the operation phase.

283. The large-scale felling of trees along the line corridor might impact the nesting sites of birds as well as habitat and movement of other arboreal species like monkeys, primates etc. available in these areas. During operation, pylons might attract population of primates like Langur (*Semnopithecus entellus*) and Rato Bandar (*Macaca mulatta*) in the project areas as they are climbers and transmission lines could pose a danger for such animals, in particular electrocution. It is likely that arboreal mammals will only utilize towers to escape from predators, to chase prey or out of curiosity. The required vegetation clearance distances around the base of towers and along spans will ensure that monkeys cannot move directly from trees onto towers or lines, however, given the inquisitive behavior of monkeys, a hazard may remotely exist. Therefore, anticlimbing devises will be installed on towers to prevent monkeys and other arboreal mammals from climbing towers. There are also risks of bats electrocuting from the transmission lines particularly in the forest areas. Priority bats for this Project are Myotis species, which usually have limited collision risk with powerlines. As per Nepal Electricity Rules, 2050 (1993) the minimum ground clearance for 132 kV transmission line is 6.1 meter i.e. the lower most electrical conductor wire between two adjacent towers will be stringed in such a

way that the minimum height from actual ground level is always more than 6.1 meter which will be sufficient for safe passage of any large mammals. Moreover, the 132kV towers used in this project will all be 25 to 30m in height, with the lower conductor 11m in height from the ground.

284. Due to different construction activities and influx of outsiders, physical habitats, feeding habits, reproductive behaviors and movement of wild animals and birds might be disturbed due to construction activities and increased human presence in and around the project area. This might change the existing ecosystem diversity altering natural communities of plants and animals. Ultimately protected plant and animal species will be more prone to such adverse impacts.

285. Construction disturbances resulting from site clearance, excavation of foundation, vehicle movement, transportation of materials and other related activities would interrupt normal movements, feeding and other activities of wildlife available in the surrounding areas. Construction activities may affect movement of birds resulting in the temporary disturbance to their normal route. Similarly, electric lights in and around the work site and the presence of humans will also affect wild animals grazing around the area. The clearing, excavation, grading and filling activities will affect less mobile, frequently smaller species such as frogs, lizards and small mammals (rats). Water pollution from project activities (muck disposal, washing of concrete batching plant, solid waste and accidental spill of oil and lubricants) may also affect the local wild fauna and water birds.

286. The EGMP will have a relatively small direct footprint, comprising land clearance for towers and rights of way for 113 km of transmission line (for components 1, 2, and 3). Limited loss of habitat under this footprint is extremely unlikely to significantly impact any Critical Habitat-qualifying species. Likewise, significant fragmentation impacts on Critical Habitat-qualifying species are unlikely as normal practice is to allow scrub and small trees to re-establish within powerline rights of way, facilitating movement of all priority terrestrial species. It is possible that Bengal Florican (at Koshi Tappu) would avoid areas near powerline infrastructure, resulting in de facto habitat loss. Nonetheless, the powerline in that location is only an upgrade of existing infrastructure and there are no recent records of this species from the area directly around that infrastructure, so this potential impact is not considered likely to be significant.

287. Based on the critical habitat assessment carried out (supported by the consultations with Bird Conservation Nepal) it is found that the EGMP area is possible critical habitat for Vulture species namely White-rumped Vulture (*Gyps bengalensis*), Red-headed Vulture (*Sarcogyps calvus*), and Slender-billed Vulture (*Gyps tenuirostris*). The vultures are known to be breeding in the Dang Dekhuri Foothill Forest and West Rapti Wetland IBA, which is in the project area of influence of Ghorahi-Madichaur Transmission Line. Charinge Community Forest is identified as very good nesting site. The nesting of these species is impacted due to loss of large trees and anthropogenic disturbance. This nesting site is about 2 km away from the alignment of the Ghorahi-Madichaur Transmission Line (Figure 65) and will not be directly impacted.

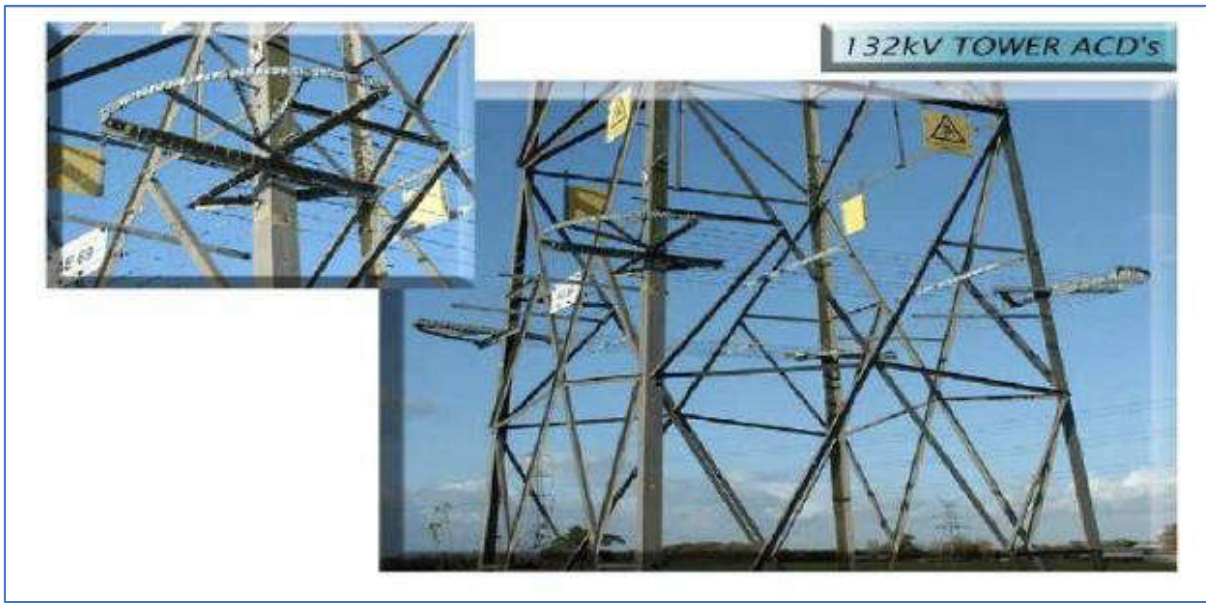
288. Significant indirect impacts on all Critical Habitat-qualifying species and sites are possible owing to disturbance. Nonetheless, these risks are not likely at levels that would cause significant (population-level) impacts to any of the species.

289. **Mitigation.** 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 devises 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.
- Prior to excavation for tower foundation, area will be checked by ecologist for any signs of burrows etc. If determined to be occupied, only manual digging under the supervision of ecologist will be permitted.
- Excavated pits will be robustly fenced or covered so as 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.
- 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.
- During inspections of power lines count fauna carcasses encountered, if any, record species and assess cause of death (e.g. electrocution/collision).

290. The anti-climbing devices (ACD) (Figure 64) can be used at all four tower corners with two opening and two non-opening fences, made of barbed wire and accessories as exemplified in pictures below.

Figure 64: Typical Tower Anti-Climbing Devices



(iv) Increased Use of Fuel Wood, Timber, NTFP, Hunting and Poaching

291. Existing community and government managed forest of the project areas is found to be large enough to support demand for forest resources such as firewood and timber of the dependent households who rely on it for their livelihoods even with the loss of trees under the project. Most of the unskilled labor force will be from the project areas. Thus, there will only be

about 25 skilled people from outside the project area for a short period of time. Due to this, the increase in demand for fuel wood and timber during the construction period is expected to be minor. Moreover, there will not be any permanent settlements that may lead to encroachment on forest land, only temporary workers camps. However, during the site clearance, the construction workers, local community or any other incoming people from the surrounding areas may encroach on the forest area. Opportunist people may try to fell down the trees beyond the ROW of the transmission lines or try to maximize the number of felled trees for economic benefits. Some people may enter into the forest during the period to harvest other forest products. During operation, the ROW may provide easy access to the local and other people for encroachment on the forest areas and their products, looking for income generating opportunities through the sale of timber and non-timber products. However, the possibility of encroachment of forests is minor due to the continuous monitoring by the Community Forest User Groups (CFUG) for community managed forest and by Forest Guards for Government Forest.

292. Possible poaching by the labor force may also cause short-term localized impact. The local hunters as well as the workforce might be attracted to hunt birds and other wild animals with adverse impacts on the local wild fauna, exacerbated due to eased access from ROW clearance. Such pressure on wildlife would be site specific and is expected to decrease as construction workers leave the site.

293. During the operation phase, the ROW may provide easy access to wildlife habitat resulting in hunting/trapping/poaching.

294. Significant indirect impacts on all Critical Habitat-qualifying species and sites are possible owing to firewood or timber collection, hunting, or fishing. Nonetheless, these risks are not likely at levels that would cause significant (population-level) impacts to any of the species.
295. Wood and other forest products extracted as part of the site clearance from the forest will be managed as per the Forest Regulations, 2051 (1995).

296. **Mitigation.** The following mitigation will be adopted:

- Strict prohibition on construction workers to enter protected or forest areas outside of their working hours unless an existing resident within a buffer zone.
- Strict prohibition of fuelwood or timber being cut by the construction workers.
- Strict prohibition on purchase, sale, and use of firewood, timber and NTFPs, hunting and poaching of fauna by workers.
- Contractor and construction workers will be prevented from the use of firewood for cooking their food and heating etc.
- Contractor to undertake regular, compulsory awareness raising activities for all workers related to prohibitions including tool box talks, and posting of information and warning signs at site offices, worker camps, and at all work sites in forest land, patrols by security guards employed by the Contractor, regular inspections of the worker camps, and, disciplinary procedures for any contravention by the workers.
- Contractor to provide good standard of worker accommodation with heating and all meals to help discourage breaches of prohibition by the workers.
- Contractor to provide alternative fuel source (e.g. kerosene/LPG, which will be stored in safe conditions) to communal kitchen and for heating of worker accommodation. Use of fuelwood in communal kitchen

- During maintenance activities, all requirements for construction phase, in particular strict prohibitions on workers, are applicable.

a. Forest Fires

297. Influx of construction workers can increase the possibility of fire hazard to the local forest, in particular in those temporary work camps. Improper handling of fuel, oil or cooking fuel could induce such impact. Significant indirect impacts on all Critical Habitat-qualifying species and sites are possible owing to fires started by construction workers. Nonetheless, this risk is not likely at levels that would cause significant (population-level) impacts to any of the species.

298. **Mitigation.** For forest fire risk, the following mitigation will be adopted:

- Contractor to ensure detailed design of transmission lines incorporates lightening protection to minimize forest fire risks
- Detailed design will need to include firefighting provision at substations with development of emergency response plan with basic fire training and training drills undertaken for substation staff in event of forest fire.
- Fuel will be stored outside of and refueling will take place outside of forest areas to minimize the risk of fire.
- Contractor to provide fire-fighting equipment at work site with compulsory basic fire training for all workers and training drills undertaken in preparation for forest fire.
- In case of forest fire, Contractor to act swiftly so as to minimize impacts on the environment and human life.
- Contractor to coordinate with DFO or community forest groups for definition of additional measures for inclusion in the Construction Emergency Preparedness and Response Plan (see health and safety section) where works are to be carried out in proximity to forested areas and there is risk of forest fire to plan for.

b. Bird electrocution and collision

299. Electrocution can cause a risk to bird species which perch on powerline infrastructure, usually if they can touch both live and earthed infrastructure components at the same time. Such a risk is greatest for birds of prey, which regularly perch on transmission towers and similar infrastructure. Nonetheless, standard insulator length on most transmission lines is longer than the wingspan of even the largest priority species (the vultures). As such, pending confirmation of detailed design, it is not likely that electrocution poses significant risks to Critical Habitat-qualifying species, except where transmission lines descend to substations. These locations often have a number of easily bridged gaps between live and earthed infrastructure components and thus pose a significant risk to birds of prey, such as the three Critical Habitat-qualifying vultures.

300. To reduce electrocution risk, the stringing of conductor for the transmission line needs to be carried out maintaining insulators/isolators between live and earthed components of infrastructure, and between phase conductors, being over 2.7 m horizontally and over 1.8 m vertically, and bird guards/perch management techniques to prevent perching or nesting by birds. Use of suspended insulators and vertical disconnectors is preferable; if upright insulators

or horizontal disconnectors are present these need to be covered -- length of insulated chains to be higher than 0.7m. Such arrangement will reduce the likelihood of electrocution of large winged birds present in the project areas like White-rumped Vulture (*Gyps bengalensis),* Red-headed Vulture (*Sarcogyps calvus), and* Slender-billed Vulture (*Gyps tenuirostris)* because the distance between energized conductors will always be more than the maximum wing span of the bird. The common practice of horizontal distance between two conductors for 132kV transmission lines of NEA is 6m and vertical distance is 3m (well above the spacing required).

301. Based on NEA standard design, according to a study done in 2013 for 400kV transmission line in Nepal for bird sensitive areas in Terai[53] the following design modifications were recommended to achieve "bird sensitive" design:

- Modification to physical structure with minimum of 60 cm distance between cross arm and conductors.
- Minimum of 140 cm distance between conductors
- Avoiding use of hardware that prevents arcing on both side of the conductors.
- Use of Bird Diverters above insulators.
- Over Voltage Rector is attached below the cross arm and all down leading wires are insulated with tubing
- On tower stations all contacts directly above the switch as well as between the switch and transformer should be insulated with tubing.
- Safety of the switch towers increased by having their witched below the cross arm.

302. The greatest impact is potentially mortality from collision with overhead powerlines. Although a range of bird species suffer mortality from collisions with wires, floricans and vultures are particularly susceptible to collisions with power lines, which may cause unsustainable rates of mortality in such long-lived, rare birds with low natural mortality. Without

Image: Carcass of Bird killed by a Power Transmission Line

[53] https://www.nea.org.np/admin/assets/uploads/supportive_docs/76502940.pdf

mitigation this type of impact is predicted to be major, particularly in low visibility conditions such as bad weather and foggy days and during nights, when conductors are not visible. Inability of birds to notice the conductors (wires) can cause fatal injuries from collisions (see image). The collusion of birds is mostly reported during landing and takeoff in areas close to water bodies, designated bird areas/sanctuary having large congregation of birds or lines intersecting identified migratory paths. Koshi-Tappu Ramsar Site where the birds are flying and taking water from Koshi River and Dang Dekhuri Foothill Forest and West Rapti Wetlands IBA are two such sites.

Image: Typical Bird Protection Devices Placement of Steel Lattice Tower

303. To prevent 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 (see image). The bird divertors will be as large as possible. The spacing between them will not be more then 5 to 10m (5 m within protected areas). Marker device will be chosen to contrast as much as possible with the background colors (Figure 66) and importantly be visible at night (most bird collisions are reported to occur at night).

304. An extensive recent review found a mean reduction of mortality of just 50.4% for various types of flight diverter (Bernadino et al. 2019). Therefore, at best, the EGMP can only plan for <50% reduction in predicted vulture and florican mortality on transmission lines with bird flight diverters. Cheaper flapper-type diverters have had rapid and high rates of failure in some contexts (Dashnyam et al. 2016), so it is important that high quality, reliable (ideally guaranteed) flapper-type bird flight diverters are installed. Experts usually recommend the FireFly by Hammarprodukter, which is available at least in neighboring India and can be installed easily by drone. This diverter rotates, reflects UV light, glows in the dark, and has been extensively tested.

Figure 65: Location of Vulture Nesting Site and Ghorahi-Madichaur Transmission Line

305. **Mitigation/Compensation.** For bird electrocution and collision, the following mitigation and compensation (offsets) will be adopted:

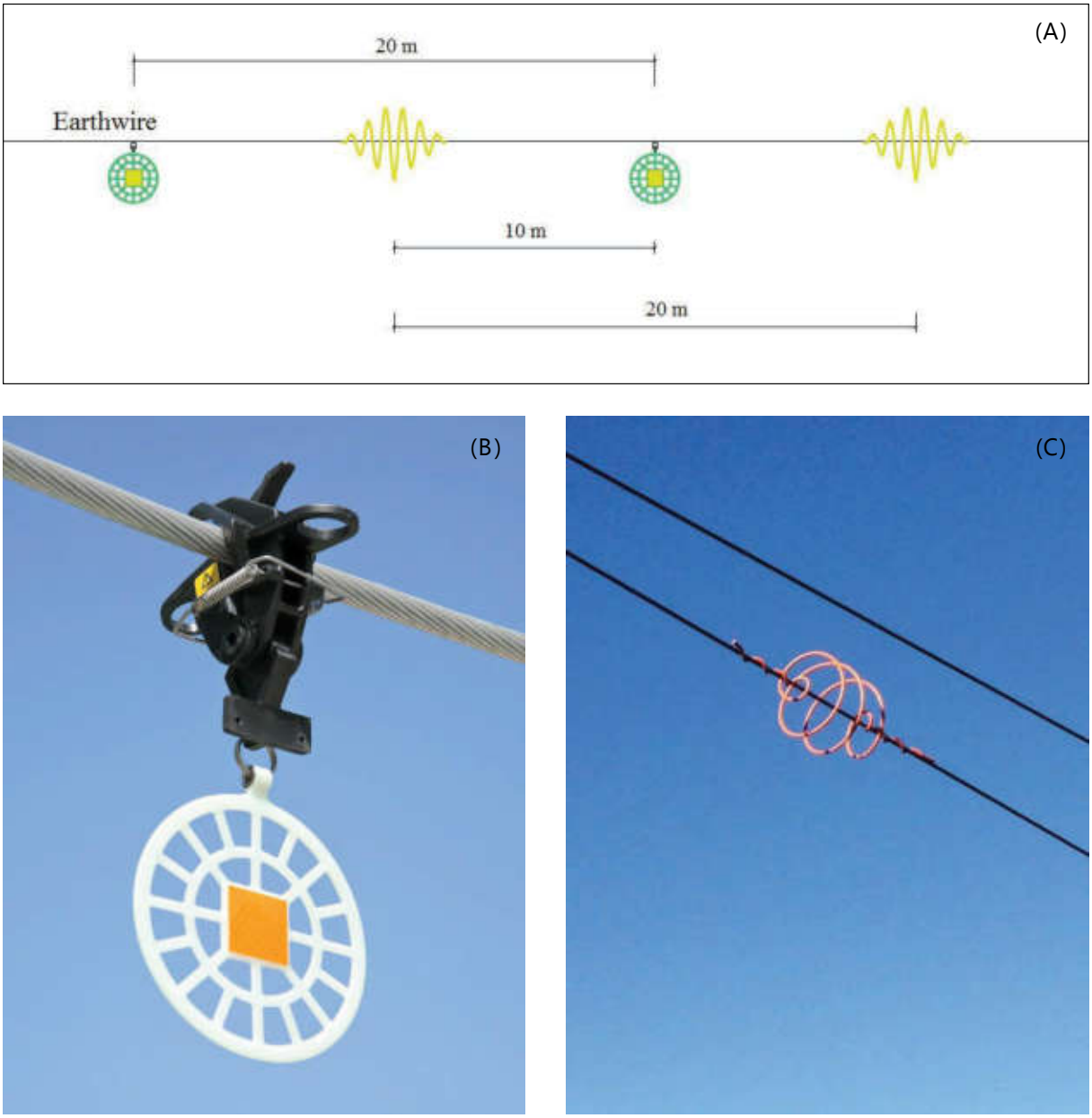
- NEA to review the technical and economic feasibility and the environmental and social cost-benefits of adopting horizontal versus vertical tower arrangement, which have conductor cables arranged at one height (single level arrangement) and the neutral cable only slightly higher, in order to reduce collision risk.
    - to prepare an Avian Protection Plan setting out technical details of how the detailed designs for new and upgraded transmission and distribution line components will incorporate or retrofit "bird-sensitive" design in accordance with the critical habitat assessment and international good practice (e.g. APLIC, 2006 and 2012)[54] and how monitoring of any electrocutions and collisions during operation & maintenance will be undertaken.
- To minimize electrocution risk, "bird sensitive" design measures will include insulators/isolators between live and earthed components of infrastructure, and between phase conductors, being over 2.7 m horizontally and over 1.8 m vertically, bird guards to prevent perching and nesting by birds, and considering insulating any lower voltage wires and/or jumpers at substation connections.

[54] https://www.nrc.gov/docs/ML1224/ML12243A391.pdf
https://www.aplic.org/uploads/files/15518/Reducing_Avian_Collisions_2012watermarkLR.pdf

- To minimize collision risk bird divertors, at most 10 m apart, as large as possible, of contrasting colors, and visible at night, will be installed as specified for each transmission line plus 500m either side of all ridge/valley crossings and waste dumps, or waste dumps will be relocated by NEA in consultation with local communities before the start of any works.
- NEA will include in the Avian Protection Plan installation of bird flight diverters on an additional 90 km of existing transmission lines located within vulture safe zone and suitable vulture habitat, to offset potential collision risk impacts on vultures.
- Contractor will employ field ecologists under supervision of their biodiversity officers during detailed route surveys of components 1-3, 9a and 9b to confirm areas (ridge/valley crossings and waste dumps) for marking of transmission lines in accordance with the critical habitat assessment.
- Contractor's detailed designs will be reviewed by the PSC International Biodiversity Specialist to confirm that all the measures required by the Avian Protection Plan and international good practice (APLIC, 2006 and 2012) have been adequately incorporated before approval of detailed designs and that the detailed designs have responded to any concerns raised by Bird Conservation Nepal.
- For existing substations which are already located in protected area, protected area buffer zones or IBA, PSC to assess the electrocution risk to birds from any lower voltage wires and/or jumpers at incoming and outgoing connections and where risk is deemed to be high then they will be retrofitted by NEA with "bird sensitive" design measures where technically feasible.
- 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: integrity of the "bird sensitive" design features including bird diverters and insulators etc. If lost or damaged, immediately undertake maintenance work required to repair.

306. Required cost for purchase of the bird divertors will be included in the contractor's cost, the contractor will also be required to install them.

Figure 66: Schematic of Typical Design and configuration of Markers to Reduce Bird Collision



(A). Schematic of the installation pattern of Bird Flight Divertors, (B). photo a flapper and (C). photo of a spiral installed on transmission line

Source: Dashnyam et al. Malfunction of bird flight diverters (Mongolian Journal of Biological Science, Volume 12(1-2), 2016), BirdMark™

307. For EGMP project components, including associated facilities, it is proposed to place bird diverters on sections of the 66/132/220 kV transmission lines on which birds are particularly prone to collision. In addition to bird divertors being installed at 500 m either side of all ridge/valley crossings and waste dumps the following specific locations will have bird divertors installed. Figure 67 shows the project component specific locations of the proposed bird divertors.

308. **Component 2**, maximum 5m apart for the entire section within Chure Conservation Area and up to the boundary of Dang District due to presence of vultures plus 1 km additional buffer length (8.5km) and maximum 10m apart for the entirety of the rest of the Ghorahi-Madichaur Transmission Line (31.5km).

309. **Component 9a**, maximum 5m apart for the section of Pathlaiya-Dhalkebar Transmission Line running through the Parsa National Park plus 1 km additional buffer length (8.4km) and in two locations through Chure Conservation Area plus 1 km additional buffer length either side of the protected area (7.1km, also along Bagmati River Corridor, and 6.2km).

310. **Component 9b**. maximum 5m apart for 6.7 km length of Duhabi-Kusaha Transmission Line (all section of transmission line in buffer zone of Koshi Tappu Wildlife Reserve) (between tower 1 to 18 and 1km section between tower 18 to 20).

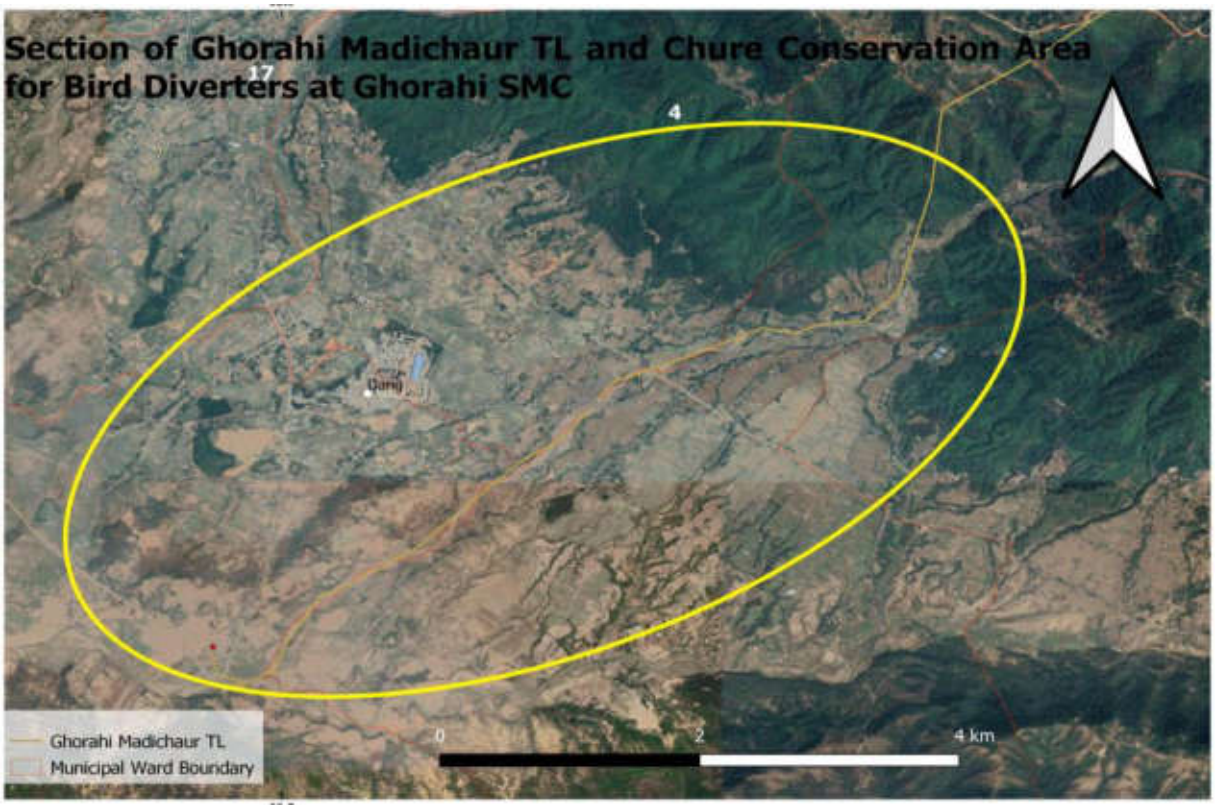
311. It is estimated that at least 10,530 bird divertors will be required to effectively mitigate adverse impact on birds. Note that further needs may be identified during further thorough detailed route survey at detailed design stage, given ridge/valley crossings and waste dumps need to be mapped. Based on current available knowledge 5400 bird divertors may be needed for 36 major river crossings for the three new transmission lines. Then for the offset of 90km at 10m spacing at least 9,000 bird divertors will be required. Given uncertainties is therefore recommended to prepare for contingencies by budgeting above the minimum amount of bird markers identified here by 10%.

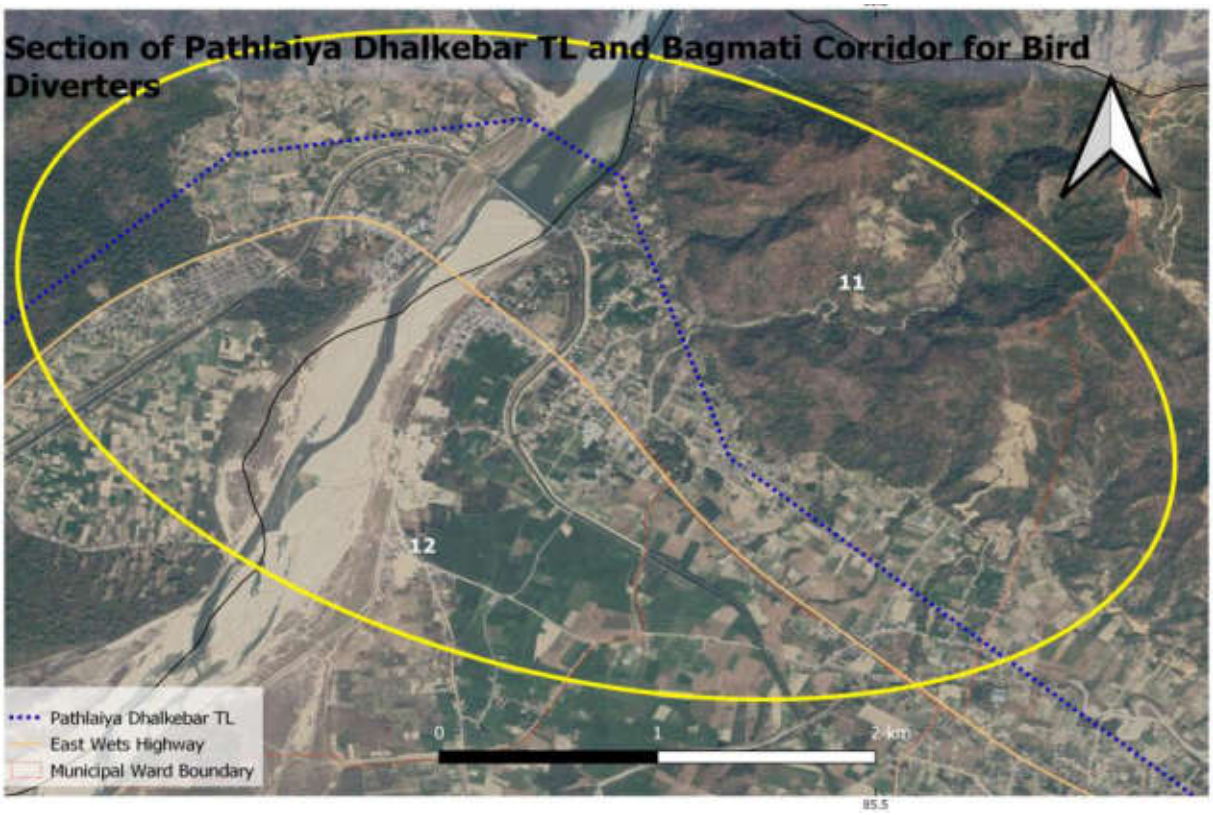
312. Considering the average cost of $51 per divertor, the total cost is estimated at $1398573 plus installation costs. Table 62 presents the component-wise details of the bird divertor requirements.

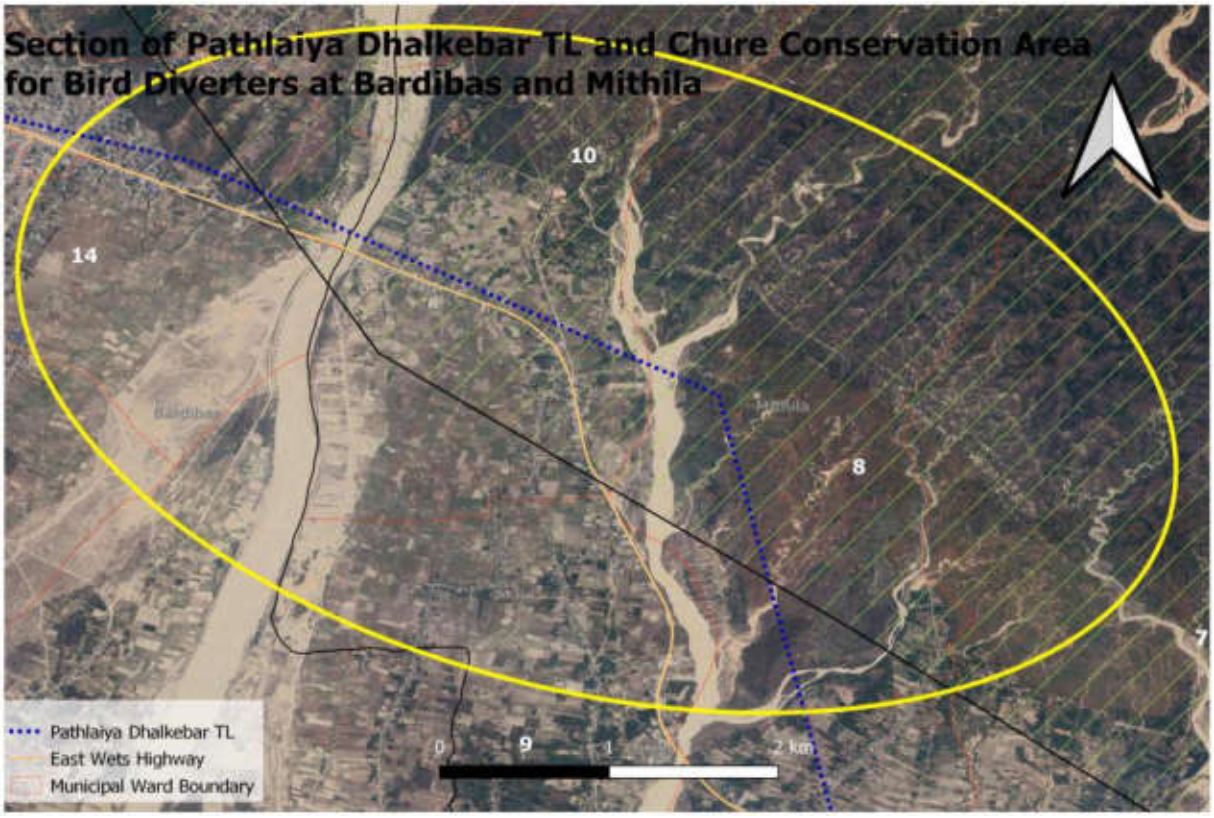
Table 62: Locations of Bird Diverters/Markers and Estimated Cost

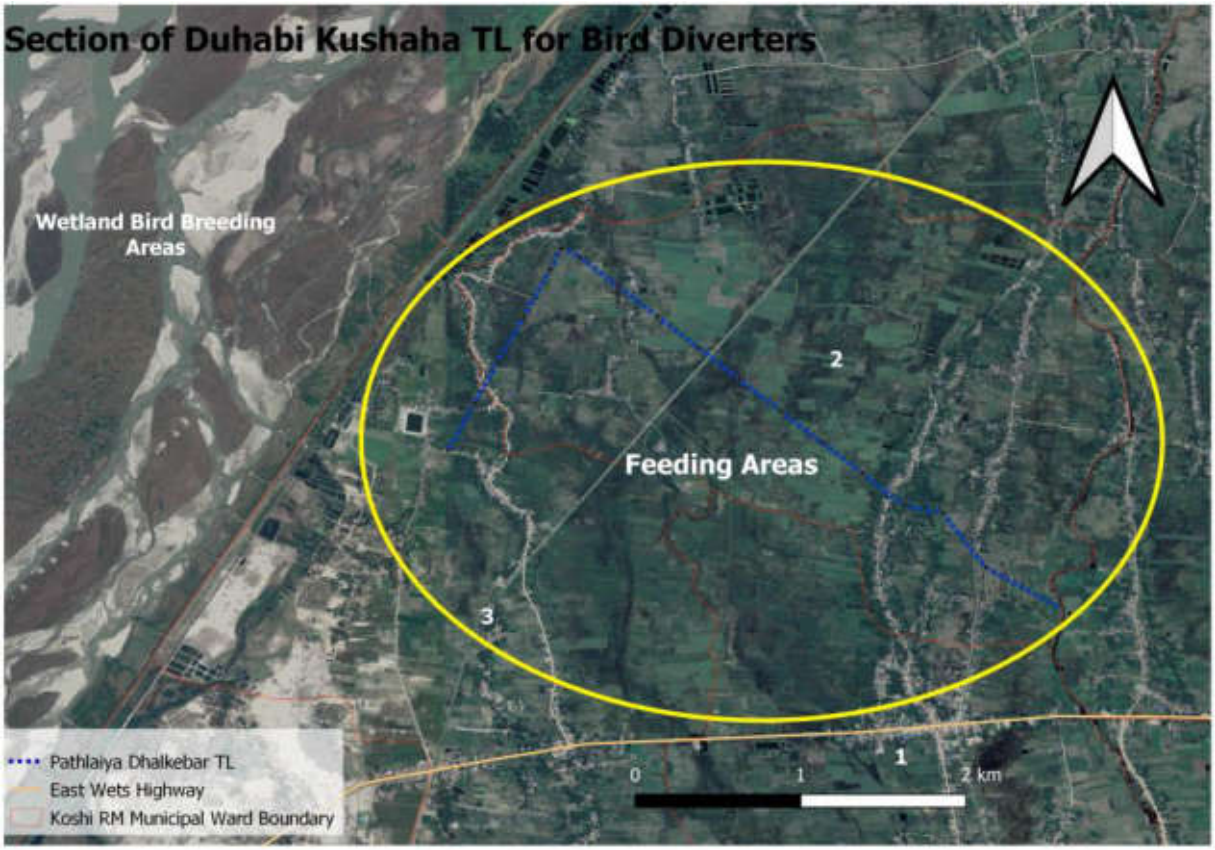
Location for Bird Divertors/ Markers	Distance (m)	Maximum Spacing (m)	Number of Bird Markers	Total Cost of Bird Divertor Markers ($)	Municipality
Ghorahi-Madichaur Transmission Line (Section of Line in Chure Conservation Area and Dang District) 7.5km +1 km	8,500	5	1,700	86,700	Ghorahi SMC Ward No 2 and 4
Ghorahi-Madichaur Transmission Line (remainder) 31.5km	31,500	10	3,150	160,650	All along the TL line
Pathlaiya-Dhalkebar Transmission Line (Section of Line in Parsa National Park) 7.4 km +1 km	8,400	5	1,680	85,680	Jitpur Simara Submetropolitan City Ward No. 1 and Nijgad Municipality Ward No. 4
Pathlaiya-Dhalkebar Transmission Line (Section of Line along Bagmati River Corridor and Chure Conservation Area) 5.1 km +2km	7,100	5	1,420	72,420	Chandrapur Municipality Ward No 1 and Bagmati Municipality Ward No 11 and 1
Pathlaiya-Dhalkebar Transmission Line (Section of Line along Chure Conservation Area) 4.3 km +2km	6,200	5	1,240	63,240	Bardibas Municipality Ward no 14 and Mithila Municipality Ward No 10 and 8
Duhabi-Kusaha Transmission Line (Section of line in buffer zone of Koshi Tappu Wildlife Reserve) (between tower 1 to 18 and 1km section between tower 18 to 20) 5.7 km +1 km	6,700	5	1,340	68,340	Koshi Rural Municipality Ward No 2 and 3
Major River Crossings (Table 59) 36 x 1,500m each	54,000	10	5,400	275,400	All project areas
Offset 90km	90,000	10	9,000	459,000	All project areas
10% Contingency				127,143	
Total	**212,400**		**24,930**	**1,398,573**	

Figure 67: Component Specific Locations of Bird Divertors/Markers




Section of Pathlaiya Dhalkebar TL and Bagmati Corridor for Bird Diverters
11
12
Pathlaiya Dhalkebar TL
East Wets Highway
Municipal Ward Boundary
0
1
2 km
85.5


Section of Pathlaiya Dhalkebar TL and Chure Conservation Area for Bird Diverters at Bardibas and Mithila
10
14
8
7
Pathlaiya Dhalkebar TL
East Wets Highway
Municipal Ward Boundary
0
9
1
2 km



(d) Socioeconomic Environment

(i) Physical Cultural Resources

313. There are number of temples and other physical cultural resources in the project areas, however, none are anticipated to be adversely affected by the project components except Janaki Temple at ward no 1, Kalimati, Dang district and the UNESECO Kathmandu Valley (Swayambhu) World Heritage Site. For the former it should be possible to avoid the temple compound, However, as suggested by the local communities during the consultations, the newly constructed temples boundary wall will be reconstructed in case it is adversely impacted. For the latter, since the project activities in this area will be limited to replacement of conductors on existing towers within an existing ROW impacts are limited to any damage to monuments that could occur during the stringing works which will need to be carefully managed since if it did occur the impact would be major given the WHS designation. Whilst the main monument is about 500m distance from the works there are several small monuments in close proximity to (and may be in) the ROW (Section IV) which will need to be protected during construction.

314. Nepal is a country where civilization has existed for thousands of years and encountering physical cultural resources in construction related excavations is a distinct possibility. During construction, with many small construction sites along the line alignment,

there is potential to unearth or discover objects of a cultural nature that will need to be protected. While there is no evidence of such sites within the project areas it is important to have a procedure in place to ensure that there is a mechanism in place to handle any physical cultural resources finds. In particular, the Ghorahi-Madichaur transmission line is set in geological conditions prone to fossil finds, which are of archeological, scientific, and cultural importance.

315. **Mitigation**. The following mitigation will be adopted:

- NEA will ensure that all project components are sited and designed to avoid significant damage to physical cultural resources. Contractor will confirm during detailed route surveys that except for the two mentioned above no other physical cultural resources of local importance fall within the right of way of transmission lines.
- Contractor to strictly locate all temporary construction facilities outside of proposed and current World Heritage Site boundary and at least 100m from any identified physical cultural resource e.g. temple.
- Contractor to undertake alignment review during detailed route survey for the Ghorahi-Madichaur transmission line, to consider re-siting of angle point towers such that routing in vicinity of the Janaki temple is located as far as possible from it, ideally outside the ROW but at minimum ensuring the entire temple compound falls well outside safety clearances under the Electricity Rules.
- To inform the alignment review NEA and Contractor to consult with communities who utilize Janaki temple to seek their views on the routing and reflect their concerns in the detailed design, consultations are to be documented.
- NEA to take the services of a third-party archeologist (either consultant and/or DOA expert) to undertake, to a TOR agreed with ADB, a heritage assessment for works in the current and proposed boundaries of the Kathmandu Valley World Heritage Site (Swayambhu) including consideration of accident scenario.
- NEA to consult with communities who utilize the two WHS monuments located beneath the transmission line and incorporate their views into the heritage assessment.
- NEA will obtain all necessary national approvals from the Department of Archaeology in order to undertake works within Kathmandu Valley World Heritage Site (Swayambhu) and secure written confirmation from the Department of Archaeology (DOA is representative of UNESCO) as to actions required to ensure 150m upgrade of the Suichatar-Balaju 66kV transmission line is in accordance with the integrated management plan.
- NEA and Contractor will follow the requirements of the Department of Archaeology and recommendations of the heritage assessment in implementing works within the current and proposed boundary Kathmandu Valley World Heritage Site (Swayambhu)
- Contractor to develop site-specific heritage management plan (HMP) detailing mitigation and monitoring measures for approval by NEA and clearance by ADB prior to the commencement of any works, including enabling works, on the Suichatar-Balaju 66kV transmission line. HMP will set out how impacts on the Kathmandu Valley World Heritage Site (Swayambhu) will be minimized through the detailed design, construction methods, siting of temporary construction facilities, restrictions on construction workers etc.

- Contractor will undertake a detailed pre-construction photographic record of all physical cultural resources including WHS monuments within the right of way of 66kV transmission line, detailed condition survey of WHS monuments located within the ROW must be undertaken if one is not already available from Department of Archaeology
- If monuments are used by community and access must be restricted to ensure health and safety Contractor to notify affected communities well in advance, and time works to avoid any such restrictions during important festivals etc.
- During pre-construction, Contractor will undertake a condition survey of all tower foundations to confirm they are sound, paying particular attention to the condition of foundations in the Kathmandu Valley World Heritage Site (Swayambhu) parts of which have been subject to landslide. If there is a risk of tower failure due to foundation condition remedial works to be undertaken prior to restringing works.
- Contractor to provide appropriate scaffolding or overhead bamboo frames to monuments within Kathmandu Valley World Heritage Site (Swayambhu) located within ROW of 66kV transmission line (12m)
- Department of Archaeology must be informed of and agree to construction schedule in order that they can facilitate on-site supervision.
- Prior to the start of any works, NEA and Contractor to provide trainings and awareness raising activities to all workers to inform them of (i) presence of and precautions to be taken for works in Kathmandu Valley World Heritage Site (Swayambhu) and (ii) chance find procedures.
- NEA archaeologist (either consultant and/or DOA expert) and Contractor's heritage officer to monitor and supervise on a full-time basis all construction works in the current and proposed World Heritage Site boundary for their duration to ensure no damage to any monuments.
- Contractor must immediately stop work if requested by Department of Archaeology or NEA's archaeologist (either consultant and/or DOA expert) and before resuming works agree and implement appropriate corrective action for dealing with unanticipated impact or non-compliance.
- Contractor will be responsible for repairing at their cost any damage to physical cultural resources including WHS monuments within the right of way of 66kV transmission line. Repairs to WHS monuments would need to be undertaken under the instruction of Department of Archaeology by appropriately qualified and experienced restoration contractors using appropriate materials and construction techniques etc.
- Contractor to develop a Chance Find Procedure (CFP) for NEA approval prior to commencement of any works, including enabling works, to address the event any physical cultural resources (including fossils) are found during works with involvement of Department of Archeology, Nepal. The CFP is to be implemented as soon as any monuments or artefacts encountered during construction activities strictly ensuring no chance finds are tampered with.

(ii) Health and Safety

316. Construction and operation may affect human health and safety therefore it is necessary to understand the occupational and community risks involved so that they can be managed.

317. ***Occupational 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 applied while working at construction sites, handling machines and equipment, driving vehicles, working at heights, working with electricity, etc. In particular, work at heights and work with electricity are particularly dangerous activities required to implement the project. Construction workers will be required to handle materials such as cement, bitumen, chemicals, fuels, etc. which will increase health risks if personal protective equipment is not used. Poorly designed temporary labor camp and sanitation facilities may also pose a health threat and nuisance to the workers. Uncontrolled food and drinking water at work sites may pose a risk with respect to the transmission of contagious diseases like typhoid, diarrhea, malaria, and dengue in particular. Workers should be allowed to complain about unfair treatment or unsafe living or working conditions (without reprisal). Migrant and illiterate workers can be particularly vulnerable.

318. ***Community health and safety risks***. Heavy construction vehicles will be required to carry construction materials and equipment. Construction vehicles will pose a risk to local communities. Local vehicles (such as trucks, buses, jeeps, microbuses, cars, rickshaw vans, motorbikes, bicycles), as well as students and local people walking on the roads could result in traffic jams, especially during morning and evening times. The construction vehicles will add more traffic and as a result, traffic congestion and road accidents could increase. Traffic congestion may also occur if stock piling of construction materials occurs at the sides of roads. Traffic management will be required with special care in project sites adjacent to public or project components requiring large number of trucks to transport the construction materials.

319. The work at crossing (rivers, road, telecommunication lines, power lines etc.) will be carried out in coordination with, and with prior permits from, the concerned authorities. All crossings of existing transmission and distribution lines will be designed with standard safe vertical and horizontal clearances for lines of their respective voltages as specific in the Electricity Rules of Nepal. Design clearances for communication lines will be maintained. For this, the standards referred by the Electricity Regulation, 1993 (Rule 48, 49, 50 and 55) shall be followed.

320. During operation, collapse of towers (possibly during a cyclone or earthquake) and broken or low-hanging lines could pose a risk to local communities. In normal circumstances transmission lines should not pose a hazard to local communities, as long as they do not climb them, or fly kites or drive tall items into them. Since local communities and children may not be familiar with these risks not having had transmission line in their location before awareness raising will be particularly important to be provided to them from pre-construction to operation, along with safety signages, anti-climbing devises, etc.

321. Children are a vulnerable group particularly at risk, in case of climbing of towers or flying kites into transmission lines. In particular, the Borang-Naubise 220kV Transmission Line at AP

27 in Netrawati Ward No. 1 (Figure 34) may infringe into the boundary of a school compound, this school does not have a compound wall and the proximity to the transmission line may pose risks to the children's safety. The school authority has demanded the project to ensure adequate safety measures are put in place to ensure the safety of this school and pupils by the project. As suggested by the local communities during the consultation, NEA has allocated funds for fencing the school compound. NEA will complete fencing of the school compound prior to start of tower foundation work.

322. ***Communicable diseases***. During construction, improper health policies at work sites may lead to an outbreak of different diseases in the surrounding communities/public, if in-coming construction workers are sick. 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. Containing the spread of COVID-19 will require adequate sanitation and welfare facilities including for hand washing and personal protective equipment are provided on-site and at accommodation and to consider the ability of communities to comply with protective measures such as regular handwashing and for the local health care facilities capacity to deal with any surge in infections as consequence to influx of workers and any resulting community transmission. Particular attention must be paid to accommodation of workforce given the transient nature of work, to avoid spreading any virus among workers and between workers and communities. Given the specialist nature of responding to COVID-19 public health officials/experts to be consulted in undertaking the risk assessment and management planning for COVID-19. Although presently the total ratio of affected people in Nepal with HIV/AIDS is far less than 0.1%, this percentage is slowly increasing due to injection drug users and overseas migrant workers returning to Nepal; thus, HIV and other STDs are also a risk.

323. ***EMF (electromagnetic field) and corona.*** 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. The higher the voltage, the stronger the electric field at a given distance from the wire. Magnetic fields are created when electric current flows; the greater the current, the stronger the magnetic field. Electric fields are strongest close to a charge or charged conductor, and their strength rapidly diminishes with distance from it. Magnetic fields arise from the motion of electric charges. The strength of the magnetic field is measured in micro tesla, μT. Health concerns over exposure to EMF are often raised when a new transmission line or substation is proposed. However, in spite of 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. The IFC EHS Guidelines (June 2007) recommend using exposure guidelines published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The ICNIRP (2010) has set the limits for public exposure at 50 HZ as: (1) electric field strength (kV per meter) below 5 kV/m, and (2) magnetic field strength (micro tesla) below 200 μT (equivalent to 160 A/m); while for the occupational exposure: (1) maximum allowed electric field strength is 10 kV/m and (2) maximum allowed magnetic field strength is 1000 μT.

324. One of the phenomena associated with all energized electrical devices, including high-voltage transmission lines, is corona. The localized electric field near a conductor can be

sufficiently concentrated to ionize air close to the conductors. This can result in a partial discharge of electrical energy called a corona discharge, or corona. Several factors, including conductor voltage, shape, and diameter, and surface irregularities such as scratches, nicks, dust, or water drops, can affect a conductor's electrical surface gradient and its corona performance. Corona is the physical manifestation of energy loss and can transform discharged energy into very small amounts of sound, radio noise, heat, and chemical reactions with the air components. During corona activity, transmission lines (primarily those rated at 220 kV and above) can generate a small amount of sound, which may cause limited inconvenience to workers or the broader community in general. This audible noise can increase during bad weather conditions. Water drops may collect on the surface of the conductors and increase corona activity so that a crackling or humming sound may be heard near a transmission line. Transmission line audible noise is measured in decibels using a special weighting scale, the "A" scale, that responds to different sound characteristics similar to the response of the human ear. Audible noise levels on typical 220 kV lines are very low and are usually not noticeable. For example, the calculated rainy weather audible noise for a 220 kV transmission line at the right-of-way edge is about 25 dBA, which is less than ambient levels in a library and much less than background noise of wind and rain.

325. Overhead transmission lines do not, as a general rule, interfere with radio or TV reception. There are two potential sources for interference: corona and gap discharges. The corona discharges can sometimes generate unwanted electrical signals. Corona-generated electrical noise decreases with distance from a transmission line and also decreases with higher frequencies (when it is a problem, it is usually for AM radio and not the higher frequencies associated with TV signals). Corona interference to radio and television reception is usually not a design problem for transmission lines rated at 230 kV and lower at the edge of the ROW in fair weather and in rain, as is the case in the project. The crossing of transmission lines with communication lines can cause interference with the signal. Likewise, radio and television signals may also get disturbed.

326. **Mitigation for general health and safety risks**: Project implementation will be in accordance with the Nepal Labor Code regulations and the EHS General Guidelines sections on Occupational and Community Health and Safety and the Electric Power Transmission and Distribution Guidelines and the following mitigation to ensure provision of safe working conditions:

- Undertake a H&S risk assessment through a facilitated workshop during the detailed route survey so that it can inform both the detailed design and pre-construction preparations. H&S risk assessment to consider both occupational and community H&S risks resulting from the construction and operation & maintenance stages of the project.
- Informed by the H&S risk assessment, prepare a Construction Health and Safety Management Plan (CHSMP) including site-specific measures as needed for each construction site addressing both occupational and community H&S risks and adherence to national health, safety labor laws and regulations.
- Keep CHSMP as a living document, to be updated as required and re-approved by NEA if any changes in construction methods, site conditions, in response to accident, near miss etc.
- Provide worker training on H&S and daily/weekly briefings led by site-appointed Health and Safety Officer.

- PPE to be provided for all workers (regardless formal and informal, directly contracted or subcontracted) in accordance with Table 2.7.1. Summary of Recommended Personal Protective Equipment According to Hazard in IFC EHS Guidelines on OHS.
- Enforce disciplinary system (e.g. immediate removal from site) for non-compliance with PPE requirements and other H&S measures (e.g. social distancing for COVID-19).
- NEA to ensure all substation staff and maintenance workers have received appropriate OHS trainings for their role
- Check the load of the vehicles before use, all drivers, and passengers to fasten seatbelt and comply with all transportation-related H&S laws and regulations
- Examination of all equipment and tools' quality and the presence of operational safety features before use
- Implementation of safety measures while excavating to avoid collapse e.g. shoring if soil unstable
- Ensure good housekeeping in the premises at all times, including on construction site, workers camps, storage areas, etc. Perimeter is to be kept neat and tidy, with no trip hazards on the ground e.g. open channels, materials, equipment, trash laying around. Do not leave hazardous conditions (e.g. unlit open excavations without means of escape) overnight unless no access by public can be ensured.
- For all works on or adjacent to public roads, prepare a Construction Traffic Management Plan (CTMP) appropriate to the pedestrian and vehicular traffic flows on the road in consultation with relevant local authorities/traffic police to ensure proper execution of traffic controls including where temporary blockage of the road during installation is required for health and safety purposes and ensure that highly visible guides, advance warning signs or flag persons are in place to direct pedestrian and vehicular traffic.

327. **Mitigation for working with electricity and at height**: this is a particular risk for the project during construction and O&M, therefore the following mitigation measures will be adopted:

- Untrained workers will not be permitted to work with live electricity or at height.
- Observe IFC EHS Guideline on Electric Power Transmission and Distribution requirements for working with live power lines; only allow suitably trained workers that meet the requirements set out in above-referred IFC guideline to work on live power lines with strict adherence to safety standards including those listed in said guidelines; these workers must have training record of attending suitable training course on electrical safety and be provided with and wear the appropriate PPE for their role.
- Ensure proper grounding and deactivation of any live power lines during construction work or before any work in close proximity to the lines and that this has been checked and certified by the on-site Health and Safety Officer in advance.
- Measure exposure levels to electromagnetic fields (EMF) and provide workers working in zones where EMF levels are above reference levels with personal EMF monitoring device to be attached onto their PPE.

- Require workers to observe the minimum approach distances for excavations, tools, vehicles, pruning, and other activities when working around power lines.
- Observe IFC EHS Guideline on Electric Power Transmission and Distribution requirements for working at height; only allow suitably trained and qualified workers to work at height, these workers must have training record of attending suitable training course and be provided with and wear the appropriate PPE for their role. Require workers to test the structural integrity of towers prior to proceeding with the work. Use fall protection measures when working on towers, i.e. mobile elevated working platform, and all workers at height are required to wear body harness. Ensure sufficient harnesses and gear are available on site for all workers, that workers are trained to use such harness and are obligated to use the latter at all times when working at height.
- Unless transformers have been certified PCB free workers must wear suitable chemical and/or oil resistant gloves, goggles, and protective clothing whilst working with transformers. Eye wash station and water supply to shower to be provided during works due to risk of PCB coming into contact with skin.

328. **Mitigation for emergency scenarios:** Given that health and safety incidents may occur as a result of human error or a natural hazard occurring during project implementation (health emergency, work-related accident, traffic accident, accident involving the community, natural disaster, fire especially forest fire, virus outbreak etc.). the following mitigation is required:

- CHSMP to include a Construction Emergency Preparedness and Response Plan (CEPRP) including communication systems and protocols to report an emergency situation.
- Adequate attention will be given to the risks associated with COVID-19 pandemic and other communicable viral diseases. National restrictions for containing the spread of COVID-19 must be complied with and Government of Nepal (https://covid19.mohp.gov.np/) and ADB guidance (https://www.adb.org/publications/safety-well-being-workers-communities-covid-19) is to followed, as well as further guidance detailed in Appendix 8.
- Provide health/accident insurance for all workers (formal and informal) for the duration of their contracts.
- Check health condition of workers on daily basis, for example, use of self-certification forms and temperature checks before being allowed on the construction site with more thorough monthly health checks by qualified medical professional.
- Contractor to allow a minimum number of sick leave as per Nepal law or 10 days per year, whichever is the higher.
- During construction works, ensure qualified first aider and trained fire marshal is available on-site at all times with an appropriately equipped first aid kit and appropriate fire extinguisher and other firefighting equipment immediately available for use.
- Provide an ambulance for more serious cases to transport the patient to the hospital for treatment
- Prepare signboards reminding of health and safety measures and procedures to follow in case of accident, including key contact details (ambulance, doctor, hospital, etc.)

- Keep a log of all incidents, near-misses and accidents and include these in monthly monitoring reports submitted to NEA and periodic monitoring reports to ADB.

329. **Mitigation for the health and safety of workers/worker camps**: The following mitigation measures are required in addition to the above to ensure all workers have a healthy and safe working environment in which to operate:

- Temporary worker camps will include proper sanitation, alternative fuel to firewood, clean eating area, water supply, and secure storage of domestic solid wastes for disposal off site to suitably licensed waste management facilities.
- Provide an adequate number (about 1 toilet per 10 workers) of toilets and washing facility with hot and cold running water.
- Toilets to be equipped with soap and hand sanitizer.
- There should be an indication of whether toilet and washing facility is “in use” or “vacant” if not gender segregated.
- Toilets should be cleaned at least twice daily to ensure they are kept in a hygienic condition.
- Prevent standing water as it may become a breeding habitat for mosquitoes etc.
- Provide workers with access to a shaded rest area on-site.
- Provide workers with a clean eating area for breaks and lunchtime.
- Provide all construction workers will an adequate supply of potable drinking water meeting national standards. Groundwater used must be appropriately treated and only be used where it will not put stress on local water resources. Where a risk of arsenic contamination is identified, prohibit the use of groundwater as a source of the drinking water.
- If ground or surface water is used for drinking water, it must first be tested to confirm it meets drinking water standards and continue to be regularly tested every week. If drinking water standards are not met, potable water shall be imported to site.
- If workers are not local to the area use may be made of existing accommodation facilities but if a construction camp is provided it must be adequately equipped with sufficient toilets, hand washing facilities, showers or baths, food preparation and clean eating area, etc.

330. Mitigation for minimizing health and safety risks during operation: The following mitigation measures will be adopted:

- Use of any asbestos containing materials is prohibited.
- Include in the design of all substations and transformers within the substation a secure wall or fence with lockable entry featuring written and visual warning signs to include the ISO 7010 "Hazard Type: Electrical Symbol" warning of the risk of electrocution.
- 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.
- Indoor work areas at substations to be well ventilated and well-lit in accordance national regulations and IFC EHS Guidelines on OHS.
- Detailed design of substations to ensure EMF levels within the substation boundary are within international good practice levels as per International Commission on Non-Ionizing Radiation Protection (ICNIRP https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf) (reference and

peak values) for the occupational exposure; in areas where EMF levels could be exceeded posting of written and visual warning signs.

- Detailed design of substations, transmission, and distribution lines to ensure EMF levels at all regularly occupied properties is within international good practice levels as per International Commission on Non-Ionizing Radiation Protection (ICNIRP) (reference and peak values) applicable to the public exposure.
- Use of shielding equipment/materials to decrease electromagnetic field exposure.
- Establish applicable right of way and safety clearance corridor in accordance with the Electricity Rule. During detailed route survey identify the presence and use of any structures found in the (i) right of way and (ii) safety clearance corridor. Consider re-siting of angle point towers such that any structures are outside the ROW or if not possible outside the safety clearance corridor. If it is not possible to avoid regularly occupied structures in the safety clearance corridor these are to be relocated with adequate compensation in accordance with the Resettlement Plan. Such properties must be relocated, and applicable compensation provided by NEA prior to the start of any works. Consider grounding roofs and other metallic surfaces on any properties remaining within ROW to avoid induced current and electricity related accidents.
- Specifically for the Borang-Lapang transmission line, to consider re-siting of angle point towers such that routing in vicinity of the school referred to in the IEE is located as far as possible from it, ideally outside the ROW but at minimum ensuring the entire school compound falls well outside safety clearances under the Electricity Rules. NEA will provide fencing to school found along Borang-Lapang transmission line, so the school compound is clearly demarked. PMD to recruit the necessary third party to build a fence around the school grounds
- Detailed design of substations to include adequate sanitation and welfare facilities for all NEA workers to be posted at or visiting the substations including indoor kitchen, eating and sleeping facilities (if applicable) and adequate number of indoor toilets/washrooms with a hot and cold running water supply.
- Source of drinking water that meets drinking water standards to be provided to substations. If substation is in district which suffers from arsenic contamination of drinking water, groundwater must not be used, and alternative source must be identified. If any surface or groundwater sources are proposed for use in substations, Contractor is to undertake a baseline water quality sampling per EMoP (Table 10.B) to confirm its suitability for use. If drinking water standards are not met, detailed design to consider alternative source or include water treatment facilities at the substation to facilitate safe drinking water supply.
- Provide a dedicated shelter to security guards, shielding them from rain, wind, and extreme (hot and cold) temperatures.
- Keep the substation neat and tidy at all times.
- Remove any trip hazards on the ground, e.g. open channels, materials, equipment, trash laying around.
- Visually inspect for any standing water on site, and when identified, remove or provide appropriate drainage to remove in timely manner; ensure drainage system is not blocked and fully operational.
- Maintain all lights in working order.
- Ensure all vents are free of blockages and regularly maintained.

- Label all containers with its content and potential risk signs (e.g. flammable, corrosive, toxic, etc.) Display material data sheets for fuels, oil, or chemicals. If chemicals are handled on site, provide an emergency eye wash or shower.
- Monitor electromagnetic field strength workers are exposed to and ensure occupational exposures are within the limits of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) reference level. If EMF limits are often reached, provide workers with personal radiation monitors that shall set off an alarm when exposure limits are reached.

331. Mitigation for minimizing the consequences of emergency scenarios during operation:

- Given high seismic risk across the project area, design of all substation and tower foundations and any structural components (e.g. buildings) are checked for seismic safety by the design team as well as by an independent expert, separate to the design team, to confirm that international good practice seismic design standards are met.
- Buildings, poles, towers and conductors to incorporate climate adaptation measures as per the Climate Risk and Vulnerability Assessment, including to withstand extreme temperatures and gale force wind speeds, at minimum equal to upper end of gale conditions on Beaufort scale (40 knots) given 30 knots experienced during the 31 March 2019 tornado event in Nepal.
- Contractor to ensure detailed design of transmission lines incorporates lightening protection to minimize forest fire risks.
- Detailed design of substations to include fire safety measures including detector, alarm, and firefighting equipment in accordance national regulations and IFC EHS Guidelines on OHS.
- Ensure a recent, full, first aid kit and adequate firefighting equipment is available on site at all times, stored in clearly labelled and easily accessible area.
- Replace the first aid equipment timely as required to keep all equipment within its expiry date.
- Service the firefighting equipment timely as required to keep all equipment in date
- Provide first aid and firefighting training to select, volunteer staff; at least one staff having recently carried out first aid and firefighting training must be present on site at all times. Refreshers are to be provided once a year.
- Hang posters showing first aid procedures especially for electrocution, and fire procedures, as well as listing all emergency contacts. Display the emergency phone number and location of doctor and hospital in a clear and easily accessible location.
- Display clear emergency exits signs (in working order, if light signs, ensure works) and keep exits clear of any blockage.
- Keep an accident log and make accident logbook available on site upon request.
- Monitor closely in case of extreme weather events and be ready to act immediately.
- Ensure any buildings on site are structurally sound if any earthquake occurs, check building soundness prior to allowing workers back on site.
- Carry out regular pest control where pests are a risk; favor natural pest control measures when possible.

332. Mitigation specific to community health and safety. The following mitigation measures will be adopted:

- Contractor to undertake construction safety community awareness raising activities in all local communities within 500m of substations, transmission, and distribution lines prior to construction.
- NEA to undertake electrical safety community awareness raising activities in all local communities within 500m of substations, transmission and distribution lines prior to construction, awareness raising activities to be repeated on completion of construction; to include electrocution risks, EMF, corona noise, etc.
- NEA will provide awareness raising on electrical safety to pupils of school found along Borang-Lapang transmission line, given unless it can be moved outside the ROW pupils may play in close proximity to it (climbing on towers, flying kites, etc.). The opportunity to carry out along with these activities additional simple talks on electricity and electricity networks is recommended, which could raise children's interest in science, with special consideration of gender inclusion and girls' interest in science.
- Installation of barriers (a temporary fence ideally solid fence) at construction areas with hazard warning signs to deter people from accessing the construction site
- Do not leave hazardous conditions (e.g. unfenced and unlit open excavations without means of escape) overnight unless no access by public can be ensured
- Define construction schedule for sections along or crossing roads in coordination with local authorities/traffic police particularly where road closures required.
- Implement CTMP during construction works with advance warning signs or flag persons to ensure traffic safety of construction workers and road users, in coordination with traffic police.
- Access to the construction site will be under traffic controls when trucks enter and exit.
- Road safety and warning signs must be posted at 500m, 100m, and immediately in advance of the works at least two weeks prior to the works commencing to inform the public of the temporary blockage.
- Require all project drivers to abide by Nepal road safety regulations at all times.
- Use of scaffold and bamboo frames to support stringing to protect structures, roads, utilities etc. as well as pedestrians, vehicles, and the conductor itself.
- Restore the utilities immediately after all necessary works carried out to minimize public inconvenience
- Construction workers including subcontractors will be given awareness raising in HIV/AIDS, other communicable diseases including COVID-19, and sexual, exploitation, abuse and harassment with strict penalties (e.g. immediate removal from site) for any non-compliance of workers to an agreed code of practice
- Avoid ponding of water during construction to avoid habitat creation of vector borne diseases e.g. malaria
- 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) is maintained; integrity of the towers and wires is in good condition, including anti-climbing devices; electrical safety warning signs and lighting arrestors; missing or corroded parts are immediately identified and replaced; and, any vegetation growth that may damage or threaten the integrity of the lines etc.
- Consider employing security personnel to guard the premises where the risk of entry for theft might be high.

- During O&M, carry out periodic safety related awareness raising in neighboring communities regarding living in proximity to power lines and substations, including but not limited to, electrocution risks and effects of EMF; include information to the community regarding potential corona noise heard during operation.
- Monitor electromagnetic field strength where regularly occupied properties are in the ROW and ensure public exposures are within the reference levels of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines.

(iii) Employment

333. During the 30-42-months construction, there will be a need for both skilled and non-skilled labor to build the tower pads, erect towers, and string conductors. Most of the unskilled manpower will be hired locally as per available skill and experiences although there are certain jobs which because of health and safety requirements must only be undertaken by suitably qualified and experienced workers. About 300-350 people will be employed (about 230 unskilled, 45 semi-skilled and 25 skilled) (both male and female) may be required at various work sites. Some local people may also involve themselves in small businesses (e.g. tea stall, grocery shop, etc.).

334. Once operational, due to an increase in power transmission capacity and the reliability of power supply, the social life and economic condition of the local people might be improved.

335. **Mitigation.** Contractors will abide by the Nepal Labor Code and labor regulations and the following mitigation measures:

- Contractor must prohibit child labor (under 18 years old).
- Contractor should not discriminate in employment
- Contractor should proactively encourage employment from local communities where appropriately skilled.
- Contractor should proactively encourage employment of women on the project where appropriately skilled.

D. Cumulative and Induced Impacts

336. The proposed Electricity Grid Modernization Project (EGMP) will construct individual project components (transmission lines and substations) across seven provinces of Nepal to improve the existing transmission system.

337. Cumulative adverse impacts may arise from the interaction of project components in the project area, or from future planned expansion or similar projects being undertaken in the project area. Project component interactions have been considered in the assessment above, particularly in relation to bird electrocution and collision since whilst the project components are dispersed vultures in particular occupy a large habitat area. In relation to future planned expansion, once constructed, further expansion of the new transmission lines may be undertaken by NEA to further improve the INPS as discussed in Section III (Figure 25) which depending on their exact alignments may result in additional impacts on forest land, bird electrocution and collision. NEA will need to ensure all future planned expansion follows national regulations for EIA/IEE, the capacity building measures for biodiversity included in the

project should also assist with ensuring “bird sensitive” design is reflected in any future expansion.

338. Induced adverse impacts may arise from access to electricity and hydropower or other development which is encouraged by the presence of an extended national grid in the project area.

339. In 2018, the government issued a comprehensive white paper highlighting the existing energy situation and issues and outlining a future road map on the energy sector, and water resources and irrigation. The white paper covered several actions for (i) increasing per capita energy consumption by 700 kilowatt-hours (kWh) per year within 5 years (by 2023) and 1,500 kWh per year in 10 years (by 2028); (ii) developing 15,000 MW in 10 years (by 2028) with one mega-project in each state with people’s participation in financing; (iii) developing in-country and new cross-border transmission line projects; (iv) resolving right-of-way issues during the construction of transmission lines; (v) providing access to electricity for all within 5 years (by 2023); (vi) modernizing the electricity distribution system; and (vii) developing the market for power trading.

340. 28% of potential consumers are waiting to be connected to the grid and this project will support Nepal to achieve SDG Target 7 of Affordable Energy Access to All. The project will be beneficial in supporting the government's white paper target of increasing grid access to meet the demand of electricity for domestic and industrial consumers and providing safe, reliable, and quality electricity supply which in turn will help support economic development of the country and improving the livelihood. This projection can be supported with the pre-COVID19 projection of increasing Nepal’s per capita GDP from $728.4 in 2017 to $800 in 2020.[42] The Nepal Telecommunications a major communication partner in Nepal indicated between 2016/2017 to 2017/2018 there was a 10.76% in data demand for internet service, mostly for video streaming, which is also correlated to increase energy demand. The demand for electricity at present has dropped following the economic slag faced after COVID 19 pandemic.

341. Conversely it is likely to result in the desired increase in per capita energy consumption, which if the demand is not met from clean sources may contribute to GHG emissions and climate change (currently country’s dependence of fossil fuel is 37.25% with trans-border trade of electricity with India) or if supply is insufficient will require the development of new generation facilities, such as storage hydropower in the Nepal context (power production in Nepal mostly being Run of the River fluctuates seasonally between peak production in monsoon season and dry season) having associated major environmental impact. Therefore, it will be important that NEA also focuses on energy efficiency to balance the system to minimize any such environmental impacts.

342. The implementation of this project will increase livelihood activities of local communities as discussed above. There is also high potential for industrial growth in the project area. Existing lines and substations feeding existing Industrial Corridor are required by GON to be augmented and new industrial corridors are required to be developed to support the industrial growth of the country, which will be rendered feasible by increased, safe and reliable electricity access. Based on 2018/19 Industrial Statistics, by Department of Industry a total of 387 industries were registered in the Project Affected Districts of this highest 42% were registered

in Kathmandu itself and 12% in Lalitpur Districts this was followed by 6% in Kaski district. Most of these Project Affected Districts are benefitting from Substation Automation component or Smart Meter of EGMP. The total number of industries registered till 2015/16 in the Project Affected Districts was 6,048 of these highest (49%) were in Kathmandu, and lowest in Syangja District. The transmission system enhancement may therefore encourage industrial growth in the area which will be an induced impact in terms in land use change and pollution load from industrial development. Land values in the general area are likely to increase because of the availability of additional power supply resulting in changes in land use from agriculture to commercial and industrial uses.

343. On the generation side, with an annual load growth rate of 13.8%, more power generation is required to meet the increasing load growth of country. According to the load forecast prepared by the System Planning Department (SPD) of NEA, the peak demand is expected to grow at an average 9.7 per annum over the coming years. This gap between the demand and supply of electricity particularly widens during dry winters (October to March) because of the dominance of run-of-river hydropower plants and the lack of hydropower plants with sufficient storage capacity. To minimize the gap resulting from lower generation and the growing demand for electricity, Nepal is currently importing up to 400 MW of power from India. The government has set targets for generating 15,000 MW by 2027. Survey licenses for 302 projects with a total capacity of 15,885 MW have been issued by the government, of which construction is ongoing for 4,642 MW. Power purchase agreements have been completed for 244 projects with a total capacity of 4,138 MW. The completion of these projects will increase the electricity supply in Nepal. The timely completion of transmission lines under construction and those planned by NEA in the future will be key to developing Nepal's hydropower resources.

344. The project components under EGMP i.e. the Dandakhet - Rahughat 132 kV Transmission Line will improve power supply in Dhaulagiri zone and evacuate power from hydropower plants of Rahuganga river, Myadgi river and Kaligandaki river basins of Myadgi district, while the 132 kV Ghorahi-Madichaur Transmission will reinforce the power supply system and facilitate power evacuation to different IPPs of Madi Khola, Lungri Khola and its tributaries in Rolpa district. Similarly, Borang-Lapang-Ratmate Transmission line system will support the evacuation of the electric power generated by IPPs of Aankhu Khola Corridor to the Integrated Nepal Power System and to augment the same. In relation to induced hydropower development, any such development will occur independently of the project but Government of Nepal will need to ensure that all future hydropower expansion follows the national regulations for EIA/IEE.

VI. INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

A. Consultation Process

345. As part of the environmental assessment for the EGMP consultations with affected persons and other concerned stakeholders have been carried out for the project components relative to their impacts and risks. Further details of the consultations are provided in Appendix 9.

346. During the preparation of the national EIA/IEE for the 3 new transmission lines, as well as the national IEE for the transmission line related to Pangtang substation, consultations/meetings with stakeholders and the public were held. Consultations/meetings were conducted with government line agencies in Kathmandu and at District level, in villages where the substations are proposed, as well as in villages along the alignment of the transmission lines. Formal and informal discussions were held, and participants were informed about details of the project component(s). The purpose of these consultations/meetings was to:

- provide information to the public on the key features of the project component(s) including benefits, potential impacts and how such impacts will be avoided or managed;
- obtain views and concerns from the communities with respect to environmental and social issues relating the project component(s);
- gather site specific information from the stakeholders' perspective on the physical and social aspects of the project component(s) environment.

347. For the Dandakhet-Rahughat transmission line (Component 1) consultations/meetings were organized by NEA as part of national IEE preparation in 7 wards (highlighted in map, Figure 68) of 4 municipalities (out of 6 municipalities) through which the alignment traverses. Likewise, as part of national EIA preparation, NEA organized consultations/meetings for the Ghorahi-Madichaur transmission line (Component 2) in 5 wards (highlighted in map, Figure 69) of 4 municipalities through which alignment traverses. For the Borang-Ratmate transmission line (Component 3) NEA organized consultations/meetings as part of the national IEE preparation in 10 wards (highlighted in map, Figure 70) out of 15 wards of 7 municipalities through which the alignment traverses. The consultations/meetings were organized jointly to discuss both environmental and social issues associated with the project. Environmental discussions were focused mainly on forests and protected areas including local flora and fauna found in and around the alignment, health and safety issues from the project, local environmental issues such as air pollution, drinking water sources and water quality, physical cultural resources, expected benefits from the project, and willingness of local communities to involved in the project during implementation. In addition, the tree enumeration along the RoW for trees above 10cm dbh and sampling for sapling below 10 cm dbh and observations for wildlife were also discussed.

348. Consultations continued during preparation of this IEE. Due to COVID-19 pandemic situation, field visits to all project components were not possible therefore consultations were conducted virtually (through e-mail and telephone calls) with the help of questionnaires designed separately for stakeholders (line agencies at national and district level, NGOs, CSOs

etc.) and communities in the project areas (village heads, school teachers etc.). Where communities have not been reached directly under the current restrictions, further meaningful consultation will be carried out prior to the start of project activities, during detailed design phase.

Figure 68: Map showing wards/municipalities consulted along the Dandakhet-Rahughat Transmission Line Corridor

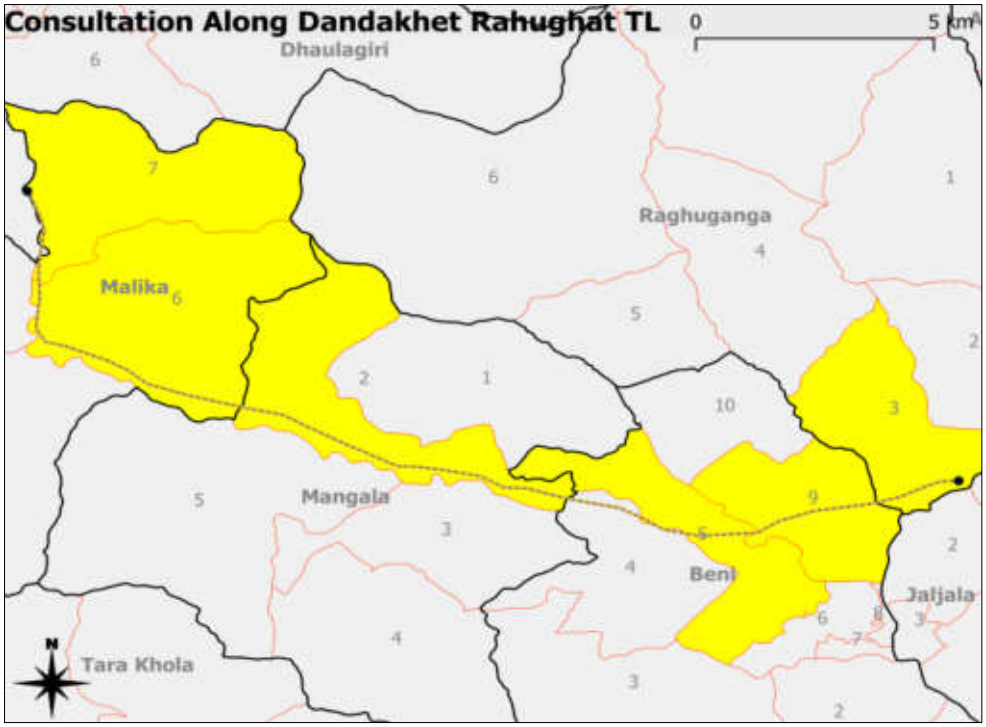


Figure 69: Map showing wards/municipalities consulted along the Ghorahi Madichaur Transmission Line Corridor

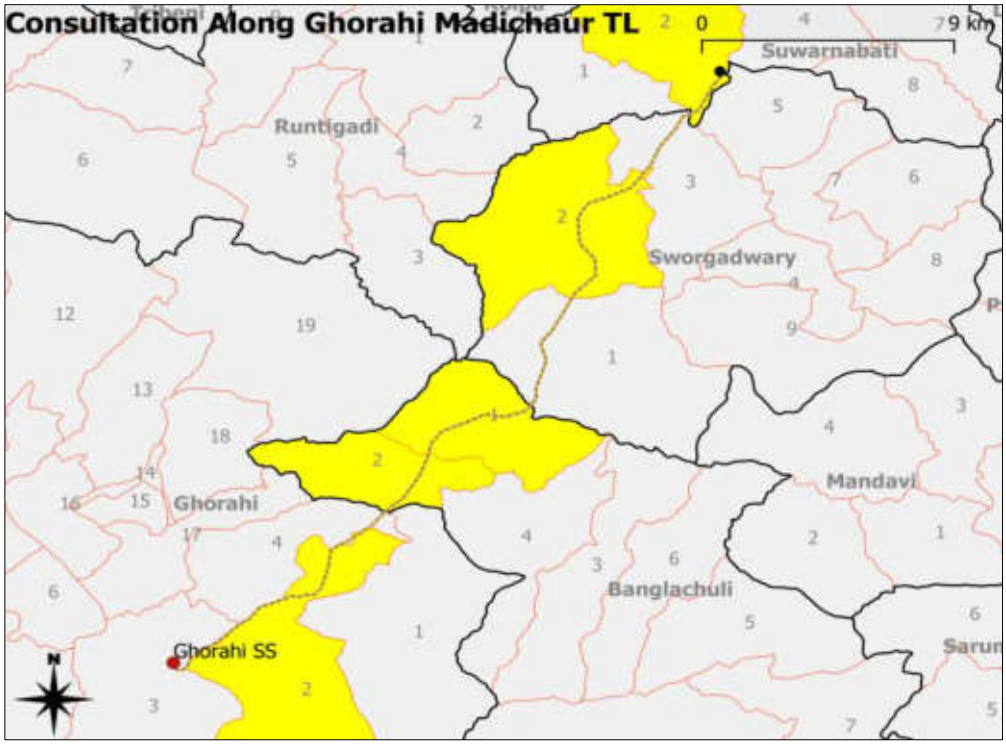
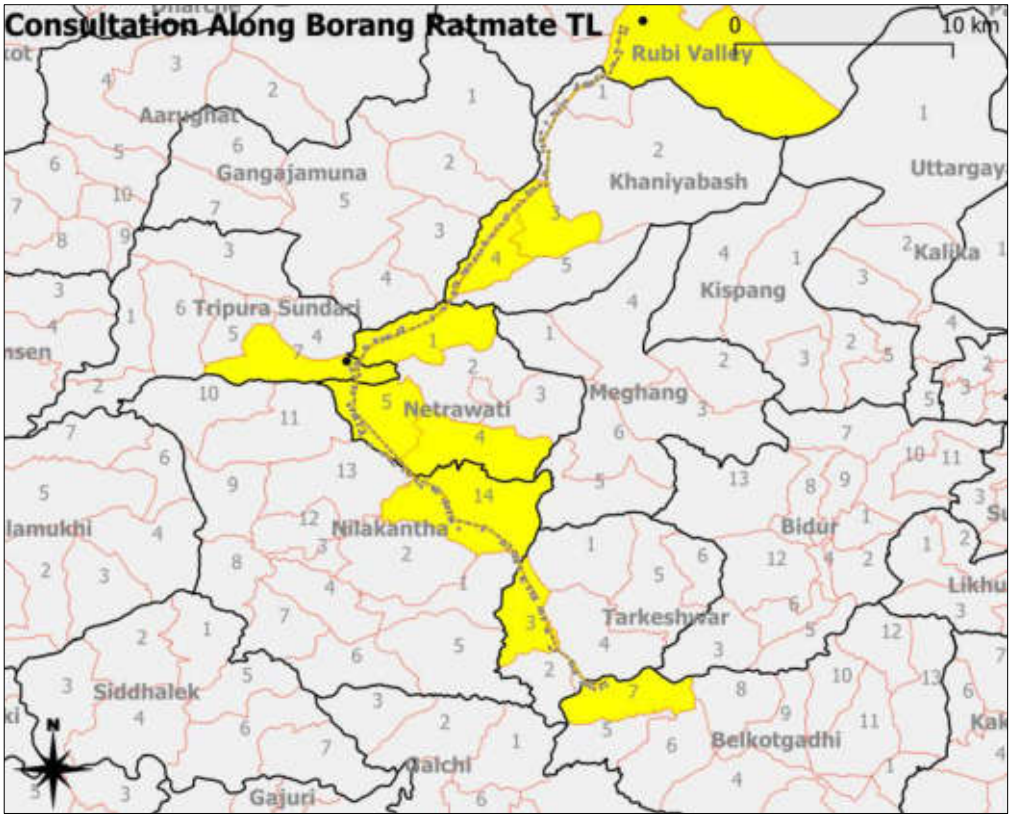


Figure 70: Map showing wards/municipalities consulted along the Borang-Ratmate Transmission Line Corridor



B. Concerned Stakeholder Consultations

349. Stakeholder consultations have been undertaken at national level as well as district levels during preparation of the national environmental assessment reports (2018-2019) and continued in the month of June-July 2020 during preparation of this IEE. Concerned stakeholders involved in the consultations included:

- Department of National Parks and Wildlife Conservation (DNPWC) for Parsa National Park
- DNPWC for Koshi Tappu Wildlife Reserve
- Chure Terai Madhesh Conservation Development Board
- Bird Conservation Nepal (BCN)
- Women Groups / Community Forest Groups
- Department of Archeology
- Nagarjun Subdivision Forest Office, Swayambhu
- IUCN Nepal
- WWF Nepal

350. Table 63 presents a summary of concerned stakeholder consultation carried out during preparation of IEE.

351. **Bird Conservation Nepal.** Given the presence of critical habitat, the potential impacts and mitigation measures of the transmission lines on avian fauna (mainly birds) have been discussed with the officials from BCN, one of the leading organizations of Nepal working in bird conservation. EGMP components were discussed and information on the sensitivities of project location(s) were received. Outcomes of the meetings are summarized here with further details included in Appendix 9.

352. General suggestions: nesting colonies such as wetlands need to be considered for mitigation; closely place transmission lines running parallel to nesting colonies/wetlands can pose risk for bird collision hence such alignment should be avoided or adequate mitigation or corrective measures should be incorporated in case such alignment occurs; good ecologically sound international practices for transmission lines include minimizing placement over the top of a ridge in hill or cliff and instead positioning at side of such cliff (the height of tower not rising above the cliff) this can minimize collision risk. Other practice includes avoiding areas of wetland where birds flock or breed in large numbers. Not positioning the alignment between flocking, breeding to feeding areas. Standard practice is avoiding nesting grounds by at least 1 km. Also, trees close to such sites are very important where several birds roost.

353. Putting reflector in Bagmati River for Component 9a will be effective as birds flock in such areas and several scavenging birds, raptors also come to feed in this area looking for food.

354. Key recommendations of BCN for Component 9b were: (i) the Koshi River is an area where birds roost, but collision incidents have not been recorded in this area; some important wetland bird species found in Koshi Tappu Wildlife Reserve include Swamp Francolin but since this transmission line is 30 to 35 m high it will not have too much of a negative impact on it; (ii) this is an existing line and hence not much can be suggested other than use of bird diverters; (iii) bird diverters for migratory birds are advised along sections that run parallel to the bank of the river, the alignment falls between roosting and feeding grounds of birds of the Koshi Tappu Wildlife Reserve hence mitigation measures should be included. Incorporation of bird divertor is advised along key stretches of transmission line, based on site sensitivity, while keeping under consideration cost and effectiveness; (iv) bird divertors can be important for wetland birds but may not be so effective for soaring birds such as vulture, eagle; and (v) currently the migratory bird population coming to Koshi Tappu Wildlife Reserve has been declining and has shifted to Birju/Chimdi Lake to southeast which has become more important for migratory birds – see image. Unfortunately, the main route of migration of birds is still under study hence further details could not yet be shared at this stage.

355. BCN provided key recommendations based on review of the alignment for Component 2:

- Nesting site for white rumped vulture and slender billed vulture (critically endangered vulture species) located at Charinge Community Forest and its surroundings. It is recommended to ensure the transmission alignment is at least 2km (north-west) of such nesting sites.

- Vulture foraging sites are along rivers; they scavenge on carcass usually thrown along the river. Hence avoiding such foraging sites if possible and/or using bird divertors.
- Transmission line is along the boundary of the Dang Deukhuri Foothill Forest and West Rapti Wetland IBA just crossing into it, this is known for threatened species of birds such as globally threatened vultures, steppe eagles, great slaty woodpecker etc. If possible, avoiding IBA by slightly shifting the transmission line alignment will be good.
- Mitigation measures suggested included bird divertors in this section as valuable because vulture safe feeding sites (Jatayu Restaurant) lies in Bijauri (approximately 22km away) near Tulsipur and hence there is frequent movement of vultures from nesting sites to feeding sites and which will pose a high risk of collision as well as electrocution.
- Areas above Kailali District can also be considered as important site for bird migration such as bar headed goose; they fly at high altitude but areas close to wetland need to be considered important.

Table 63: Concerned Stakeholders Consultation List

Stakeholder	Name	Designation	Date	Points Discussed / Recommendations	Project Response
Department of National Park and Wildlife Conservation	Ram Chandra Kandel	Deputy Director General (Male)	6/29/2020	• Details of the project locations and nature of work shared with DNPWLC officials. • Deputy Director General of DNPWLC recommended and supported in registering the formal letter from NEA to be sent through email to Park Warden of Parsa National Park and Koshi Tappu Wildlife Reserve as suggested by Management Officer.	• Formal Letter to DNPWC from NEA (sent but response is awaited as of 1 August 2020.
Department of National Park and Wildlife Conservation	Shyam Kumar Shah	Management Officer (Male)	6/28/2020, 6/29/2020, and 7/22/2020	• The details of the project location and nature of work shared with DNPWLC officials.	• Movement of wildlife, especially birds, has been considered in the project

Stakeholder	Name	Designation	Date	Points Discussed / Recommendations	Project Response
				• Since there are existing transmission line for which followed practice is annual brush cutting after taking permission from National Park, it is advised to NEA to take similar procedure to get formal opinion from DNPWC for this project. • It was informed that the accepted procedure is NEA should send formal request letter to DNPWLC with a project document to Director General which can be forwarded to Park Warden of Parsa National Park and Koshi Tappu Wildlife Reserve to seek their feedback for the proposed upgradation of 132kV transmission lines related to their protected areas. • It was suggested that NEA should follow national policies and regulations while planning and implementing the project, and measures in approved EIA/IEE.	design. Further consultation will be undertaken with DNPWC local officer and DFO during project implementation .

Stakeholder	Name	Designation	Date	Points Discussed / Recommendations	Project Response
				• DNPWC informed that NEA should coordinate with local level DNPWC office and Division Forest Offices while implementing the project in protected areas. • DNPWC forwarded NEA's letter to the park wardens and suggested to incorporate mitigation measures to address wildlife movements in the area.	
President Chure Terai Madesh Conservation Development Board	Rajan Regmi	Under Secretary (Male)	6/28/2020	• Project details were shared and key issues associated with implementing the project were discussed. • It was informed that the accepted procedure for information is that NEA should send a formal letter with approved EIA to seek feedback they can then make a field visit and provide recommendations, however in this case EIA is already complete and was carried out in consultation with Chure Board. • It was informed that the Chure Conservation Area is	• Geologist of Chure Board has been consulted (see below)

Stakeholder	Name	Designation	Date	Points Discussed / Recommendations	Project Response
				spread over entire Chure region and its conservation status is different than DNPWLC protected areas. • Development activities can be implemented in Chure area with prior permission from Chure Board. • Further information about Chure area can be obtained from Geologist at Chure Board.	
President Chure Terai Madesh Conservation Development Board	Premnath Poudel	Geologist	7/12/2020	• Received Chure Conservation Area boundary maps. • Informed that NEA were provided with formal letter to conduct the national EIA for Ghorahi-Madichaur transmission line. • Chure Board informed of the nine conditions put forward by Chure Board on 19 February 2019, including standards of Development Works that need to be followed by the project. • Measures for landslide, erosion and flood control should be followed, slope stability analysis with corrective measures	• Landslide, erosion control and flood risks have been identified for further attention during detailed design. • National approval requirements will be complied with during project implementation.

Stakeholder	Name	Designation	Date	Points Discussed / Recommendations	Project Response
				to be carried out and land degradation needs to be minimized in addition to following procedural requirements with Ministry of Forests and Environment.	
Bird Conservation Nepal, Kathmandu, Nepal	Ishana Thapa	CEO (Female)	6/28/2020 and 7/7/2020	• Details of the project location(s) and nature of work shared. • CEO provided suggestions particularly on location of vulture nesting site within 5 km of the alignment, provision of bird divertors on the transmission line etc. • Subsequently proposed measures such as adding bird diverters along the areas close to Balim Khola were agreed with. If other related mitigation measures can be implemented, it will be positive. • Bird diverters next to the Koshi Tappu Wildlife Reserve of the Duhabi Kusaha transmission line is an encouraging mitigation measure.	• Bird divertors are to be provided on the entire Ghorahi-Madichaur transmission line with additional mitigation measures re vultures included in the EMP. • Further consultation will be undertaken with BCN during project implementation
Department of Archeology (DoA)	Suresh Suras Shrestha	Archeologist	7/19/2020	• EGMP project components and location maps were shared. • Identification of 66kV conductor upgradation crossing 500 m	• Presence of World Heritage Site identified for further attention during project

Stakeholder	Name	Designation	Date	Points Discussed / Recommendations	Project Response
				behind the Swayambhunath Stupa as a World Heritage Site was informed. • Suggested that changing of old conductors with new with no changes to the existing towers will not be of major concern although NEA needs formally write letter with detailed maps of the project location to DoA. • Project can be implemented with DoA approval and during implementation DoA officials will have to be there on site.	implementation . • Department of Archaeology will continue to be consulted during project implementation , their permission to undertake works within the World Heritage Site will be sought and they will be present to supervise the works.
Nagarjun Sub Division Forest Office, Swayambhu	Shobha Adhikary and Shreya Pathak	Field Officers	7/15/2020	• EGMP project component of 66kV transmission line behind their office where conductors will be replaced was informed. • They mentioned that NEA changing cables will not be of major concern. • In current practice NEA occasionally undertake trimming of trees /bushes below the transmission line.	• Forest Office will continue to be consulted during project implementation .
IUCN Nepal	Amit Pudel	Technical Officer	7/16/2020	• EGMP project components Duhabi Kusaha 132kV TL upgradation related to	• N/A

Stakeholder	Name	Designation	Date	Points Discussed / Recommendations	Project Response
				Ramsar Site boundary discussed. • Suggested they were comfortable since BCN has given their views.	
WWF Nepal	Promod Neupane	Senior Program Officer	7/23/2020	• EGMP project components and issues were discussed. • Provided the project information leaflets with map of project components location. • Informed that transmission lined have not had major issues related to wildlife in the past in Nepal. • Expert was of the opinion that development works for building transmission lines was crucial for development of Nepal and WWF Nepal has been working recently with other donor agencies providing suggestions and biodiversity friendly mitigation measures. • WWF looks forward to the biodiversity study of the project areas and are ready to coordinate with the team.	• WWF Nepal will continue to be consulted during project implementation .

C. Public/Community Consultations

356. Public/community consultations have been carried out during preparation of the national environmental assessments as well as during preparation of this IEE. Table 64 summarizes the details of the public/community consultations carried out and tools/methods used for each component.

Table 64: Summary of Public/Community Consultations Carried Out for EGMP

Sl. No.	Project Component	Scope/Activities under Component	On Site Consultations by NEA during National IEE/EIA Preparation	On Site Consultations by NEA during ADB IEE Process	Consultations through Questionnaire	Informal Consultations through Phone / NEA Project Managers
1	Construction of Dandakhet - Rahughat 132 kV Transmission Line and associated Substations	Construction of 25km long 132 kV Transmission line from Dandhakhet - Rahughat	Yes	Yes (neighboring district)	Yes	Yes
		Construction of New 220/132 kV GIS substation at Rahughat	Yes	Yes (neighboring district)	Yes	Yes
		Construction of New 132/33 kV substation at Dandakhet	Yes	Yes (neighboring district)	Yes	Yes
2	Construction of Ghorahi - Madichaur 132 kV Transmission Line and associated Substation	Construction of 40 km long 132 kV Transmission line from Ghorahi to Madichaur	Yes	Yes	Yes	Yes
		Construction of New 132/33 kV substation at Madichaur	Yes	Yes	Yes	Yes
		Extension of Ghorahi substation	Yes	Yes	Yes	Yes
3	Construction of Borang - Lapang - Ratmate (132/220kV) Transmission Line and associated Substations	Construction of 25 km long 220 kV Transmission line from Ratmate to Lapang	Yes	Yes	Yes	Yes
		Construction of 23 km long 132 kV Transmission line from Lapang to Borang	Yes	Yes	Yes	Yes
		Construction of New 220/132/33 kV substation at Lapang	Yes	Yes	Yes	Yes

Sl. No.	Project Component	Scope/Activities under Component	On Site Consultations by NEA during National IEE/EIA Preparation	On Site Consultations by NEA during ADB IEE Process	Consultations through Questionnaire	Informal Consultations through Phone / NEA Project Managers
		Construction of New 132/33 kV substation at Borang	Yes	Yes	Yes	Yes
4	Construction of 132/33/11 kV Substation at Pangtang	Construction of New 132/33 kV substation at Pangtang and extension of Barhabise Substation	No	No	Yes	Yes
5	Construction of 132/33/11 kV substation at Keraun (Morang)	Construction of New 132/33 kV substation at Keraun.	No	No	Yes	Yes
		Construction of 30 km long associated 33 kV lines.	No	No	Yes	Yes
6	Grid Substation Automation (Outside Kathmandu Valley)	Installation of substation automation system at around 34 nos. of 400/220/132/66/33/11 kV existing Substation outside of the Kathmandu Valley	No	No	Yes	Yes
7	Construction of Distribution Command and Control Centre	Construction of DCC Center Building and Infrastructure, Software and Hardware	No	No	Yes	Yes
8	Smart Metering in Kathmandu Valley (2nd Phase)	Installation of 350000 smart meters and associated facilities in 9 distribution Centers of NEA.	No	No	No	Yes
9	132 kV /66 kV Transmission Line Conductor Upgradation	Upgrading conductor (DC) on 102km long 132kV Pathlaiya-Dhalkebar T/L	No	No	Yes	Yes
		Upgrading conductor (DC) on 28 km long 132kV SC Line Duhabi Kusaha	No	No	No	Yes
		Upgrading conductors (DC) on 14 km long 66kV	No	Yes	No	Yes

Sl. No.	Project Component	Scope/Activities under Component	On Site Consultations by NEA during National IEE/EIA Preparation	On Site Consultations by NEA during ADB IEE Process	Consultations through Questionnaire	Informal Consultations through Phone / NEA Project Managers
		lines inside Kathmandu valley				

(i) Consultations Carried out During IEE through Questionnaire

357. Consultation under EGMP has been carried out from 21 June 2020 to 12 July 2020 with public/community consultees where 67 persons (Table 65/Appendix 9 Table 9.A) provided inputs of which 13% were female. Consultations were conducted using Project Introduction Sheet, Questionnaires, Maps and Checklist. Following COVID 19 restrictions on movement stress were made on using local residents close to the project area, phone calls and email communications for the Consultations Works. Consultations were targeted at Affected People and Local/District Stakeholders. Questionnaires were distributed to all components; Table 65/Appendix 9 Table 9.A reflects the consultations that were received as of 15 July 2020. Despite questionnaires being sent out for all, consultation is continuing for other project components.

Table 65: Summary of Consultations Carried Out for EGMP During IEE through Questionnaire

Component	Male	Female	Total
Construction of Dandakhet - Rahughat 132 kV Transmission Line and associated Substations	3	0	3
Construction of Ghorahi - Madichaur 132 kV Transmission Line and associated Substation	50	8	58*
Construction of Borang - Lapang - Ratmate (132/220kV) Transmission Line and associated Substations	5	1	6
	58	**9**	**67**

* During lockdown period field teams were available from local areas to undertake field consultations. Therefore, response for this component is good.

358. For Dandakhet-Rahughat transmission line (Component 1) the major (intolerable) issues were considered to be fire risks, electrocution risks, electromagnetic radiation and use of hazardous chemicals. However, a supportive opinion for electrification and development was recorded. The air water and noise condition of the area was informed to be clean and quiet. Ganesh Himal (mountain) is considered as an area of importance for local people in terms of culture and a festival for Singh Lama is organized every year in the month of August in the area.

359. Similar concerns were raised for and Ghorahi-Madichaur (Component 2) transmission line.

360. For Borang Ratmate transmission lines major concerns raised were regarding compensation amount for affected land to be done through negotiations with local people at market price, preferably avoiding private land but people were supportive towards the project. No major wildlife was reported in the area except Himalayan Goral and Wild Boar habitats in Forest of Belkotgadhi Ward No. 7 (these forests are away from settlements and not under the alignment). However major damages caused by wildlife was caused by monkeys and tiger in Borang, Lapang and Ratmate.

361. Based on use of a Wildlife Identification Sheet, wildlife found in the wider project area identified by consultees includes tiger, red panda, Chinese pangolin, hog deer, musk deer, dhole, monkey, leopard, and bear. Among birds found in the area includes Baer's pochard, yellow breasted bunting, white rumped vulture, Indian Vulture, slender billed vulture, red headed vulture, sociable lapwing, and greater adjutant.

(ii) Public/Community Consultations by NEA

362. Consultation with local communities, landowners, village heads and directly affected people was conducted by NEA during preparation of the national EIA/IEE for the 3 new transmission lines and one substation[55]. A total of 50 public meetings including two public hearings involving 719 participants (535 male and 184 female) were organized in villages along the alignment of the transmission lines between March 2018 to January 2020. For the public hearings, as required under the EPR 1997, a 15 days public notice was published. The notice consisted of a statement with brief project information and request to provide comments and suggestions within 15 days to the NEA project office. A team was mobilized in the field with a copy of the public notice along with cover letters to the concerned municipalities, district level line agencies and other local stakeholders. A copy of the notice was displayed in the subproject sites (villages) and proof of deed (Muchulkas) were collected. Similarly, same notice was published in local paper and on the local radio.

363. Each formal meeting involved 6-25 participants including women participants. Issues associated with environment, health and safety were discussed during these consultation meetings. A brochure with relevant information about the EIA findings of the proposed project was prepared in Nepali language and distributed to the participants of the public hearing programs. Informal group meetings were carried out with local informants to collect the information on wildlife. The local people were asked about the presence of wildlife in the project area. Similarly, the group meetings especially with CFUGs was also focused on collection of suggestions from respective groups.

364. Besides this, there were several informal consultation sessions and focus group discussions organized. Consultations with women groups as well as Indigenous groups were also carried out as part of national IEE/EIA.

[55] Consultations for Pangtang substation was carried out by NEA as part of the national IEE for Balefi Corridor transmission line.

365. Table 66 provides a summary of the public/community meetings (with 535 Male and 184 Female participants, 134 of these participants were indigenous people (Table 66 A to G/ and Pictures). Details of above public consultation meetings (photographs, signed attendance sheets) including issues discussed during these meetings are provided in Appendix 9.

366. Consultation attendance sheets are included in Appendix 9. To put participation in context, the total directly affected people by the project is 1,295 of this 48.72% are women and 3 households are women headed households. A total of 108 households that will be affected by the project are Indigenous people and the total indigenous population affected by the project is 625.

Table 66: Consultations for Transmission Lines Carried out by NEA

A. Consultation Meetings for Dandakhet-Rahughat 132kV Transmission Line

S. No.	RM/ Municipality-Ward No.	Place	Date	No of Public Meeting	Participants Number		
					Male	Female	Total
1	Malika-7	Tallogaun	1/5/2019	1	7	3	10
2	Malika-7	Khara	1/5/2019	1	8	2	10
3	Malika-6	Dhukhubesi	1/4/2019	1	7	3	10
4	Malika-6	Dhaireni	1/4/2019	1	4	4	8
5	Malika-7	Bim-Dhunote Tole	1/1/2019	1	5	3	8
6	Malika-6	Dhukhubesi	1/1/2019	1	5	6	11
7	Malika-6	Upallo Darbang	1/1/2019	1	7	5	12
8	Malika-6	Dhadkharka	12/31/2018	1	4	6	10
9	Mangala-2	Kaskeri	1/3/2019	1	10	0	10
10	Mangala-2	Baniyachaur	1/2/2019	1	6	3	9
11	Mangala-2	RanaBang	12/30/2018	1	5	6	11
12	Mangala-2	Simalchaur	12/29/2018	1	7	4	11
13	Rahuganga-3	Ambawang	1/2/2019	1	13	1	14
14	Rahuganga-3	Rakhupiple	12/28/2018	1	9	2	11
15	Beni-5	Pulachaur-Chipleti	12/27/2018	1	6	4	10
16	Beni-5	Jagannathe	1/5/2019	1	7	3	10
17	Beni-9	Kaulegauda	1/4/2019	2	18	6	24
18	Beni-9	Patarukh, Dhupibot	12/24/2018	2	9	7	16
Total				**20**	**137**	**68**	**205**

Picture 1: Consultation Meeting with CFUGs for Dandakhet Rahughat (Component 1)

Picture 2: Consultation Meeting with CFUGs for Dandakhet Rahughat (Component 1)

Picture 3: Consultation Meeting with CFUGs for Dandakhet Rahughat (Component 1)

Picture 4: Consultation Meeting with CFUGs and DFO, Myagdi for Dandakhet Rahughat (Component 1)

Picture 5: Key Informative Interview at Beni-5 for Dandakhet Rahughat (Component 1)

Picture 6: Key Informative Interview at Piple, Rahuganga for Dandakhet Rahughat (Component 1)

Picture 7: Key Informative Interview at Site for Dandakhet Rahughat (Component 1)

Picture 8: Consultation at Darwang, Malika-7 for Dandakhet Rahughat (Component 1)

Picture 9: Consultation with CFUGs at site for Dandakhet Rahughat (Component 1)

B. Consultation Meetings for Ghorahi-Madichaur 132kV Transmission Line

S.N.	Venue of Meeting	No. of Participants	Male	Female	Date
1	Khungri, Sunil Smriti RM-2	11	8	3	2019/12/13
2	Khungri, Sunil Smriti RM-2	10	8	2	2019/12/13
3	Khal, Sworgadwary Municipality-2	7	7	0	2019/12/13
4	Malarani, Sworgadwary-2	8	7	1	2019/12/14
5	Kalimati, Banglachuli RM-1	7	6	1	2019/12/14
6	Purung, Banglachuli RM-2	7	6	1	2019/12/16
7	Tengtengkhola, Banglachuli-1	8	7	1	2019/12/15
8	Takura, Banglchuli-2	8	8	0	2019/12/14
9	Laxmipur, Ghorahi SMC-1,2	8	6	2	2019/12/16
10	Kalimati, Ghorahi SMC-2	10	9	1	2019/12/15

11	Ghorahi SMC-2, Ward Office	9	7	2	2019/12/17
12	Ghorahi SMC-2, Ward Office	8	8	0	2019/12/17
Total		**101**	**87**	**14**	

C. Public Hearing Meeting (on 2020-1-10 Ghorahi SMC, Dang) for Ghorahi-Madichaur Line

Venue of Public Hearing Program		Location	Participants Number		
District	**Location**		**Male**	**Female**	**Total**
Dang	Ghorai SMC	RCTMCDC	1	0	1
		District Administrative Office, Dang	1	0	1
		DFO, Dang	2	0	2
		Ghorai SMC	56	24	80
		Bangalachuli RM	15	12	27
		Takura	4	1	5
		Syuja	6	0	6
		Police Office, Gogli, Dang	2	0	2
		Media	0	1	1
		DCS, Dang	3	0	3
		Ghorahi Madichaur Project	4	0	4
		ESSD	10	1	11
Total			**104**	**39**	**143**

D. Public Hearing Meeting (on 2020-1-11 Sworgadway-2, Phyuthan) for Ghorahi-Madichaur Line

Venue of Public Hearing Program		Location	Participants Number		
District	**Location**		**Male**	**Female**	**Total**
Phyuthan	Sworgadwary Municipality	RCTMCDC	1	0	1
		Sworgadwary	56	15	71
		Sunilsmriti RM	16	3	19
		Mandawi RM	0	1	1
		DCS, Phyuthan	1	0	1
		Police Office	2	0	2
		Ghorahi Madichaur Project	5	0	5
		ESSD	4	3	7
Total			**85**	**22**	**107**

Picture 10: Stakeholder Consultation at Project Area in Ghorahi Component (Component 2)

Picture 11: Information Sharing of Public Hearing Program through School Students along Ghorahi Madichaur (Component 2)

	
Picture 12: Public Hearing Program in Ghorahi Madichaur (Component 2)	Picture 13: Public Hearing Program in Ghorahi Madichaur (Component 2)
	
Picture 14: Consultation with RM Representative, Project Staff and ESSD for Ghorahi Madichaur (Component 2)	

E. Consultation Meetings for Borang Ratmate Transmission Line

S.N.	Municipality/RM	Place	No. of Participant	Male	Female	Date
1.	Tripurasundari-7	Lapangbesi	24	18	6	2019/7/1
2.	Tarkeshwor-3	Jor Chautara	6	4	2	2019/7/3
3	Netrawati Dabjong-1	Dabjong	10	5	5	2019/4/5
4	Belkotgadhi-7	Khaniyabas	9	9	0	2019/4/2
5	Netrawati Dabjong-4	Bharayng Bhurung	9	7	2	2019/4/3
6	Netrawati Dabjong-5	Dhamala Gaon	7	6	1	2019/4/5
7	Nilkantha-14	Ratmate	7	3	4	2019/4/10
8	Tarkeshwor-3	Tarkeshwor	10	9	1	2019/4/8
9	Khaniyabash-4	Ghamsa	8	7	1	2019/4/2
10	Khaniyabash-3	Dundure Darkha Bazar	10	6	4	2019/4/2
11	Netrawati Dabjong-1	Kintang Phedi	11	11	0	2019/4/3
12	Ruby Valley-4	Borang	12	6	6	2019/3/31
13	Khaniyabash-4	Ganesh Himal	12	9	3	2019/4/2
14	Khaniyabash-4	Khadgabari	12	8	4	2019/4/5
15	Khaniyabash-4	Budhsingh Dhakal Thok	9	9	0	2019/7/3
		Total	**156**	**117**	**39**	

Picture 15: Affixing of Public Notice at Nearby Settlement for Borang Ratmate (Component 3)	Picture 16: Stakeholders Meeting at Lapang (Component 3)
	
Picture 17: Stakeholders Meeting at Borang (Component 3)	

F. Consultation Meeting Details for Pangtang Substation

S.N.	Municipality/RM	Place	No. of Participant	Male	Female	Date
1	Jugal RM-4	Dallepokhari	7	5	2	3/22/2018

367. During consultations with local communities, villagers have shown their support to the project. However, as detailed in Appendix 9, the local communities also repeatedly stressed the need for project affected families to be adequately compensated, to be kept informed about the project, for compensatory reforestation, for Community Forest User Groups to be involved during cutting and replantation works for affected forest land, as well as being provided with training in forest management, skill development, livelihood development, on opportunities for local employment, on ensuring wildlife is protected and the project's control of hunting and poaching within forest areas, and on ensuring health and safety control including risk of landslide. Suggestions were made on realignment, consideration of underground cables which was flagged as not possible due to cost-benefit, and rural electrification for all was a further concern raised.

368. As referred earlier, a particular safety issue raised during consultations to be taken care of at AP 27 of Borang-Ratmate transmission line, is that it traverses near the boundary of a school which does not have a compound wall. NEA confirmed that during detailed route survey the angle point will be shifted to avoid the school compound. Also fencing of the school boundary will be provided.

D. Meaningful Ongoing Consultation

369. Meaningful consultation should inform the environmental assessment before the commencement of works but should also continue throughout project implementation. Consultations at different stages may take the form of public consultations/meetings in villages,

focus groups e.g. for women, or one-on-one consultations with landowners, adjacent residents etc.

370. Given the current COVID-19 pandemic, in undertaking any additional face to face consultations once travel restrictions are lifted, it will need to be ensured by NEA and the contractor that national COVID-19 requirements and WHO meeting and hand hygiene guidelines are followed, including awareness raising activities for those undertaking consultations, minimizing travel requirements, undertaking screening health checks to confirm those going in the field are not symptomatic, providing them with adequate supplies of personal hand sanitizer and masks, ensuring social distancing of at least 1m, that masks are worn at all times during consultations, and that a register of all contacts is maintained as detailed in Appendix 8.

371. **Before Award of Contract**: During the detailed design stage public/community consultation through NEA will be carried out for all project components before contract award, specifically those components which due to COVID-19 restrictions it was not possible to complete at this stage. Consultations for each component must ensure a representative percentage of the local community are consulted, as well as gender balance and representation of vulnerable groups. Consultation suggestions/recommendations will be included in the updated IEE.

372. For the consultations, the dates, attendees, male/female split, details of any participants vulnerabilities, topics covered, and, views and opinions raised should be recorded along with details of how the project has responded to them. Consultation meetings are to have at least 20% representation of women (excluding NEA representatives) and involve indigenous peoples, if it is not possible at the public meeting/consultation a separate gender focus group must be held to ensure their concerns are heard. If public meetings are not possible to convene due to COVID-19 restrictions, then the same representation should be achieved through door-to-door consultations within communities.

373. Consultations should also convey how the DISCOM and contractor will ensure community health and safety during construction.

374. **Ongoing Consultation During Project Implementation**: Public consultation is an integral part of the project implementation. The process of public/community consultation and consultation with other concerned stakeholders will be continued during project implementation and as necessary during the operation and maintenance stage. The public and other concerned stakeholders will be informed about the project at every stage of project execution through notices, pamphlets, information provided through community representatives, and face-to-face consultations etc.

375. During detailed route surveys, NEA field officials will post notices and conduct meetings in concerned villages within 500m of substations, transmission, and distribution lines to include at least 20% representation of women (excluding NEA representatives) and involve indigenous peoples (and keep records of these meetings) at least one month in advance of any works taking place to inform them about the agreed schedule of and details of planned construction works in their area to help manage any disruption and disturbance and potential conflicts with local communities.

376. During detailed design and pre-construction, contractors in coordination with NEA field officers will hold face-to-face consultations will all persons occupying properties in close proximity of the substations up to 500m and within the ROW up to 50m of the transmission line alignment who will be most impacted to keep them fully informed of the nature of works and latest schedule, and to discuss any specific concerns these persons may have regarding environmental and social impact. Every individual on whose land the towers will be installed will also be consulted by the contractor/NEA prior to finalization of the position of the tower footings. In addition, all schools, health centers, places of worship and community centers along the transmission line alignments will also be consulted prior to finalization of the position of the tower.

E. Information Disclosure

377. All environmental safeguards documents are subject to public disclosure, and therefore will be made available to the public. In disclosing environmental information for the project to the public:

(i) NEA is responsible for ensuring that all environmental assessment documentation, including this IEE and environmental monitoring reports, are properly and systematically kept as part of the NEA project specific record;
(ii) all environmental documents (draft IEE, final/updated IEE, and environmental monitoring reports with corrective action plan (if required)) are subject to local public disclosure, and will therefore be made available to public by NEA (see below); and
(iii) environmental documents (draft IEE, final/updated IEE, and environmental monitoring reports also have to be disclosed on ADB's website, any update to the IEE during project implementation will be subject to ADB review and clearance before disclosure.

378. NEA to locally disclose by posting the environmental documents on the NEA website and ensuring full copies of the latest IEE and its executive summary translated into Nepali are available at all local NEA offices and project substations.

379. Notices will also be placed on noticeboards at the project sites and local NEA offices and pamphlets should be distributed in the project areas in Nepali, informing of the main findings of the IEE and the availability of the IEE and reports with notice given that help with their translation into Nepali and affected persons' dialects will be extended free of charge on request.

VII. GRIEVANCE REDRESS MECHANISM

380. NEA will establish a project-specific Grievance Redress Mechanism (GRM) to receive and manage any grievances (complaints) that may arise from the project and facilitate prompt resolution of affected persons' issues, concerns, problems, or claims. Affected persons may include members of the local community or construction workers. The project-wide GRM will address both environmental and social safeguard and other related eligible grievances/complaints raised by affected persons, in a timely and culturally appropriate manner.

> A **grievance** is an issue, concern, problem, or claim (perceived or actual) that an individual or community group wants to see resolved by the project.
>
> The **Grievance Redress Mechanism** is a locally based, project-specific extra-legal way to deal with and resolve project-related grievances/complaints faster than legal mechanisms and thus enhance project performance standards in terms of environmental and social safeguards.

381. The GRM will ensure that:

(i) physically or economically displaced people receive appropriate compensation in accordance with the Resettlement Plan;
(ii) the basic rights and interests of every person affected by the environmental and social performance of NEA and their contractors on the project are protected; and
(iii) issues, concerns, problems, or claims arising from any poor environmental or social performance of NEA and their contractors during the conduct of pre-construction, construction, operation & maintenance activities are promptly and effectively addressed.

382. Recourse to the project's GRM does not impede access to the country's judicial or administrative remedies. 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 Mechanism56 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 environmental and social safeguard policies.

383. The GRM will be set up upon loan effectiveness and be operationalized prior to the commencement of any civil works, including enabling works. PMD and the Contractor will appoint community engagement officers/GRM focals (focals): PMD will appoint a full-time project-wide focal, and the Contractors will appoint one full-time focal for each contract package/lot. All staff of NEA, PMD and the Contractors, as well as local and central government and other entities directly involved in the GRM process will receive a training prior to the start

[56] There are two parts to ADB's Accountability Mechanism, problem solving led by ADB's special project facilitator can assist the complainant in finding solutions to their problems, while compliance review, led by a three-member panel, can investigate alleged violations of ADB's operational policies and procedures, including safeguard policies, and recommend corrective actions to ensure project compliance.

of works to fully grasp their roles and responsibilities within the GRM as well as approaches to constructively resolve project-related grievances/complaints.

384. Communities within the project's area of influence will be made aware of this GRM as well as how to access it, including addresses and contact numbers, through (i) community awareness raising during community or one-on-one meetings; (ii) pamphlets distributed to the general public in the direct vicinity of the project site, in Nepali and translated in local languages as applicable; and (iii) notices on the radio and/or local newspaper, as well as notice boards on project-sites, at local NEA offices, and on NEA's website etc. Any concerned person or group of people can file a complaint through the project's GRM, at any time and at no cost.

385. PMD's and contractor's focals 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[57], 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. All staff and workers of NEA, PMD, Contractors and Subcontractors, will also be made aware of the existence of the GRM and must know who to direct any complainant to, if approached regarding a grievance. The local ward chief, District Forest Office, community forest groups, protected area managements, etc. will also be made aware of the GRM and will be able to provide appropriate contacts and redirect people to the focals.

386. The GRM will follow the three-tier structure. Figure 71 summarizes the process, while Table 67 lists key members and timelines.

387. An exhaustive grievance log must be kept at all times on-site by the contractor's focal. Any grievance/complaint received, whether minor or major, whoever it was first addressed to, must be reported to the contractor's focal and documented, including: name of the person making the complaint; date and time the complaint was received; relation of the complainant to the project; nature of the complaint; details of all meetings held, including participants, date, issues discussed and decisions taken; details of all actions taken towards resolution of the grievance; log of all formal communication sent to the complainant informing of the evolution of the process etc. Table 68 provides a template for a grievance/complaint register; it is recommended that a project-wide grievance handling database be set up by the PMD focal replicating the site logs at project-level.

388. Once a resolution has been proposed to the complainant, they will be asked to sign a form acknowledging receipt of that proposal and providing their approval or refusal, as applicable; this form will be added to the grievance/complaint register and once all actions are taken the associated entry will be closed but not deleted.

[57] The PMD web page has a dedicated space to send a message.

A. Site-level grievance handling protocol

389. The contractors will define a site-level grievance handling protocol, as initial input to the GRM. For any urgent matter, in particular emergency and health and safety issues, the contractor's site-level focal will take note of the grievance/complaint and get immediately in contact with the EHS Officer on site or with the EHS site supervisor for immediate action. Short-term issues (e.g. dust, noise, leaks, inappropriate behavior, conflict, etc.) may be corrected immediately under the direction of the focal, in collaboration with respective construction workers. In case of impending damage to structures, flora or fauna, or physical cultural resources, the focal shall get in immediate contact with the EHS Officer, biodiversity expert, or heritage expert who shall have the power to halt works until corrective action is taken. Whatever the source and the form in which the grievance/complaint is received and its nature, it should be accepted by the focal and registered in the grievance register.[58]

(i) First level of GRM

390. For longer-term grievances, the formal first level of GRM will be triggered. The contractor's site-level focal is in charge of this first level. All grievances/complaints will be sorted by the focal for their eligibility, 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.). The focal will send a formal reply to the complainant within 3 working days of the receipt of the grievance/complaint, to acknowledge receipt, provide the complaint's registration number, and set up a meeting in presence of the contractor's project manager. Through the first formal reply,[59] the complainant will be informed of the process and of his/her possibility to subsequently escalate the complaint in case no resolution were found at this stage; contacts to the second level GRM will be included.

391. During the meeting other participants may be called upon, including but not limited to: contractor's environment, health and safety, biodiversity or heritage officer, subcontractor's representative, PMD's junior EHS officer when on-site, etc. The affected person(s) may come in presence of two representatives of their choice (selected so as 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.

392. This first meeting shall take place no later than one week after receipt of the grievance/complaint.[60] During the meeting, the complainant and contractor's site-level focal will agree on the course of action to be taken and timeline to resolution. Details of the meeting will be documented; minutes of meeting will be signed by both complainant and the contractor's site-level focal and annexed to the grievance's file. If both parties do not agree on a resolution, the complaint may be escalated to the second level of GRM. If both parties agree, the contractor

[58] If the complaint is not eligible, the complainant should be informed of the reasons in writing and directed onto other appropriate mechanisms if applicable.

[59] Same template of this first communication is recommended to be followed project-wide.

[60] This timeline may only be extended if the affected person/group requests for a later date for the meeting based on availability. If the complainant has difficulty to travel to meeting location upon short notice, the location of the meeting may be flexible.

(and subcontractors, as applicable) 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 timeframe 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.

393. 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 contractor's on-site focal.

(ii) Second level of GRM

394. The second level of the 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 informed formally of 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.

395. 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 representative including one IP representative if applicable, PMD's senior environment, health and safety, biodiversity and/or social officer, as well as other members if applicable, including 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 timeframe 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.

(iii) Third level of GRM

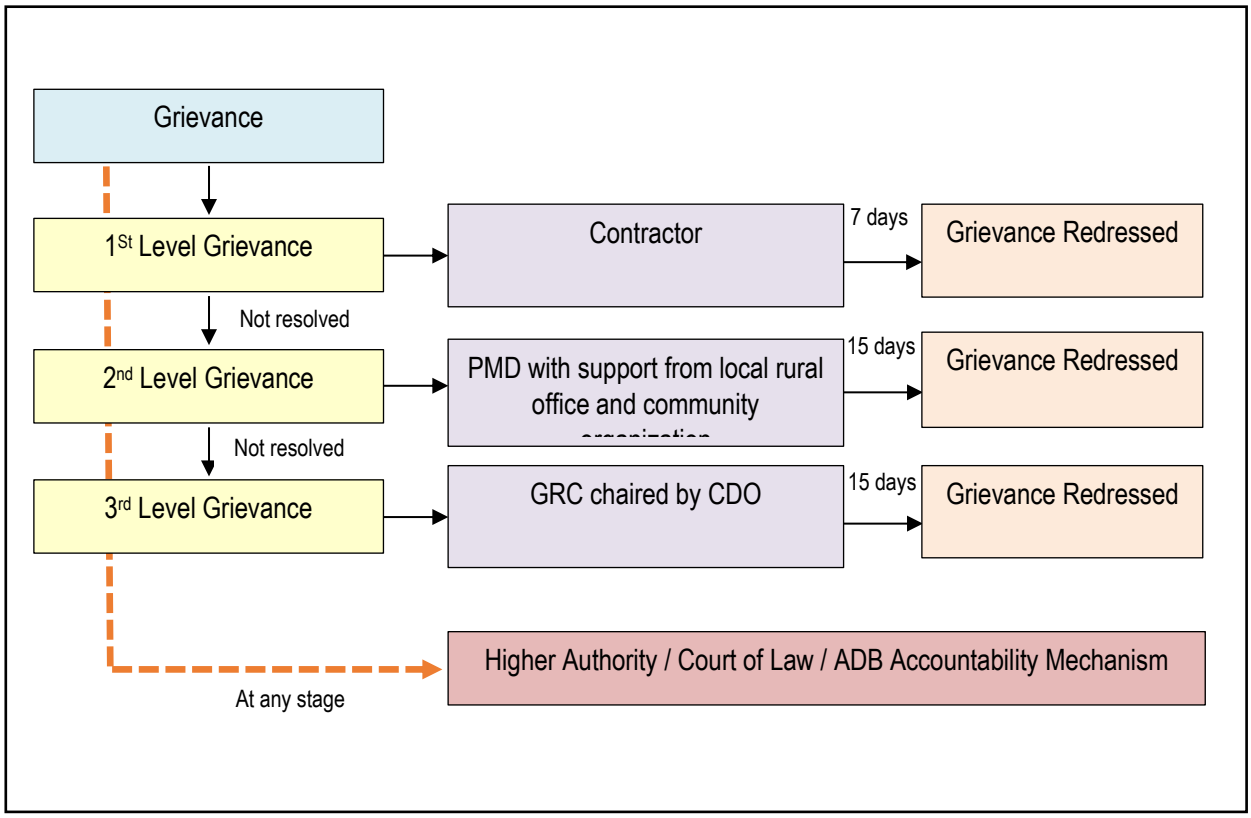
396. The same process of logging the grievance/complaint, communicating with the complainant and reporting will be followed. The third level of GRM is handled by NEA's EGMP project manager who will form a grievance redress committee chaired by the Chief District Officer, District Administration Office and made up of PMD's focal and environment or social 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.

397. 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.

398. 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. PSC 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.

399. **Budget.** NEA and the contractor will need to provide staff for and allocate budget for the GRM that will sufficiently cover the costs of its operations including initial awareness raising, capacity development trainings, support services, field inspections, meetings, documentation, and supplies etc.

Figure 71: Project's Grievance Redress Mechanism



CDO= Chief District Officer, GRC = Grievance Redress Committee, PMD = Project Management Department

Table 67: Summary of GRM level responsibilities and timelines

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) - Contractor's representative - Subcontractor's representative - PMD Junior EHS officer when on-site Total meeting members: 4-8	3 days: confirmation of receipt to complainant 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 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, biodiversity and/or social officer as applicable depending on environment or social issues being resolved - Local rural office and community organization representative Total meeting members: 4-8	3 days: confirmation of receipt to complainant 15 days: meeting between EGMP project manager and complainant and action plan agreed upon (or escalation to level 3) 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)	3 days: confirmation of receipt to complainant 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.

GRM Level	Composition	Maximum timeline
	- 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	

Table 68: 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

VIII. ENVIRONMENTAL MANAGEMENT PLAN

A. Introduction

400. This section is the Environmental Management Plan (EMP) prepared for the Electricity Grid Modernization Project (EGMP) that sets out the mitigation measures to avoid, minimize, mitigate, or compensate adverse environmental impacts and risks that have been identified in the previous sections. The EMP is a management tool and the issues are accordingly addressed with regard to the sequence of operations, i.e., those activities that apply to the detailed design, pre-construction, construction, and operation & maintenance phases of the project. The EMP has been developed as part of the environmental assessment to avoid, minimize, and mitigate potential negative impacts of the project. The EMP is applicable to all components under the EGMP.

401. The purpose of the EMP is to guide the detailed design, pre-construction, construction, and operation & maintenance of the project as per Nepali environmental, health and safety and ADB Safeguard Policy Statement (2009) requirements. The EMP reflects national requirements and international good practice for potential environmental impacts and risks during implementation, including developing site-specific biodiversity and heritage management plans for transmission lines affecting ecologically and culturally sensitive areas which will be cleared by ADB before any works can go ahead; adhering to electromagnetic field (EMF) exposure and noise guideline levels; approving contractor's pollution prevention, solid and hazardous waste management, and health and safety management plans (including COVID-19 provisions) prior to works; prohibiting PCB use in new transformers and asbestos containing materials in construction; and, community awareness raising activities on biodiversity conservation in the vicinity of ecologically sensitive areas and the health and safety risks of electrical equipment. To assure these mitigation measures are implemented, the Project Management Directorate (PMD) within Nepal Electricity Authority (NEA) supported by a Project Supervision Consultant (PSC) will undertake a program of environmental supervision and monitoring during project implementation.

402. The EMP is dynamic and can be updated as appropriate during project implementation. However, any update to the EMP will first need to be cleared by ADB. In addition, any unanticipated impacts, or requirements for corrective action due to non-compliance during project implementation will be reported by NEA to ADB, and appropriate action taken by NEA to address them.

403. The EMP contains a number of components crucial to effective environmental management within the project, these include:

- proposed Corrective Action Plan for existing facilities to be implemented by NEA pre-construction (Appendix 3);
- plan for mitigation of impacts (during detailed design, pre-construction, construction and operation & maintenance) including performance standards (Appendix 10 – Table 10.A);
- quantitative monitoring plan including monitoring parameters and performance indicators (Appendix 10 – Table 10.B); and,
- implementation arrangements, including organizational roles and responsibilities for mitigation, supervision, monitoring and reporting, preliminary cost estimates/budget (Table 70), and capacity development requirements (for various aspects of EMP implementation) (Table 69).

- Grievance redress mechanism – Section VII of the IEE, with roles and responsibilities for the contractor and NEA.

404. Once the ADB loan has become effective, NEA will award 9 contract packages/lots covering the 10 project components therefore the project will involve up to 9 different contractors. This EMP will be part of all bidding and contract documents and during detailed design, pre-construction, and construction the contractor will be responsible for implementing all relevant measures for the project components in their package/lot under the supervision of NEA supported by the PSC.

405. NEA will establish a formal, fully functional environment and social safeguard safeguards unit in the PMD and provide requisite facilities and equipment to enable its operation. Under the direction of this safeguards unit, NEA will assign or appoint a suitably qualified and experienced environmental safeguards team to the project support EMP implementation and be responsible for undertaking regular on-site supervision and monitoring of the project. The environmental safeguards team will comprise (i) a full-time Senior Environmental Officer; (ii) a full-time Senior Occupational Health and Safety Officer, (iii) a full-time Senior Biodiversity Officer; (iv) 8 full-time Junior EHS Field Officers, who will be based on-site to supervise the contractors during the construction period;[61] and (v) a full-time Community Engagement/GRM Officer. NEA will also employ ecological and archaeologist (either consultant and/or DOA expert) third-party services in relation to ensuring full-time supervision and monitoring of all works undertaken within the boundaries of Parsa National Park, Koshi Tappu Wildlife Reserve buffer zone, Chure Conservation Area,[62] existing/proposed key biodiversity areas and the existing/proposed Kathmandu Valley World Heritage Site (Swayambhu).

B. Corrective Action Plan

406. Since the project involves existing facilities (substations) that have been subject to environmental audit it is necessary for corrective action to be undertaken. Appendix 3 contains the corrective action plan for existing facilities; unless otherwise indicated, all actions are to be completed by NEA prior to the contractor being given access to project sites involving existing facilities.

[61] 3no. EHS Field Officers, one each for the 3 contract packages covering components 1, 2, and 3; 3no. EHS Field Officers for the contract package covering components 9a, 9b and 9c; 1no. EHS Field Officer to cover all new substation packages/lots covering components 4 and 5, and 1no. EHS Field Officer to cover all remaining contract packages for components 6, 7 and 8.

[62] Chure Conservation Area is an environmental protection area, it does not have the same protected area status as a conservation area.

C. Mitigation Plan

407. Table 10.A in Appendix 10 presents the mitigation plan. The actions in the mitigation plan are set out according to when they are to be implemented by NEA and the contractor, e.g. during (i) detailed design and pre-construction preparatory activities; (ii) on-site enabling, construction, testing and commissioning work activities which are primarily the responsibility of the contractor; and (iii) operations and maintenance activities which are the responsibility of NEA. Biodiversity conservation is a key concern given that project components and associated facilities pass through or in the vicinity of protected areas and their buffer zones, important bird areas, and forest areas as discussed in the IEE. The mitigation plan requires further biodiversity assessment and management planning to be undertaken for all project components and associated facilities directly or indirectly affecting ecologically sensitive areas. In relation to associated facilities it also requires the completion of a strategic environmental assessment of the Transmission System Master Plan 2020-2040 (July 2018) focusing on transmission line routings affecting protected areas/critical habitat and potential alternatives.

D. Monitoring Plan

408. Table 10.B in Appendix 10 presents the minimum provisions for quantitative environmental monitoring and performance standards for implementation of the project. Quantitative monitoring activities may be modified during project implementation, depending on contractors' performance and analytical results. If environmental performance is worse than expected, corrective action will be identified, and monitoring activities will need to be adjusted accordingly to help resolve any noncompliance. 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.

409. Power transmission and distribution systems including lines and substations do not emit conventional pollutants, except for emissions from construction activities, used equipment and materials, and domestic wastes from substations. Given requirements to site away from surface and groundwater sources sediment laden runoff, spills of fuel, lubricating oils, and transformer oils would be localized and unlikely to result in detectable pollution of surface or groundwaters unless extensive. Since works on transmission lines are transient, quantitative air quality and noise monitoring is focused on earthworks and noisy activities when construction impacts are likely to be greatest. For project components and associated facilities affecting ecologically sensitive areas, quantitative monitoring including tree loss, reforestation, and bird collision will be undertaken.

410. Once the ADB loan has become effective, NEA will prepare and submit environmental monitoring reports to ADB semiannually as well as safeguards inputs to quarterly progress reports. The semiannual environmental monitoring reports will describe project implementation progress, any scope or design changes, compliance against safeguards loan covenants, progress of environment activities, quantitative monitoring results in accordance with the EMP, grievances received, and a time bound, budgeted corrective action plan for any breaches of performance standards or other non-compliances recorded by NEA, PSC and/or the contractors.

411. NEA will carry out the following actions to supervise and monitor EMP implementation, not an exclusive list.

(i) Environment safeguards team (para 5) to conduct and document the findings of at least weekly supervision visits by junior officers, using checklists, for all ongoing construction works; as some contract packages/lots involve multiple locations or linear construction, officers should direct their supervision efforts towards the most environmentally sensitive but at the same time ensuring no active construction sites are overlooked.

(ii) Environment safeguards team to undertake and document the findings of at least monthly supervision visits and periodic "spot check" site visits by senior officers, involving detailed review of safeguards compliance using checklists, for all ongoing construction works; as some contract packages/lots involve multiple locations or linear construction officers should direct their efforts to the most environmentally sensitive but at the same time ensuring no contract packages/lots are overlooked by their supervision.

(iii) Environment safeguards team to confirm compliance of the PMD and the contractors with the EMP and progress toward the desired outcomes for ongoing measures; if necessary, identifying corrective actions for any non-compliance identified and developing corrective action plans.

(iv) Require the PMD and/or contractors to implement corrective action plans to ensure progress toward the desired outcomes.

(v) Environment safeguards team to document its monitoring findings in the environmental monitoring reports, including corrective actions for any non-compliance identified – consolidating the findings of monthly reports from the contractors and their own supervision visits into the safeguards inputs to quarterly progress reports and semiannual environmental monitoring reports for submission to ADB.

(vi) Submit the safeguards inputs to quarterly progress reports and semiannual environmental monitoring reports to ADB for review and disclosure on the ADB website, from loan effectiveness up until the Project Completion Report is issued, or longer if recommended on completion.

(vii) Locally disclose the findings of the environmental monitoring reports through publication on the NEA website, making copies of the reports available at all local NEA offices and project substations, and posting notices at construction sites informing of the main findings and the availability of the reports which should be shared in full and translated into Nepali and affected persons' dialects upon request.

(viii) Inform ADB of any changes to the design or scope of the project or other unanticipated impacts and any changes to the IEE/EMP that are required prior to implementing the changes; any IEE/EMP update must be cleared by ADB and disclosed on its website.

412. NEA will facilitate ADB to carry out the following monitoring actions to supervise project implementation:

(i) Conduct periodic site visits during the project implementation to confirm compliance with the EMP, loan covenants, SPS 2009 and IFC EHS General and Transmission and Distribution Guidelines.

(ii) If required, conduct supervision missions with detailed review by ADB's safeguard specialists/officers or consultants.

(iii) Review and comment on the periodic environmental monitoring reports submitted by

NEA to ensure that adverse impacts and risks are mitigated as was planned and agreed with ADB, that any corrective actions have been duly implemented, and that the GRM is fully functional.

(iv) Work with NEA to rectify to the extent possible any failures to comply with their safeguard commitments, as covenanted in the loan agreement, and exercise remedies to re-establish compliance as appropriate.

(v) Prepare a project completion report that assesses whether the objective and desired outcomes of the EMP has been achieved, considering the baseline conditions and monitoring results.

413. For this purpose, NEA and their contractors will provide ADB with access to the site and all requested information on the project.

414. For any ADB supervision missions to ongoing construction works NEA and their 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 IFC EHS General Guidelines - Occupational Health and Safety Section.[63]

E. EMP Work Plan

415. Once the ADB loan has become effective, the project will be implemented over a period of five years from 2021-2025. However, the detailed design stage has already commenced in parallel with project preparation. During the remaining detailed design period, additional meaningful consultation, baseline data collection, assessment, and management planning as detailed in Table 10.A in Appendix 10 will be completed by NEA to comply with ADB Safeguard Policy Statement (2009) requirements.

416. This includes confirming that all works within protected areas are in accordance with the relevant management plan and undertaking further biodiversity and heritage assessment and management planning for all project components affecting environmentally sensitive areas. Strictly no contracts will be awarded, and no forest clearance, on-site pre-construction or construction activity is to take place before the updated IEE/EMP reflecting completion of these actions for the relevant project components and site-specific biodiversity and heritage management plans have been cleared by ADB and the final EMP has been incorporated into the contract documentation.

417. NEA will secure the required national EIA/IEE approvals from the Ministry of Energy, Water Resources, and Irrigation for all new transmission lines before any contracts are awarded.

[63] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

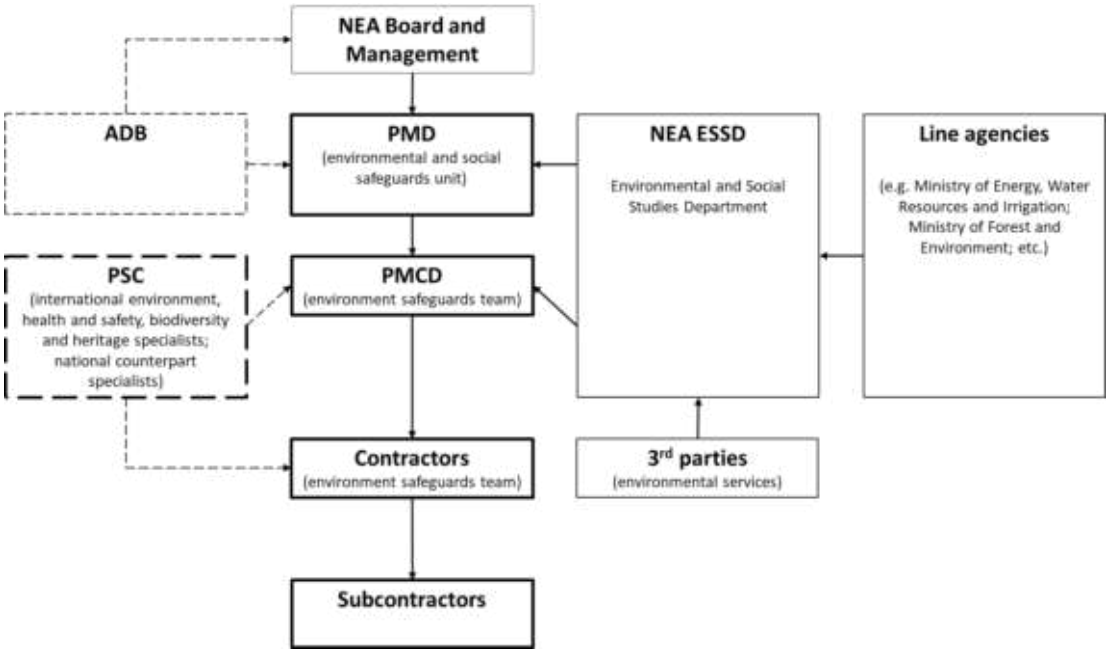
F. Institutional Arrangement and Responsibilities for EMP

418. The main institutions that will be involved in environmental management and monitoring activities for this project are:

- NEA, as the Project's executing agency – responsibility for environmental, health and safety management and compliance with Nepali regulatory requirements and ADB's Safeguard Policy Statement (2009) and the Project's loan covenants ultimately lies with NEA Board and Management.
- Project Management Directorate (PMD) of NEA as the Project's implementing agency – responsible for the overall management of the technical, environmental, and social aspects of the project and thus compliance with Nepali regulatory requirements and ADB's Safeguard Policy Statement (2009) and the Project's loan covenants. Within the PMD, the Project Management Coordination Division (PMCD) will be responsible for the day-to-day management of the technical, environmental, and social aspects of the project including updating the IEA/EMP for ADB clearance and obtaining the required national EIA/IEE approvals.
- Project Supervision Consultants (PSC) – consulting firm employing national and international consultants to support the PMD in overseeing project implementation, including environment safeguards capacity development and training of NEA officers.
- Contractors for each of the 9 contract packages/lots and their subcontractors, if any – through the contract NEA will delegate responsibility for implementing all relevant measures for the project components in their package/lot under the supervision of NEA supported by the PSC.
- Construction workers employed formally or informally by the contractors and their subcontractors – these workers will need to abide, in their behavior and work, to directives issued by their employer with regards to environmental, health and safety management.
- NEA Environment and Social Studies Department – provides technical support to NEA operations.
- Line agencies with regulatory responsibilities (e.g. Ministry of Forest and Environment; Ministry of Energy, Water Resources, and Irrigation; Department of National Parks and Wildlife Conservation; President Chure Terai Madhesh Conservation Development Committee; etc.).
- ADB – project finance.

419. Key roles and responsibilities with respect to EMP implementation, supervision and monitoring are discussed in more detail below with the implementation arrangements illustrated in Figure 72.

Figure 72: Institutional Arrangement for Environmental Management Plan Implementation



NEA= Nepal Electricity Authority, QA/QC= Quality Assurance/Quality Control

(a) NEA

420. NEA is both executing and implementing agency with overall responsibility for implementing the EMP and complying with Nepali regulatory and ADB's Safeguard Policy Statement (2009) requirements.

421. During project implementation, NEA is responsible for the following (not an exclusive list):

(i) Establishing a formal, fully functional environment and social safeguard safeguards unit in PMD and providing requisite facilities and equipment to enable its operation. This unit is to be established before the commencement of works, including any pre-construction enabling works.

(ii) Upon loan effectiveness, assigning or appointing a suitably qualified and experienced environmental safeguards team, under the direction of the safeguards unit, to support EMP implementation and be responsible for undertaking regular on-site supervision and monitoring of the project. The environmental safeguards team will comprise: (i) a full-time Senior Environment Officer, (ii) a full-time Senior Health and Safety Officer, (iii) a full-time Senior Biodiversity Officer, (iv) 8 full-time

Junior EHS Field Officers, who are to be based on-site during the construction period, and (v) a full-time Community Engagement/GRM Officer.

(iii) Securing ecological and archaeologist (either consultant and/or DOA) third-party services in relation to further assessment, management planning and ensuring full-time supervision and monitoring of works in Parsa National Park, Koshi Tappu Wildlife Reserve buffer zone, Chure Conservation Area, and the Kathmandu Valley World Heritage Site (Swayambhu).

(iv) Implementing and supervising and monitoring implementation by the contractor of the EMP during the detailed design, pre-construction, construction, operation & maintenance phases.

(v) Continue to consult with and secure written confirmation from the protected area management of Parsa National Park, Koshi Tappu Wildlife Reserve buffer zone, and Chure Conservation Area as to actions required to ensure works are in accordance with their management plans and measures to promote and enhance their conservation aims, to comply with ADB Safeguard Policy Statement (2009) requirements for legally protected areas.

(vi) Continue to consult with and secure written confirmation from the Department of Archaeology (DOA is also representative of UNESCO) as to actions required to ensure works in Kathmandu Valley World Heritage Site (Swayambhu) are in accordance with the integrated management plan, to comply with ADB Safeguard Policy Statement (2009) requirements for physical cultural resources.

(vii) Undertaking additional meaningful consultation, baseline data collection, assessment, and management planning as detailed in the EMP to comply with ADB Safeguard Policy Statement (2009) requirements during detailed design. This includes undertaking further biodiversity assessment and management planning for all project components affecting ecologically sensitive areas; further heritage assessment and management planning for the works in Kathmandu Valley World Heritage Site (Swayambhu) with particular emphasis on accidental scenario.

(viii) Project components having associated facilities which are unable to avoid significant irreversible impacts on protected areas/critical habitat post-mitigation cannot be supported by the project.

(ix) Updating the IEE/EMP prior to contract award, to ensure it reflects the findings of additional meaningful consultations, baseline data collection, assessment, and management planning and obtaining ADB's clearance prior to incorporation of the final EMP in the contract documentation. Once cleared, ADB will disclose the updated IEE online.

(x) Incorporating the final EMP into the bidding documents and contract documents for each package before contract awards. The contract will explicitly exclude the use of PCBs and any asbestos containing materials, require the contractor to undertake health and safety (H&S) risk assessment and develop a H&S plan including COVID-19 response, and to provide counterpart safeguards staff, as applicable to the project components under their contract.

(xi) Updating the IEE/EMP to ensure it reflects the detailed design for all project components and obtaining ADB's clearance prior to the commencement of any work, including any pre-construction enabling works. Once cleared, ADB will disclose the updated IEE online.

(xii) Implementing the corrective action incorporated into the EMP before any works at existing facilities (substations) commence.

(xiii) Ensuring works in Parsa National Park, Koshi Tappu Wildlife Reserve buffer zone, and Chure Conservation Area, as reflected in the IEE, are confined solely to the new or existing rights of way of these lines and substation boundaries and supervised full-time by a third-party ecologist under the direction of the Senior Biodiversity Officer. Site-specific measures for these locations as set out in the EMP are to be implemented, with detailed designs and site-specific construction biodiversity management plans to be agreed in writing and cleared by ADB before any works in these ecologically sensitive areas including enabling works are permitted. For works within the biodiversity protected areas actions to promote and enhance their conservation aims as agreed with the protected area management are to be implemented. No other works will take place in the boundaries or buffer zones of internationally important biodiversity areas.

(xiv) Ensuring works in the existing/proposed Kathmandu Valley World Heritage Site (Swayambhu) are confined solely to the existing right of way of the line and supervised full-time by a third-party archaeologist (either consultant and/or DOA expert) under the direction of the Senior Environment Officer, as well as Department of Archaeology staff. Site-specific measures for this location as set out in the EMP are to be implemented, with detailed designs and site-specific construction heritage management plan to be agreed in writing and cleared by ADB before any works in this culturally sensitive area take place. No other works will take place in the boundaries or buffer zones of internationally or nationally important cultural heritage sites.

(xv) Establishing and operationalizing the grievance redress mechanism (GRM) for affected persons (construction workers and local community members) in line with provisions of the IEE, including establishing a grievance redress committee headed by the NEA project manager, for affected persons before loan effectiveness, and promptly addressing any environmental grievances received throughout the project. Contact details for the GRM will be prominently displayed on notice boards at the project sites. Further details on the GRM are provided in Section 7.

(xvi) Continuing to undertake meaningful consultation (community liaison) during implementation, including prior to finalization of detailed designs, giving attention to consultations with women, Indigenous Peoples, and other vulnerable groups. All ongoing consultation and grievance-related information, such as, minutes of the meetings and decisions will be documented and summarized in the periodic environmental monitoring reports submitted to ADB.

(xvii) Locally disclosing the IEE and other environmental safeguards documentation. This will include NEA website publication and ensuring full copies of the IEE and its executive summary translated into Nepali are available at all local NEA offices and project substations; notices will also be placed on noticeboards at the project sites and local NEA offices and pamphlets should be distributed in the project areas in Nepali, informing of the main findings of the IEE and the availability of the IEE and reports with notice given that help with translation to Nepali and affected persons' dialects will be extended free of charge on request.

(xviii) Updating the IEE/EMP as necessary and locally disclosing any updates if unanticipated impacts (including project scope or design changes) occur during implementation; any such updates must be submitted to ADB for clearance and disclosure on the ADB website before any works commence.
(xix) Ensure adequate budget, institutional support, and staff resources are allocated to implement, supervise and monitor the EMP including per bullet (ii) sufficient number of suitably qualified and experienced environmental, health and safety officers to cover supervision of all the concurrently ongoing contract packages.
(xx) Ensure that all NEA project staff support and attend all capacity development and training activities provided, and to facilitate the provision of the training venues etc.
(xxi) Preparing periodic monitoring reports semi-annually up until the completion of construction, and during operation up until the project is closed, or for a longer period if this is specified in the project completion report.
(xxii) Developing and taking all requisite corrective action in case of any non-compliance with the EMP during implementation including repair of any property damage and financial compensation (insurance) for any health and safety incidents.

(b) Project Supervision Consultants

422. For environment safeguards the PSC will include: an international environmental specialist, an international health and safety specialist, an international biodiversity specialist, and an international heritage specialist to provide necessary on-the-job support and training to the NEA.

423. PSC will also include national counterpart specialists to support PMD undertake further assessment, management planning and supervision, although PMD environment safeguards team remain responsible for carrying out the regular on-site supervision and monitoring of the project.

424. In addition to supporting NEA with project supervision and monitoring and updating of safeguard documents, as required, the PSC safeguard specialists will be tasked with providing formal training sessions and on-the-job training for the project management and safeguard officers of NEA, as well as the contractors' management and safeguard officers. This includes trainings on understanding ADB's Safeguard Policy Statement (2009) environment and social requirements, implementing the EMP, and preparing the periodic environmental monitoring reports.

425. During project implementation, PSC will be responsible for the following (not an exclusive list):

(i) Develop and deliver training materials for NEA and their contractors at appropriate stages in the project implementation to develop capacity in relation to understanding of the ADB's Safeguard Policy Statement (2009) and EMP requirements, as well as international good practice.
(ii) Support NEA to update the IEE/EMP prior to contract award and to update the IEE/EMP prior to the commencement of works and subsequently as necessary due to any unanticipated impact or alterations in scope or design.

(iii) Support NEA to undertake ongoing meaningful consultation for all project components, particularly in relation to finalizing detailed designs and construction schedules or relating to any subsequent change in scope.
(iv) Support NEA to operationalize and effectively implement the grievance redress mechanism, including raising awareness of its existence with affected communities, resolving grievances related to environmental issues that have been submitted, and keeping adequate documentation.
(v) Support NEA in ensuring EMP provisions are incorporated into the contract documents for each package/lot before contract awards.
(vi) Support NEA in reviewing the environmental aspects especially "bird sensitive" design elements of detailed designs prepared by contractors, as well as contractor's preconstruction documentation.
(vii) Review documentation and undertake site visits to confirm that all corrective actions for existing facilities (substations) have been adequately implemented prior to a contractor being given access.
(viii) Prepare Detailed EHS Monitoring Framework (checklists) for use by PMD environment safeguards team to effectively supervise and monitor the implementation of the EMP and the contractor's various environmental management plans during preconstruction, construction, operation & maintenance phases.
(ix) Support NEA to undertake quantitative monitoring required by the EMP and provide advise (e.g. templates) for adequate record keeping for environmental monitoring purposes and to prepare periodic environment monitoring reports.
(x) Conduct quarterly routine inspections of ongoing construction works and recommend corrective action where non-compliance with ADB's Safeguard Policy Statement (2009) and EMP requirements are observed.
(xi) Support NEA to develop and implement corrective action plan for any non-compliance during implementation.

(c) Construction Contractors

426. Construction contractors will be required to 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.

427. Contractors will be required to comply with the EMP during detailed design, preconstruction, and construction, closely supervised and monitored by NEA supported by the PSC. The contractors will be delegated, through the contract, the requirement to undertake mitigation and monitoring actions as set out in the EMP and to assist with the GRM, but ultimate responsibility for implementation lies with NEA.

428. The EMP is to be incorporated into all bidding and contract documents and contractors are to ensure that its requirements are cascaded down to all sub-contractors undertaking works relating to the project, regardless they are formally or informally employed. Contractors will be delegated responsibility for implementation of relevant measures of the EMP including their

approved CEMPs and ensuring health and safety at construction sites as well as at any workers camps.

429. In addition to the environmental and social safeguards staff and consultants at NEA and in the PSC, the contractors will be required by the contract to employ the following suitably qualified and experienced officers:

- one dedicated environment officer and one dedicated health and safety officer for each contract package/lot to monitor and supervise safeguards work on a day to day basis;
- one dedicated biodiversity officer for each contract package involving a new transmission line – components 1, 2 and 3;
- one dedicated biodiversity officer for each upgraded transmission line (components 9a and 9b unless undertaken sequentially) and one dedicated heritage officer (component 9c) for the contract package involving upgraded transmission lines; and
- nominate a community engagement/GRM officer for each contract package/lot to keep affected persons informed of works and be available to receive and deal with any grievances at the project site level, for new transmission lines this will be a dedicated officer.

430. These officers of the contractor will be responsible for reporting environmental safeguards progress at least monthly to NEA and providing necessary inputs to NEA for the periodic environmental monitoring reports for the duration of their contract. In addition, each active construction site or team to have an engineer on-site full-time nominated to the role of EHS Officer with responsibility for ensuring EMP implementation, acting on the advice of, and reporting to the environment safeguards team.

431. During project implementation, the contractor is responsible for the following (not an exclusive list):

(i) Implementing the EMP, in particular all activities and responsibilities allocated to the Contractor under the EMP during the full duration of the Contractor's involvement in the project.

(ii) Ensuring adherence to all applicable national environment, health, safety, and labor laws and regulations.

(iii) Preparing sub-plans including Construction EMP plus Site-Specific Biodiversity Management Plan, Site Specific Heritage Management Plan, Traffic Management Plan, Construction Waste Management Plan, Health and Safety Plan, and Emergency Response Plan etc. as specified in the EMP for review by NEA and PSC and approval by NEA prior to the commencement of works.

(iv) Ensuring that construction workers including all formal and informal subcontractors understand their responsibilities to implement the EMP and mitigate environmental impacts associated with their detailed design, pre-construction and construction activities, and providing - with support from PMD - training to formal and informal construction workers and other personnel as required.

(v) Supporting the PMD in undertaking ongoing consultation and implementing the GRM; in particular, the Contractor's community engagement/GRM officer shall thoroughly document details of complaint and make its best efforts to resolve the complaint at local level; all these information are to be included in the Contractor's monthly reports to PMD.

(vi) Undertaking environmental monitoring as set out in the EMoP (Table 10.B, Appendix 10) during pre-construction and construction and documenting qualitatively and quantitatively monitoring results.
(vii) Submitting monthly environmental management reports to PMD (these reports will be included as part of the contractors' monthly progress reports), relating the work undertaken over the reporting period and documenting the environmental measures including monitoring activities that have been carried out, problems encountered including near misses and accidents, grievances received, and follow-up actions that were taken (or will be taken) to correct the problems.
(viii) Informing PMD immediately in case design changes or unanticipated environmental impacts occur during the project implementation stage, and, as required, provide any information needed to NEA/PSC to promptly update the IEE/EMP for clearance by ADB before any changes are implemented.
(ix) Informing PMD immediately in case of non-compliance and help NEA/PSC prepare and implement as necessary a corrective action plan for clearance by ADB.

G. Capacity Development

432. NEA has implemented several ADB projects and has an adequate understanding of ADB's requirements for environment and social safeguards. However, although NEA has some capacity to ensure compliance with safeguards, using their-party services where needed, a recent study carried out jointly by ADB and the World Bank identified several capacity issues. It has made the following recommendations for strengthening institutional capacity on environmental and social risk management:

- Develop an Environmental and Social Management System.
- Realign the structure of NEA to better integrate and strengthen environmental and social risk management.
- Review the procedures for obtaining environment and social safeguards services with the view to streamlining these procedures.
- Ensure adequate environment and social safeguards staffing and develop plan for capacity development.
- Form a corporate level accountability mechanism and prepare guidelines for a grievance redress mechanism.

433. The project will require NEA to initiate implementation of these reform measures by establishing a formal, fully functional environment and social safeguard unit within the PMD which will be headed by a Director and supported by NEA staff and consultants with expertise on environment and social safeguards who will initially be appointed to support the project implementation.

434. Since the safeguards capacity of NEA can be strengthened, capacity development will be provided through the PSC. International consultants with environment, health and safety, and biodiversity safeguards expertise are to be appointed under the PSC to provide necessary support and training to the NEA. To help develop NEA capacity Table 69 shows the training activities to be undertaken. Renumeration costs for PSC (resource persons) are separate to the below breakdown.

TABLE 69: PROPOSED TRAINING ACTIVITIES

Item	Attendees	Delivered By	Total Cost (US$)	Budget Source
Introduction to ADB's Safeguard Policy Statement (2009), EHS Guidelines, Project EMP (3no. separate sessions) *	Environment Safeguards Team/National PSC/Contractors' EHS Management	International PSC	12,000	NEA Contribution
EMP implementation for detailed design including biodiversity components (3no. separate sessions) *	PMD/Contractors Design Teams	International PSC	12,000	NEA Contribution
Bird electrocution and collision with power lines and adopting "bird sensitive" design	PMD/TL Contractors Design Teams/NEA/Line Agency Government Officials	International PSC	8,000	NEA Contribution
Site supervision and monitoring including use of Detailed Monitoring Framework (checklists) and preparing periodic Environmental Monitoring Reports	Environment Safeguards Team/National PSC/Contractors' EHS Management	International PSC	4,000	NEA Contribution
GRM operation	GRM Committee Members, GRM Focal Points of PMD and Contractors	International PSC	4,000	NEA Contribution
EMP implementation for pre-construction and construction including biodiversity components (3no. separate sessions) *	PMD/Contractors Construction Teams	International PSC	12,000	NEA Contribution
SF6 awareness raising for O&M	PMD/O&M	International PSC	4,000	NEA Contribution
Contingency	@ 10%		5,600	
		Total	**61,600**	

*Given 10 contractors are involved separate sessions are proposed to address the aspects of the project EMP specifically related to (i) new transmission lines, (ii) upgraded transmission lines, and (iii) other project components.

H. Environmental Management Budget

435. Preliminary cost estimates for implementation of the EMP over the 5 years implementation period are shown in Table 70. These estimates are subject to revision. The EMP cost will be funded by the project, it is approximately 3% of the total project costs. Any costs referenced in Table 70 are indicative only and will need to be updated following open bidding process of PSC and contractor, etc.

TABLE 70: ENVIRONMENTAL MANAGEMENT, INDICATIVE BUDGET

ITEM	UNIT	UNIT COST ($)	TOTAL ($)	BUDGET SOURCE
Training/Capacity Development Cost (Table 69)	LS	n/a	61,600	NEA Contribution
Safeguards Team of PMD for project duration	LS	n/a	n/a	NEA Operational Costs
Monitoring Equipment for Safeguards Team – cf. EMoP	LS	n/a	10,000	Project Loan
Ecological/Archaeological Third-Party Services	LS	n/a	99,000	NEA Contribution
PSC Safeguards Support (estimated consultant costs)	LS	n/a	452,000	Project Loan
Corrective Action for Existing Facilities (35no. substations) (Appendix 3)	LS	n/a	350,000	Project Loan
Detailed design, preconstruction and construction mitigation and monitoring cost from EMP except for compensatory reforestation and purchase cost of bird divertors (Appendix 10)	LS	n/a	2,034,870	Project Loan (Contractors Costs)
Compensatory reforestation (tree nursery, transport, plantation management)	LS	n/a	830,564	NEA Contribution
Cost for Land Necessary for Compensatory Plantation	LS	n/a	231,371	Project Loan
Bird divertors**	LS	n/a	1,398,573	Project Loan
Biodiversity enhancements (protected areas ecological enhancements)	LS	n/a	50,000	Project Loan
Conservation Awareness Raising for the Community Forest Groups	LS	n/a	10,000	Project Loan

ITEM	UNIT	UNIT COST ($)	TOTAL ($)	BUDGET SOURCE
Operation & maintenance mitigation and monitoring cost from EMP (Appendix 10)	LS	n/a	n/a	NEA Operational Costs
Contingency	LS	@10%	552,798	
TOTAL			**6,080,776**	
% of Total Project Cost	%		**3.11**	

LS = lump sum
** excludes cost of installation, to be covered in contractors' costs

IX. CONCLUSION AND RECOMMENDATIONS

436. Under ADB's Safeguard Policy Statement (2009), the EGMP has been classified as "B" for environment requiring the preparation of an IEE. Following the requirements of ADB's Safeguard Policy Statement (2009) and national (Nepal) environmental assessment health, and safety requirements, this IEE has been prepared, covering all components of the EGMP having environmental impact.

437. The transmission line and substation work under Output 1 will be spread across various locations in Province number 1, Bagmati province, Gandaki province, province number 5, and Karnali province.

438. A total of 227.5 ha will fall under the rights of way of the 3 new overhead transmission lines, including 86.7 ha of forest land for which a compensatory reforestation program will be implemented. Compensatory afforestation at a ratio of 1:25 will be provided for the 12,950 trees to be felled on forest land (8,358 private trees will also be lost) as well as forest land replacement for 3.08ha of land to be planted at 1,600 trees/ha under tower footings. In particular, 7.4 km of the new Ghorahi-Madichaur transmission line runs along a river valley that falls within the IUCN category VI Chure Conservation Area which is designated to conserve natural habitats whilst allowing sustainable use of natural resources. 400 m of this section also passes through the outskirts of the Dang Deukhuri Foothill Forests and West Rapti Wetlands Important Bird Area. Due to the location of Ghorahi substation within the protected area, whilst alternative routings were considered to minimize forest loss, it has been unavoidable to pass through it. However, its protected area management plan specifically includes improving access to energy including through "extension of access to national electricity power transmission" as an objective. 13.32 ha of land within the Chure Conservation Area will fall under the right of way of the transmission line which is mainly agricultural land (modified habitat) with existing road access; thus no forest land is impacted within the protected area and the transmission line will not open up access to it. Dang Deukhuri Foothill Forests and West Rapti Wetlands Important Bird Area was recently extended to include the Charinge Community Forest, this forest land supports a breeding site for critically endangered vultures, located approximately 2km distant. To ensure ADB's Safeguard Policy Statement (2009) critical habitat requirements can be met, and there will be no reduction in their population due to electrocution or collision, "bird sensitive" design following international good practice will be adopted including installation of bird divertors along the entire transmission line to minimize collision risk. During detailed design towers will also be located as far west as is possible from Charinge Community Forest and the river. Whilst the other new transmission lines do not affect protected areas, where they cross ridge/valley crossings and waste dumps, bird divertors will be installed 500m either side. The project will also provide a biodiversity offset in the form of installing bird divertors on an additional 90km of transmission line within vulture safe zones. During construction work, temporary storage areas and worker camps will be located outside of forest and protected areas and there will be strict prohibition with penalties for the construction workers on the use of fuel wood, poaching of wild animals, etc.

439. Output 1 also involves the upgrade of existing transmission lines in provinces 1 and 2 and Bagmati province. A 7.4 km section of the existing Pathlaiya to Dhalkebar transmission line falls just inside the southeastern corner of the recently extended perimeter of the IUCN category IV Parsa National Park designated for elephant, amongst other species (it and the Pathlaiya

substation were constructed before extension of the protected area boundary) and two sections of the Chure Conservation Area. Although its right of way runs partly through forest land, works will be confined to the existing right of way which is already maintained by NEA and mostly follows an existing road access. The opportunity will also be taken here to retrofit “bird sensitive” design including the installation of bird diverters within the protected areas and at ridge/valley crossings, such as the Bagmati river, to provide mitigation for birdlife already at risk of collision. A 5.7 km section of the existing Duhabi to Kusaha transmission line whose right of way runs through agricultural land (modified habitat) is situated in the buffer zone of Koshi Tappu Wildlife Reserve, which is for intensive use. Koshi Tappu Wildlife Reserve itself supports endangered wild water buffalo as well as migratory bird species. Flyways for migratory birds are anticipated to primarily follow the river valley but birds may also fly across the transmission line, therefore, the opportunity will be taken to retrofit “bird sensitive” design including the installation of bird diverters during reconductoring to provide mitigation for birdlife already at risk of collision from the existing line. For transmission line upgrading works all storage areas and worker camps will be located outside of forest and protected areas and there will be strict prohibition with penalties for the construction workers on the use of fuel wood, poaching of wild animals, etc.

440. NEA has requested clearance from government agencies including the Department of National Park and Wildlife Conservation and the Chure Conservation Program Office for implementation of the project, and to confirm that all works within protected areas are in accordance with relevant management plan. NEA will support actions to promote and enhance their conservation aims, including vulture conservation, in conjunction with Bird Conservation Nepal or similar organization.

441. No new substations are located in protected areas, their buffer zones or key biodiversity areas. However, the 18.6km Balefi Corridor 132 kV transmission line is an associated facility of Pangtang substation. The former has similar impacts to the project components and NEA will apply the project EMP to it, including provision of bird divertors etc.

442. Some existing substations to be automated are located in protected areas, buffer zones or important bird areas. However, as works will be undertaken within their boundaries no ecological impacts are expected from the project itself.

443. Installation of smart meters would be limited to consumers’ premises and are expected to have minimal or no impacts

444. Other than biodiversity impact, potential environmental impacts of Outputs 1 and 2 are mainly related to construction, including temporary impacts on air and water quality, noise and vibration, and occupational and community health and safety risks, in particular, related to slope stability for infrastructure on hilly terrain, seismic risk, working at height and with electricity infrastructure, and risks of communicable diseases in the context or aftermath of the COVID-19 pandemic. Specifically in relation to the upgrade of the Suichatar-Balaju 66kV transmission line under Output 1 about 150m passes over religious forest area within the current boundary of the Kathmandu Valley (Swayambu) World Heritage Site requiring prior permission from the Department of Archeology (DOA) to carry out these works, with an additional 400m passing through the proposed boundary extension which covers densely built up area. Although it is an existing transmission line and the main monument (Swayambunath Stupa) is 500m distant, there is possibility of smaller monuments within its boundary and in close proximity to the alignment

being damaged during construction if works are not well managed. NEA is seeking written confirmation from the DOA (DOA is also representative of UNESCO) as to actions required to ensure these works are in accordance with the integrated management plan, and all works within the boundaries of the World Heritage Site will be supervised by an archaeologist.

445. Longer term impacts during operation and maintenance include occupational and community health and safety risks related to the presence of electricity infrastructure in communities specifically requiring any structures (e.g. houses, schools) falling in the 5-7m horizontal safety clearance required under Nepal Electricity Rules of new or existing lines to be resettled, pollution risks related to hazardous materials and waste at substations, and climate change impacts related to use of SF6 (a potent greenhouse gas with global warming potential of 22,800 kg carbon dioxide equivalent) in the new gas insulated substations requiring leakage to be monitored. These potential environmental impacts are all well understood and can be mitigated through adherence to national requirements and international measures and standards as set out in the IFC General and Transmission and Distribution Environment, Health and Safety Guidelines.

446. This IEE including EMP are considered sufficient to meet the environmental assessment requirements of ADB for the project. However, it will be reviewed and updated as necessary prior to and following detailed design. In case of any unanticipated impact (including a scope or design change) occurring during project implementation, this IEE and EMP must be further updated by NEA and cleared by ADB before any related works commence or are cleared to continue.