UPDATED INITIAL ENVIRONMENTAL EXAMINATION
OF
HETAUDA- DHALKEBAR- DUHABI 400 kV TRANSMISSION LINE

Submitted to:

Ministry of Energy, Water Resources and Irrigation
through
Department of Electricity Development

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March, 2019

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Executive Summary

1 Introduction

Nepal Electricity Authority (NEA) is the project proponent of under construction Hetauda-Dhalkebar-Duhabi 400 kV Transmission Line Project (HDD TLP). Environmental and Social Studies Department (NEA / ESSD) is responsible for conducting the Updated Initial Environmental Examination (UIEE) Report of this project.Then Ministry of Energy (MoE) has approved the IEE report of the TL on BS 2068/11/12.

2.0 Rationality for Conducting Updated IEE

The alignment of the TL has been changed to some locations because of the construction of some residential/other structures under the previously planned TL route during the period of IEE approval and final check survey done by the Project Contractor; dispute at some locations; and technical reasons resulting into the increased length of TL from 285.2 km to 288.31 km. Similarly the numbers of towers have been increased from 608 to 792 than mentioned in the approved IEE report. Moreover, there is increase in the forest area permanently occupied by the tower pads and alternation in the number of trees to be felled under RoW.

Ministry of Forest and Environment issued a letter to the project dated 2075/1/21 to submit the IEE with revised EMAP of the project in order to provide the permit for the use of forest land and tree clearance. Department of Electricity Development (DoED) issued a consent letter to conduct Updated IEE of HDD 400 kV TL on 2075/06/19. Therefore the updated IEE of this under construction transmission line has been carried out.

3.0 Objectives of the Study

The objective of carrying out this updated IEE is to update the physical, biological, socio-economic and cultural baseline conditions of the under construction HDDTL with respect to its approved IEE report. Moreover, it also aims to identify the additional significant environmental/social impacts and risks, if any, and to suggest appropriate measures avoid/ minimize and/or mitigate the adverse impacts as well as to meet the requirements of Ministry of Forest and Environment in order to get permit for the use of additional forest land and tree clearance

4.0 Study Methodology

As such no new methods were adopted while carrying out U-IEE in comparison to the methods adopted while carrying out approved IEE. In case of vegetation study, unlike the approved IEE, the tree census data obtained from respective district forest offices and the area actually occupied by the tower pads was used. This, in fact, gave the precise number of the trees to be removed under RoW. Other methods adopted were field studies, public consultations and household survey. Available secondary information and literature in the form of reports, documents and maps related to the TL were collected and reviewed.

A public notice was published in the Gorkhapatra National Daily on14th Mangsir 2075 and 24th Falgun 2075 seeking for public/stakeholders' opinion and suggestions. Copies of the notice were displayed at concerned Rural Municipality/ Municipality Offices, Division Forest Offices, FUG Offices and other relevant places. Muchulkas of the notice display, recommendation letters and consent letters were collected from concerned Rural Municipality/ Municipality Offices.

5.0 Project Description

The HDD 400 kV transmission line is 288.31 km in length, commencing at the under construction Hetauda substation (for Hetauda-Bardghat 220 kV Project) located at Hetauda Sub metropolitan City Ward no 11 of Makwanpur district and terminating at the new Duhabi substation located at Ward no 4 Bhokrahatole (Haniftole) of Bhokraha Rural Municipality in Sunsari district. It covers 1 sub-metropolitan city, 25municipalities and 4 Rural Municipalities (Gaupalikas) covering 10 districts namely Makwanpur, Bara, Rautahat, Sarlahi, Mahottari, Dhanusha, Siraha, Saptari, Udayapur and Sunsari. There will be 3 substations, each at Hetauda, Dhalkebar and Bhokraha. The line will be of double circuits and there will be a total of 792 towers.

6.0 Existing Environment

Physical Environment

There is slight increase in the total number of the towers and length of the transmission line. The total length has been increased from 285.2 km to 288.3 km whereas the number of towers increased from 609 to 792. Moreover, a total of 57 tower locations are identified at erosion prone area. No other significant changes have been identified in the physical environmental condition.

Biological Environment

The transmission line has avoided the Koshi Tappu Wildlife Reserve and Parsa National Park. There has been no change in the length of the TL (112.66 km) in forest area and availability of flora and fauna than mentioned in its approved IEE report. However the number of FUGs has been increased from 67 to 99 and the number of trees to be cut down has been decreased from 158022 to 139059. Moreover due to increase in number of towers and area occupied by each tower, the forest area permanently occupied be the tower pads has been increased from 5.30 ha to 12.15ha.

Socio-economic and Cultural Environment

Due to the restructuring of the local bodies of Nepal, project passes through one sub-metropolitan city, twenty five municipalities and four rural municipalities of ten districts. There has been no significant change in the socio-economic and cultural environmental condition of the project area in comparison with the approved IEE, however the settlement has been increased at some localities. The area of private land to be acquired permanently for the construction of sub stations and tower pads has been increased from 23.14 ha to 38.16 ha (Row increased from 675.92 ha to 712.33). Moreover, the number of affected HHs has been increased from 130 (only APs) to 609 due to acquisition of land for tower pads and sub-stations. Similarly, number of structures to be acquired increased from 6 to 202 including 110 houses, 36 cowsheds and 56 other structures (toilets, boundary wall) are identified which are owned by 123 HHs.

7.0 Environnemental Impacts.

Physical Environment

The expected environmental impacts mentioned in its approved IEE report are almost found same during this study. In comparison to the approved IEE (2012), there is slight change in the land use required for the project components. The land area (forest land and private land) under

RoW has been increased from 1311.93 ha to 1326.23 ha whereas the land permanently acquired increased from 29.93 ha to 51.23 ha.

Moreover, a total of 53 towers are identified at erosion prone area against 11 towers identified during IEE study.

Biological Environment

There is no change in the total length of forest under TL alignment as mentioned in the approved IEE. However, due to the increased number of towers, a total of 12.15 ha of forest area is required for tower pads construction, which is 6.85 ha more than mentioned in approved IEE.

Total number of trees to be cut down has been decreased to 139059 from 158022. No other additional impact on the biological environment is identified during this updated IEE study.

Socio-economic and Cultural Environment

Additional 15.02 ha cultivated land will be acquired by the project due to increased length of the TL in private land and area of substation. Moreover, the number of affected HHs has been increased from 130 to 609 and number of structures to be acquired increased from 6 to 202 including 110 houses, 36 cowsheds and 56 other structures (toilets, boundary wall) owned by 123 HHs. There will be the depreciation of the value of land under RoW of the TL, particularly in the urban and semi-urban areas. Others impacts remain same as mentioned in the approved IEE (2012).

8.0 Mitigation Measures

Physical Environment

Sprinkling of water on the access road to substation; protection measures like bioengineering measures, gabion wall/retention wall, pile foundation with extended footings, construction of spur for 57 towers (angle and suspension) susceptible to erosion and instabilities are the mitigation measures proposed. The mitigation measures proposed remains the same as mentioned in the approved IEE report (2012).

Biological Environment

The biological mitigation measures proposed in its approved IEE are being implemented at project site. As per the agreement done with the Department of Forest, the compensatory plantation is being carried out for the cut down trees in 1:2 ratio. Therefore a total of 278118 seedlings will be planted. Moreover, the forest land equivalent to permanently occupied by the towers (12.15ha) will either be purchased and provided to the concerned Division Forest Offices with plantation or the equivalent amount will be deposited in the government fund. Moreover, the various programs are being implemented for the FUGs and the project workers.

Socioeconomic and Cultural Environment

The cost required for the compensation payment of private land and structures at tower pads and under Row will be paid at rate determined by the Compensation Determination Committee (CDC). The project is also providing support to the affected communities under IEE and VCDP program. Various type of supports like community development, rural electrification, school support, various trainings including skill development trainings are being implemented at the

project site targeting to the affected HHs and communities nearby the TL.

9.0 Environment Monitoring

The Environment and Social Management Unit (ESMU) Offices are established at 3 locations of the project-Hetauda, Bardibash and Inaruwa. The experts from ESSD and Environmental and Social Monitors deployed at each units carrying out the effective environmental monitoring, mitigation works, receiving grievances from the affected communities, coordination amongst various concerned agencies and other related activities. The quarterly report is being prepared and submitted to the concerned agencies. Till December 2018, nineteenth quarterly report has been prepared and submitted.

10.0 Conclusion

The finding of Updated IEE shows that the additional adverse impacts on physical, biological, socio- economic and cultural environment due to the implementation of the under-construction project are found minimal. The project proponent is committed to comply with the applicable legal requirements, implementation of the mitigation/enhancement measures at the project site. The efforts are being/will be made by the project to limit adverse impacts on the environment and the society. The appropriate mitigation/enhancement measures being carried out will also be continued in the coming days till the completion of the project.

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कार्यकारी सारांश

१. परिचय

नेपाल विद्युत प्राधिकरण (ने.वि.प्रा.) निमार्णाधिन हेटौंडा-ढल्केबर-दुहबी ४०० के.भी. प्रसारण लाईन आयोजनाको प्रस्तावक हो । यस संस्था अन्तर्गतको वातावरण तथा सामाजिक अध्ययन विभागले निमार्णाधिन यस विद्युत प्रसारण लाइन आयोजनाको अद्यावधिक प्रारम्भिक वातावरणीय परीक्षण (Updated IEE) प्रतिवेदन सम्बन्धि कार्य गरिरहेको छ । तत्कालिन ऊर्जा मन्त्रालय बाट मिति २०६८।११।१२ मा यस आयोजनाको प्रारम्भिक वातावरणीय परीक्षण (IEE) प्रतिबेदन स्वीकृत भएको थियो ।

२. अद्यावधिक IEE गर्नुको औचित्य

यस आयोजनाको IEE स्विकृत मिति र निर्माण अबधि बिचको समय अन्तरालमा प्रस्ताबित मार्गमाा भएका बिभिन्न संरचनाहरुको निर्माण, केही स्थानहरुमा स्थानियहरु संग भएकाो बिबाद तथा प्राबिधिक कारणहरुले गर्दा केही स्थानहरुमा यसको मार्ग परिवर्तन भएको छ । जसले गर्दा यस प्रसारण लाईनको कुल लम्बाई २८५.२ कि.मी. बाट बढ्न गई २८८.३१ कि.मी. हुन पुगेको छ र टावरहरुको संख्या समेत बढेर ६०८ बाट ७९२ पुगेको छ । त्यसै गरी टावरले स्थायी रुपले ओगट्ने वनको क्षेत्रफलमा समेत बृद्धि भएको छ र काट्नुपर्ने रुखको संख्यामा समेत जिल्ला अनुसार परिवर्तन भएको छ ।

यसै सन्दर्भमा वन तथा वातावरण मन्त्रालयको मिति २०७५।०१।२१ को पत्रबाट प्रसारण क्षेत्रको केही जिल्लाहरुको रुख कटान तथा वनको जग्गा प्रयोग गर्ने सहमती प्रयोजनको लागी संशोधित EMAP सहितको IEE प्रतिबेदन माग भएको थियो । त्यसैगरी बिद्युत बिकास बिभागको मिति २०७५।०६।१९ को पत्रबाट अद्यावधिक प्रारम्भिक वातावरणीय परीक्षण प्रतिवेदन तयारीको लागी सहमती प्रदान भएको थियो र सोही अनुरुप यो अद्यावधिक प्रतिबेदन तयार गरिएको छ ।

३. अध्ययनको उद्देश्य

अद्यावधिक प्रारम्भिक वातावरणीय परीक्षण प्रतिवेदन तयार गर्नुको मुख्य उद्धेश्य आयोजनाको बिद्यमान भौतिक, जैबिक र सामाजिक अवस्थाका बारेमा अद्यावधिक गर्ने र यसले पार्न सक्ने थप प्रभाबहरुका बारेमा अध्ययन गरी सो को न्यूनिकरण गर्नु हो । साथै सम्बन्धित निकायहरुबाट वनको जग्गा प्रयोग गर्ने तथा रुख कटान अनुमति प्राप्त गर्नु समेत यसको उद्धेश्य रहेको छ ।

४. अध्ययन विधि

स्वीकृत प्रारम्भिक वातावरणीय परीक्षण (IEE) प्रतिवेदनमा उल्लेखित विधिहरुलाई नै अद्यावधिक प्रतिवेदन तयारीको आधार मानिएको छ । वनस्पति अध्ययनका लागि पूरक प्रतिवेदनमा उल्लेख गरिएको नमूना परिक्षण विधिको सट्टा सम्बन्धित डिभिजन वन कार्यालयहरु बाट प्राप्त रुख विरुवाहरुको लगत/छपानलाई आधार मानेर गणना कार्य गरिएको हो भने स्थलगत अध्ययन एवं सरोकार समूहको राय सुझाव संकलन तथा छलफल समेत गरिएको हो । स्वीकृत प्रतिवेदनमा उल्लेखित तथ्यांङ्कको तुलनात्मक अध्ययन, विश्लेषण तथा परिवर्तन हुने रुटको नक्सा तयार गरिएको हो । साथै स्थलगत अध्ययन, घरधुरी सर्वेक्षण कार्य समेत गरिएको छ ।

राय सुझावको लागि मिति २०७५।०८।१४ र २०७५।११।२४ गते गोरखापत्र राष्ट्रिय दैनिकमा १५ दिने सार्वजनिक सूचना प्रकाशित गरि प्रभावित क्षेत्रका विभिन्न कार्यालय तथा सार्वजनिक स्थानमा राय सुझावको लागि सूचना टाँस गरिएको थियो । साथै विभिन्न कार्यालयहरुमा सूचना टाँस गरिएको मुचुल्का, सम्बन्धित नगरपालिकाको सिफारिस, प्रभावित सामुदायिक वनहरुको सहमति एवं राय सुझावहरु समेत संकलन गरिएको छ ।

५. आयोजना सम्वन्धी विवरण

नेपाल विद्युत प्राधिकरण (ने.वि.प्रा.) द्वारा निर्माणाधिन हेटौडा-ढल्केवर-दुहवी ४०० के.भी. विद्युत प्रसारण लाईनको कुल लम्बाई करिब २८८.३१ कि.मि. रहेको छ र यो आयोजना मकवानपुर, बारा, रौतहट, सर्लाही, महोत्तरी, धनुषा, सिराहा, सप्तरी, उदयपुर र सुनसरी गरी जम्मा १० जिल्लाहरुमा अवस्थित छ । आयोजना क्षेत्रमा प्रदेश नं १, २ र ३ अन्तर्गत १० जिल्लाका १ उप- महानगरपालिका २५ नगरपालिकाहरु र ४ गाउंपालिकाहरु पर्दछन् ।

नेपाल विद्युत प्राधिकरणले प्राथमिकताका साथ निर्माण गरिरहेको यस लाईन मकवानपुर जिल्ला, हेटौडा उप महानगरपालिका वडा नं. ११ थानाभञ्याङ्ग सवस्टेशन (हेटौडा-भरतपुर २२० के.भी. प्रसारण लाईन आयोजना अन्तर्गत) बाट शुरु भई सुनसरी जिल्ला, भोक्राहा गाउंपालिका वडा नं. ४ हानिफ टोलमा निर्माण गरिने नयाँ सवस्टेशनमा गई टुङ्गिएको छ । यो प्रसारण लाइनमा जम्मा ७९२ टावरहरु रहनेछन् र यो डबल सर्किटको हुनेछ ।

६. बिद्यमान अवस्था

भौतिक वातावरण

यसप्रसारण लाइनको कुल लम्बाई र टावर संख्यामा IEE प्रतिबेदनमा उल्लेख गरिए भन्दा केही परिबर्तन भएको छ । यसको कुल लम्बाई २८५.२ कि.मी. बाट बढेर २८८.३ कि.मी. पुगेको छ भने कुल टावर संख्या ६०९ बाट ७९२ पुगेको छ । साथै कुल ५७ वटा टावरहरु भू-क्षय सम्भाबित स्थलमा पाइएका छन् । अन्य भौतिक वातावरणमा खासै परिवर्तन देखिएको छैन ।

जैविक वातावरण

यो प्रसारण लाइन मार्ग कोशी टप्पु बन्यजन्तु आरक्ष र पर्सा राष्ट्रिय निकुञ्ज र यसको मध्यबर्ती क्षेत्रमा पर्दैन । यस प्रसारण लाइन मार्गमा पर्ने जंगलको क्षेत्रमा (११२.६६ हे.) र वन्यजन्तु र बनस्पतीको उपलब्धतामा समेत कुनै परिवर्तन भएको छैन । तर प्रसारण लाइन मार्गमा पर्ने वनहरुको संख्या ६७ बाट बढेर ९९ पुगेको छ भने काट्नुपर्ने रुखको संख्या १५८०२२ बाट घटेर १३९०५९ मा झरेको छ । त्यसैगरी वन क्षेत्रमा निर्माण हुने टावरको संख्या र प्रत्येक टावरले ओगट्ने क्षेत्रफल बढेकोले स्थायी रुपले अधिग्रहण गर्ने वनको क्षेत्रफल ५.३ हेक्टरबाट बढेर १२.१५ हेक्टर पुगेको छ ।

सामाजिक, आर्थिक तथा सांस्कृतिक वातावरण

नेपालको राज्य पुनर्संरचनाको कारणले गर्दा यस प्रसारण लाइन मार्गमा जम्मा १० जिल्लाका १ उप-महानगरपालिका, २५ नगरपालिका तथा ४ गाउंपालिकाहरु पर्दछन् । यस प्रसारण लाइन मार्गको बिद्यमान सामाजिक, आर्थिक तथा सांस्कृतिक वातावरणमा खासै परिवर्तन पाइएको छैन ।

तर पनि केही स्थानहरुमा बस्ती बाक्लिदै गएको पाइएको छ । टावरहरु र सब-स्टेशन निर्माण कार्यको लागी स्थायी रुपले अधिग्रहण गर्नुपर्ने निजी जग्गाको क्षेत्रफल २३.१४ हेक्टरबाट बढेर ३८.१६ हेक्टर पुगेको छ । टावर र सब स्टेशन निर्माणको लागी जग्गा अधिग्रहण बाट प्रभावित घरधुरीको संख्या १३० बाट बढेर ६०९ पुगेको छ । त्यसै गरी तारमुनि पर्ने संरचनाको संख्या ६ बाट बढेर २०२ पुगेको छ जुन १२३ जना घरधनीहरुको स्वामित्वमा रहेको छ । यसमा घर संख्या ११०, गाई गोठ संख्या ३६ र अन्य संरचना संख्या जस्तै शौचालय, पर्खाल लगायत गरी ५६ रहेको छ ।

७. वातावरणीय प्रभाव

भौतिक वातावरण

स्वीकृत प्रारम्भिक वातावरणीय परीक्षण (IEE) प्रतिवेदनको तुलनामा यस अद्यावधिक प्रारम्भिक वातावरणीय परीक्षण (Updated IEE) प्रतिवेदन अध्ययन गर्दा टावर तथा सब-स्टेशन निर्माणका लागी २३.१४ हेक्टरवाट वढेर ३८.१६ हेक्टर निजी जग्गा र ROW १३११.९३ हेक्टरवाट वृद्धि भई १३२६.२३ हेक्टर प्रभावित हुनेछ । त्यसैगरी कुल ५३ वटा टावरहरु रहेको स्थानमा भू-क्षयको समस्या उत्पन्न हुन सक्ने देखिएको छ ।

जैविक वातावरण

स्वीकृत प्रारम्भिक वातावरणीय परीक्षण (IEE) प्रतिवेदनमा उल्लेख भए बमोजिम नै यस प्रसारण लाइन मार्गमा कुल ११२.६६ कि.मी वन क्षेत्र पर्दछ । यस प्रसारण लाइन मार्गमा काट्नुपर्ने रुखको संख्या १५८०२२ बाट घटेर १३९०५९ मा झरेको छ । त्यसैगरी वन क्षेत्रमा निर्माण हुने टावरको संख्या र प्रत्येक टावरले ओगट्ने क्षेत्रफल बढेकोले स्थायी रुपले अधिग्रहण गर्ने वनको क्षेत्रफल ५.३ हेक्टर बाट बढेर १२.१५ हेक्टर पुगेको छ ।

सामाजिक, आर्थिक तथा सांस्कृतिक वातावरण

स्वीकृत प्रारम्भिक वातावरणीय परीक्षण (IEE) प्रतिवेदनको तुलनामा यसको लम्बाई बढेको र सब-स्टेशनको क्षेत्र बढेको हुनाले थप १५.०२ हेक्टर निजी जमिन प्रभावित हुनेछ । त्यसैगरी प्रभावित घरधुरीको संख्या १३० बाट बढेर ६०९ पुगेको छ भने तारमुनि पर्ने संरचनाको संख्या ६ बाट बढेर २०२ पुगेको छ । साथै तारमुनि पर्ने जग्गाको मूल्यमा, खासगरी शहरी र शहरोन्मुख क्षेत्रमा, कम हुन सक्नेछ । अन्य प्रभावहरु यथावत नै रहने आंकलन गरिएको छ ।

८. प्रभाव न्यूनीकरण

भौतिक वातावरण

स्वीकृत प्रारम्भिक वातावरणीय परीक्षण (IEE) प्रतिवेदनमा उल्लेखित प्रभावलाई न्यूनिकरणका कार्यक्रमलाई नै यस अद्यावधिक प्रारम्भिक वातावरणीय परीक्षण (Updated IEE) प्रतिवेदनमा समावेश गरिएको छ । यस अन्तर्गत सब- स्टेशन जाने बाटोमा पानी छर्ने, भू-क्षयको समस्या उत्पन्न हुन सक्ने ५७ टावर स्थानहरुमा बिभिन्न इन्जिनियरिङ्ग उपायहरु अवलम्बन गर्ने आदि रहेका छन् ।

जैविक वातावरण

स्वीकृत प्रारम्भिक वातावरणीय परीक्षण (IEE) प्रतिवेदनमा उल्लेखित जैविक प्रभावलाई न्यूनिकरणका कार्यक्रमहरु हाल कार्यान्वयनको अवस्थामा रहेका छन् । यस आयोजना र वन बिभाग बिच भएको सम्झौता बमोजिम कुल काटिएका रुखको अनुपातमा १:२ का दरले जम्मा २७८११८ बिरुवाहरु रोपिनेछन् । आयोजनाबाट स्थायीरुपले अधिग्रहण हुने १२.१५ हेक्टर जग्गा खरिद गरी सो मा बृक्षारोपण गरी सम्बन्धित डिभिजन वन कार्यालयहरुलाई हस्तान्तरण गरिनेछ अथवा सो बराबरको रकम नेपाल सरकारको सम्बन्धित कोषमा जम्मा गरिनेछ । साथै प्रभाबित वन उपभोक्ता समितिहरु र आयोजनामा कार्यरत कामदारहरुलाई बिभिन्न खालका कार्यक्रम सञ्चालन गरिएको छ ।

आर्थिक सामाजिक तथा साँस्कृतिक वातावरण

स्थायी रुपमा अधिग्रहण गरिने निजी जग्गाको (थप १५.०२ हेक्टर समेत) क्षतिपूर्ति मूल्यांकन समितिले निर्धारण गरे बमोजिमको दररेटमा क्षतीपूर्ति दिइनेछ । यस आयोजनाबाट प्रभाबित क्षेत्र तथा घरधुरीलाई लक्षित गरी हाल बिभिन्न कार्यक्रमहरु जस्तै सामुदायिक बिकास, ग्रामीण बिद्युतीकरण, बिद्यालय सहयोग, बिभिन्न सिपमूलक तालिम लगायत सञ्चालनमा रहेका छन् ।

९. वातावरणिय अनुगमन

यस आयोजनाको वातावरणीय व्यवस्थापन सम्बन्धि कार्य नेपाल बिद्युत प्राधिकरण, वातावरण तथा सामाजिक अध्ययन बिभागले गरिरहेको छ ।

मकवानपुरको हेटौंडा, बर्दिबासको महोत्तरी र सुनसरीको इनरुवा गरी जम्मा ३ स्थानहरुमा नोभेम्बर, २०१३ (बि.सं २०७०) देखी वातावरण तथा सामाजिक व्यवस्थापन इकाई कार्यालय (ESMU) स्थापना गरिएको छ । वातावरण तथा सा.अ. बिभागका विज्ञहरु साथै वातावरण/सामाजिक अनुगमनकर्ताहरु बाट यस आयोजनाको वातावरणीय अनुगमन तथा प्रभाव न्यूनीकरण, गुनासो ब्यवस्थापन, सम्बन्धित निकायहरुसंग समन्वय लगायतका कार्यहरु गरिदै आएको छ । यसैगरी त्रैमासिक वातावरणीय प्रतिबेदन समेत तयार गरी सम्बन्धित निकायहरुमा पेश गरिंदै आएको छ र December 2018 सम्मको उन्नाइसौं त्रैमासिक प्रतिबेदन पेश गरि सकिएको छ ।

१०. निष्कर्ष

यस अद्यावधिक प्रारम्भिक वातारणीय परीक्षण प्रतिवेदनमा उल्लेख भए अनुसार आयोजनाको भौतिक, जैविक र सामाजिक आर्थिक तथा सांस्कृतिक वातावरणमा पर्न सक्ने थप नकारात्मक प्रभावहरु न्यून र व्यवस्थित गर्न सकिने किसिमका रहेका छन् । प्रस्ताबक नेपाल बिद्युत प्राधिकरण हाल प्रचलित कानूनी प्राबधानहरु परिधिमा रही यस आयोजनाबाट हुने वातावरणीय तथा सामाजिक प्रभाबहरु कम गर्ने कार्यको साथै अनुगमन कार्यको लागी प्रतिबद्ध रहेको छ । साथै हाल सञ्चालनमा रहेका वातावरणीय अनुगमन तथा प्रभावन्यूनीकरणका कार्यहरुलाई समेत निरन्तरता दिइनेछ ।

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Abbreviations

AAPA	:	Aquatic Animal Protection Act
AIDS	:	Acquired Immune Deficiency Syndrome
B.S.	:	Bikram Sambat
CBS	:	Central Bureau of Statistics
CBOs	:	Community Based Organizations
CITES	:	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CFC	:	Compensation Fixation Committee
CFT	:	Cubic feet
DCC	:	District Coordination Committee
DFO	:	Division Forest Office
DoED	:	Department of Electricity Development
EIA	:	Environmental Impact Assessment
ESMU	:	Environment and Social Management Unit
ESSD	:	Environment and Social Studies Department
EPA	:	Environment Protection Act
EPR	:	Environment Protection Rule
FUGs	:	Forest User Groups
GoN	:	Government of Nepal
Ha	:	Hectare
HH	:	Households
HDD	:	Hetauda-Dhalkebar-Duhabi
INPS	:	Integrated Nepal Power System
IEE	:	Initial Environmental Examination
IUCN	:	The World Conservation Union
KII	:	Key Informant Interview
Km	:	Kilometer
Kwh	:	Kilowatt hour
LP Gas	:	Liquid Petroleum Gas
m^3	:	Cubic meter
MOWR	:	Ministry of Water Resources
MW	:	Mega Watt
NGOs	:	Non Governmental Organizations
NEA	:	Nepal Electricity Authority
NWP	:	National Water Plan
NARC	:	Nepal Agriculture Research Council
NEFIS	:	Nepal Fisheries Society
PAF	:	Project Affected Families
RM	:	Rural Municipality
TOR	:	Terms of Reference

1. Name and Address of the Individual/Institution preparing the report

1.1. Proponent

Nepal Electricity Authority (NEA), the major electricity generator and sole agency responsible for transmission and distribution of electricity, is the proponent of the under construction **Hetauda-Dhalkebar-Duhabi 400 kV Transmission Line Project** (HDDTLP). The Ministry of Energy (MoEn) has granted a survey license on 2067/02/03 valid up to 2068/02/02BS to NEA for feasibility and Initial Environmental Examination (IEE) and construction licence on 2069/10/07. A copy of survey and construction license is attached in Annex 1.

The construction work of the project has been started from February, 2013 and till Dec end 2018, almost 55% construction work has been completed. Out of total 792 towers, 545 tower foundations and 482 tower erections have been carried out.

The contact address of the project proponent is as follows:

Nepal Electricity Authority,
Hetauda-Dhalkebar-Duhabi 400 kV Transmission Line
Kharipati, Bhaktapur.
Phone No. : 01-6616660,

1.2. Organization Responsible for Preparation of Updated IEE

Environment and Social Studies Department (ESSD) of NEA executes all activities related to the environmental aspects of projects studied, designed, and constructed or operated by NEA. ESSD is responsible for preparation of this updated IEE. The contact address of the ESSD is as follows:

Environment and Social Studies Department,
Engineering Services Directorate,
Nepal Electricity Authority,
Kharipati, Bhaktapur
Phone No. : 01-6611580, Fax No. : 01-6611590
Email : env.social@nea.org.np

1.3. Rationality for Conducting Updated IEE

As per the Environment Protection Rules (EPR), 2054 and the amendment (published in BS 2065/11/26 on Nepal Gazette) made in EPR, 2054, Rule-3, Schedule-1, Clause-E, Sub-clause 1(c); for any TL of voltage level 132kV or above, an Initial Environmental Examination (IEE) is mandatory.

Similarly, as per Rule-3, Schedule-2, Clause-K (3) of EPR, 2054; for any project located in environmentally sensitive areas such as National Parks, Wild life Reserves, Wetlands and Conservation Areas, an EIA is required.

The Initial Environmental Examination (IEE) of the under construction Hetauda-Dhalkebar-Duhabi 400 kV Transmission Line has been approved from then Ministry of Energy on 2068/11/12. The approval letter is attached in Annex 2a. The construction work of the project has been started from 2014. Because of the construction of some residential/other structures under the previously planned TL route during the period of IEE approval and final check survey done by the Project Contractor; dispute at some locations; and technical reasons, the alignment of the TL has been changed at few locations. This has increased the length of transmission line from 285.2 km to 288.31 km and number of towers from 608 to 792. Moreover, in the IEE report the base area of each tower was mentioned as 15x15 sq. m. which actually ranges from 16.5x16.5 sq. m to 38.2x38.2 sq. m depending upon the tower types. All these circumstances has resulted into the changed in the land use by the project and changed in the number of trees to be cut down from the affected forests than mentioned in the approved IEE Report.

Ministry of Forest and Environment issued a letter to the project dated 2075/1/21 (attached in Annex 2b) to submit the IEE with revised EMAP of the project in order to provide the permit for the use of forest land and tree clearance. Department of Electricity Development (DoED) issued a consent letter to conduct Updated IEE of HDD 400 kV TL on 2075/06/19. Therefore the updated IEE of this under construction transmission line has been carried out.

1.4. Objective of Updated IEE

The objective of carrying out this updated IEE is to update the physical, biological, socio-economic and cultural baseline conditions of the under construction HDDTL with respect to its approved IEE report. Moreover, it also aims to identify the additional significant environmental/social impacts and risks, if any, and to suggest appropriate measures avoid/ minimize and/or mitigate the adverse impacts so that the project is implemented in an environmentally sound manner. To meet the requirements of Ministry of Forest and Environment in order to get permit for the use of additional forest land and tree clearance is also the major objective of this study.

2. General Introduction of the Project

2.1. Project Description

2.1.1. Project Location

The project is located in Province 1, 2 & 3 (then Central and Eastern Development Region) of Nepal (Figure 2.1). Physiographically the project is located in Siwaliks and Terai area of Nepal.

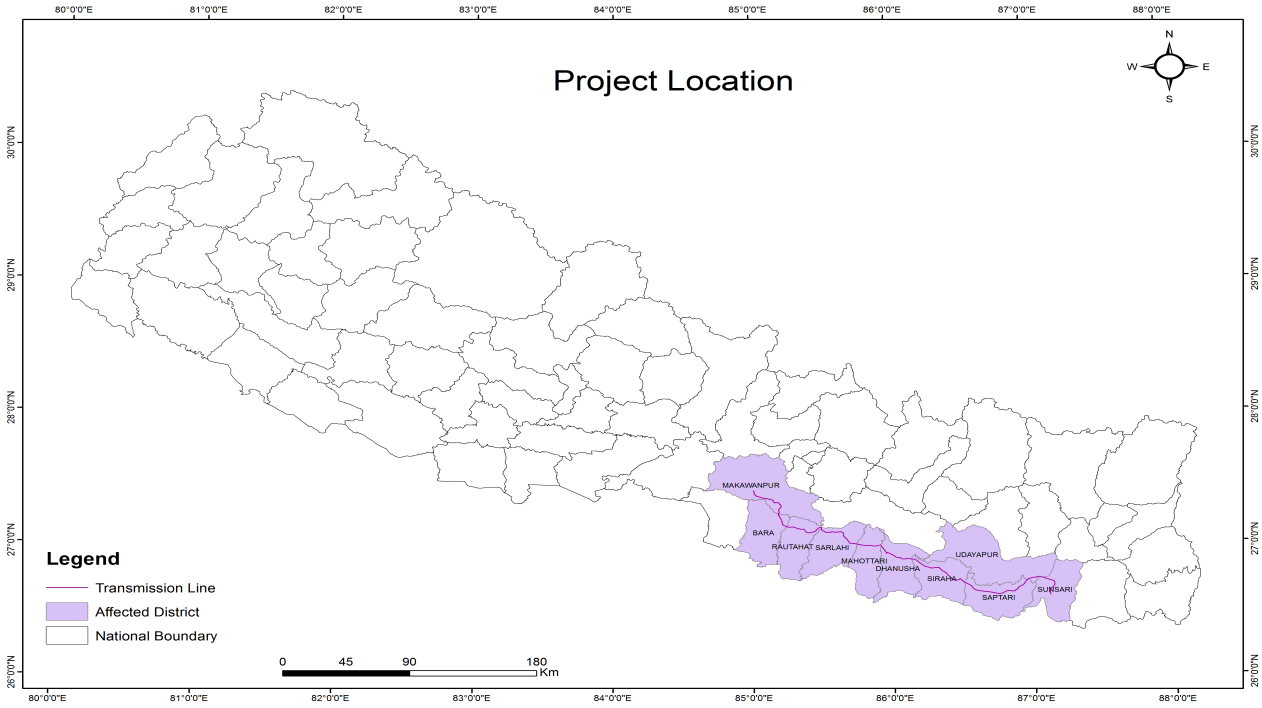
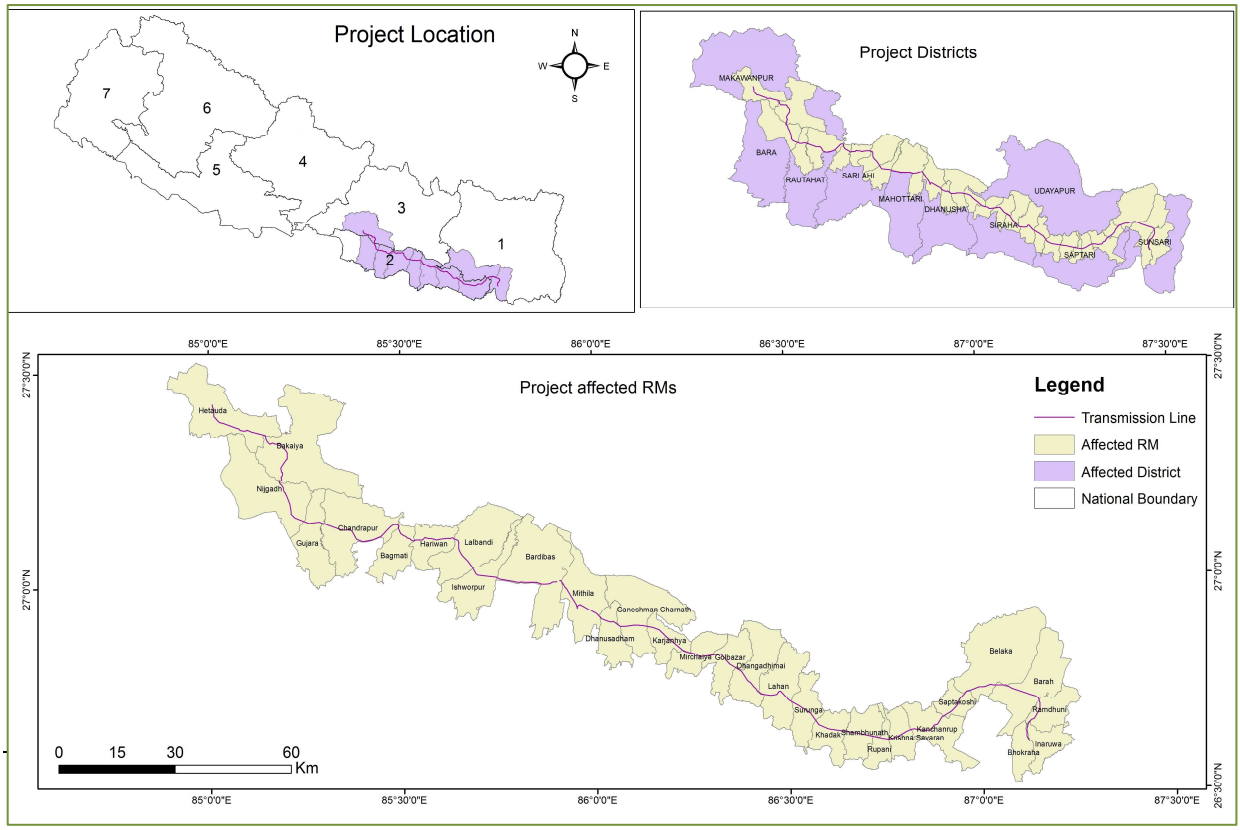


Figure 2-1and 2-2: Project Locations.



2.1.2. Project Accessibility

East-West Highway is the main access to the project area. Dhulikhel- Sindhuli- Bardibas road, Mirchaiya- Katari, Kadamchok-Gaighat road, Kanchanpur- Fattepur road are the other main access to the project area. The transmission line is accessible through feeder roads and foot trails from these roads. Simara, Janakpur and Biratnagar are the nearest airport to the site.

2.1.3. Transmission Line Route

The HDD 400 kV transmission line is 288.31 km in length, commencing at the under construction Hetauda substation (for Hetauda-Bardghat 220 kV Project) located at Hetauda Sub metropolitan City Ward no 11 of Makwanpur district and terminating at the new Duhabi substation located at Ward no 4 Bhokraha tole (Hanif tole) of Bhokraha Rural Municipality in Sunsari district.

The initial 18.92 km stretch of transmission line passes through hill section (Hetauda-Hurnamadi AP 6) and after that 25.14 km section is hill to Terai (Hurnamadi- Nijgadh AP 14). The remaining stretch (Nijgadh- New Duhabi) passes through flat plain of Terai almost parallel to north of East-West Highway.

The transmission line passes through 10 districts (2 from Province 1, 7 from Province 2 and 1 from Province 3)

2.2. Project Features

The transmission line is of double circuits comprising of quad overhead conductor. Each line circuit have three phases, each phase comprising four separate aluminum conductor steel reinforced (ACSR).

The vertical double circuit configuration tower have an average height of 45 m and the standard tower base dimensions ranges from 16.5 m x 16.5 m to 39.2 m x 39.2 m from center to center of each tower leg foundation/ footing depending upon the tower types. The differentiation of tower foundations according to tower types is given in Annex 13. Steel tower leg and body extensions are utilized to reduce foundation excavation on slopes and provide greater tower foundation structural security. The design span between tower structures is 400 m.

The right of way (RoW) of the transmission line is 23 meters on each side from the centerline of the overhead transmission line as per the Electricity Regulation, 2050 (1993). The transmission line design features are given in Table 2.1.

Table 2-1: Project features

Features	**Description**	
General		
Project	Hetauda – Dhalkebar- Duhabi 400 kV Transmission Line Project	
Provinces	Province No. 1, 2 and 3 (Former Central and Eastern Development Regions)	
Districts	10 districts (2 from Province 1, 7 from Province 2 and 1 from Province 3)	
Provinces	Districts	Sub-Metropolitan city/ Rural Municipalities/ Municipalities
Province 3	Makwanpur	Hetauda Sub-Metropolitan city and Bakaiya Rural Municipality.
Province 2	Bara	Nijgadh Municipality
”	Rautahat	Chandrapur and Gajura Municipality.
”	Sarlahi	Ishworpur, Hariaon, Lalbandi and Bagmati Municipality.
”	Mahottari	Bardibas Municipality.
”	Dhanusha	Mithila, Dhaushadham and Ganeshman Charnath Municipality.
”	Siraha	Mircharya, Golbazzar, Dhangadhimai, Karjanha and Lahan Municipality
”	Saptari	Sambhunath, Kanchanrup, Khadak, Suranga, Saptakoshi Municipality Rupani and Agnisair Sabran Rural Municipality.
Province 1	Udayapur	Belaka Municipality.
”	Sunsari	Ramdhuni, Inaruwa, Baraha Municipality and Bhokaraha Rural Municipality.
Initial point	New Hetauda Substation , Hetauda Sub-Metropolitan city, Makwanpur District	
Terminal point	New Duhabi Substation, Bhokraha Rural Municipality, Sunsari District	
Number of major road crossing	4	
Number of major river crossings	11	
Number of 33 kV line crossings	2	
Number of 66 kV line crossings	1	

Number of 132 kV line crossings	1

Design features	
Line length	288.31 km
Total Number of towers	792 Nos
Average span between towers	Around 380 m
Right-of-way width	46 m (23 m on either side of centerline)
Voltage level	400 kV
Standard tower height	45 m
Circuit	Double
Foundation area	DA (272.25 Sq.meter), DB (428.40 Sq.meter), DC(501.76 Sq.meter), DD (665.64 Sq. Meter)
Insulator	Anti fog porcelain Insulator
Foundation type	DA, DB, DC & DD Type (CAT-1 ,2 ,3)
Tower type	Steel lattice structure (DA, DB, DC & DD Type and Water logged locations i/c Koshi River)
Conductor	Aluminum Conductor Steel Reinforced 525 mm^2 "Moose"
Earth wire	Optical Fiber Ground Wire (OFGW) and EHS Steel wire

Clearances	
Roads (main and secondary)	12 m
Distribution lines	6.2 m
Communication lines	5.0 m
Ground negotiable by vehicle	9.2 m
Ground not negotiable by vehicle	9.2 m
Water surface at maximum flood	13.2 m
Substation	
New Substation	400, 220, 132, 33 kV at Hanif tole of Bhokraha Rural Municipality
Upgrading	Construction of 400,220,132 and 33 kV voltage level buses at Dhalkebar substation and 220, 132 kV bus and transformers at new Hetauda substation.

Finance	
Project Cost	USD 144 million
Funding Agency	GoN / World Bank

2.2.1. Substation

Dhalkebar Substation

Dhalkebar substation will receive power from cross border transmission line until Nepal power system will be in deficit. When there will be excess power in Nepal power system, electric power from various IPPs will flow to this substation via Hetauda – Dhalkebar – New Duhabi. This substation will also serve for providing required power for the existing 132 and 33 kV network in this area. For this purpose there will be 400, 220, 132 and 33 kV voltage level buses. The project has acquired 6.77 ha private cultivated land nearby the existing Dhalkebar Substation for the construction of new substation.

New Duhabi (Bhokraha) Substation

New Duhabi substation is in Hanif tole of Bhokraha RM. Koshi corridor transmission line will also be connected to this substation at 220 kV and the existing 132 kV line will be looped in and out in this substation. The existing Duhabi substation is at around 17 km from this location. The existing Duhabi substation is now surrounded by settlement and there is problem of constructing new transmission line in this area. Bhokraha is a comparatively open area. Koshi corridor is having a huge capacity and will be connected to this substation at 220 kV in the initial stage. So in the initial stage this substation will have 220, 132 and 33 kV voltage level busses. In future 400 kV bus will also be required and an additional cross border transmission line will be constructed in this area. The project has acquired 14.13 ha private cultivated land for the construction of new substation.

New Hetauda Substation

NEA is constructing a new Hetauda substation at Hetauda Municipality Ward-11 . The 220 kV transmission line from this substation to Bharatpur is under construction. Under this Project, 220 kV bus will be added and 2 X 150 MVA, 220/132 kV transformers will be installed. The expansion work is being conducted within the boundary of the substation and no additional land is acquired. The land required for the substation at Hetauda has been acquired by Hetauda-Bharatpur 220 kV TL Project and thus the land acquisition is not under the scope of this project.

2.3. Construction Planning

The implementation of project comprises the construction of a new 400/220/132 kV substation, extension of existing and newly built substations; tower foundation and erection of towers, stringing of conductor, testing and commissioning of the 288.31 km 400 kV transmission line. The tower construction schedule is given in Annex 14.

2.3.1. Tower Foundation

The constructions of tower foundation are undertaken by manual labor assisted by the mechanical plant. The Mechanical plant includes excavators, demountable steel skid framed concrete mixers, air compressors, air drills/chisels and tamping/compaction tools.

Excavation and the concreting of the tower foundations are carried out as per the design requirements and after necessary curing, the foundations are backfilled with suitable material. The differentiation of tower foundations according to tower types is given in Annex 13

2.3.2. Erection of Galvanized Steel Towers

Galvanized steel lattice towers are transported to the individual tower locations and are being erected manually by employing pulleys, wenches, etc. into the tower foundations.

2.3.3. Insulator Fittings, Conductor and Ground Wire Stringing

So far the project has not started conductor stringing work. Conductors, OPGW, ground wires, insulators and necessary accessories will be transported manually to the tower locations. The fitting of insulators on the tower will be carried out manually. Stringing of conductors, OPGW and EHS wire will be carried out with the help of tensioners and other pulling devices as per the design requirements.

2.3.4. Transportation

Primary site access for the project construction is gained from the East- West Mahendra Highway. No permanent access roads are constructed to tower sites from existing road. Existing feeder roads and tracks are used for construction and will be used for maintenance where available.

2.3.5. Spoil Dumping Site

Since the construction of transmission line towers requires clearing and excavation of fairly small areas at tower locations, construction work do not require spoil dumping sites. The spoil is being filled up and compacted in the tower base area. Similarly, spoil generated from the substation construction are used to the switchyard location where borrowed earth materials have to be filled and compacted for the site grading.

2.3.6. Construction Materials

The materials required for civil construction works related to the transmission line and substation are:

a. Steel reinforcement – 9984 metric tons
b. Cement – 13700 metric tons
c. Coarse aggregate – 30282 cubic meter
d. Fine aggregates (sand) – 15120 cubic meter
e. Clay
f. Admixtures

Steel reinforcing bars and cement are acquired from local manufacturers. Coarse aggregates and fine aggregates are purchased from the nearby market. The excavated foundation

material can be used as a backfill material required for the foundation construction.

2.3.7. Employment

Local people those are affected by the project implementation is being encouraged for employment. As far as possible, local semi skilled and unskilled work force is being used for construction activities and transportation of materials. Altogether about 300960 man days will be deployed during the construction of the project, which includes 152064 man days unskilled, 91872 mandays semi skilled and 57024 man days skilled manpower, assuming 20 labors each day required in each tower for 15 days.

2.3.8. Project Implementation

The estimated completion period of the project is by end of year 2020. The construction work of transmission line primarily is carried out during the dry season when ground conditions are essentially dry and river flows low to allow easy movement of materials and construction of towers. However, the construction work of the substation is conducted throughout the year.

2.4. Project Area Delineation

For the updated IEE of the project, the project area is defined as the area for the construction of a 400 kV transmission line alignment, 400/220/132 kV Substation and upgrading of Dhalkebar and new Hetauda Substation as well as the area that is impacted due to the construction and operation of the project. This area includes 4 Rural Municipalities (RMs) and 25 Municipalities of 10 districts. The project area does not lie in the national park, wildlife reserve, buffer zone, conservation area, historically and archaeologically important sites and or environmentally sensitive/ fragile areas. The study area is divided into two parts on the basis of the proximity and magnitude of impacts.

2.4.1. Core Project Area

The “Core Project Area” consists of the 46 m Right-of-Way (RoW), encompassing 23 m on each side of the alignment measured from its center line. The nearest settlement from the transmission line within 30 m from the alignment and area occupied by the substations are also considered as the core area. This area is also defined as the ‘’direct impact zone’’.

2.4.2. Surrounding Area

The term "Surrounding Area" indicates a greater area, which will directly or indirectly get influenced by the construction and operation of the project. This area includes all alignment encompassing RM/ municipalities of 10 districts excluding areas mentioned under core project area. This area is also defined as the “indirect impact zone”.

The term “project” indicates the Hetauda- Dhalkebar- Duhabi 400 kV transmission line and “Area” refers to the core project area and the surrounding area. The term “project area” is also referred to as the study area for the updated IEE.

3. Data Requirement and Study Methodology

3.1. Desk Study and Literature Review

The relevant literature of the project area including feasibility report, survey report, topographical and GIS maps and other required information were collected and reviewed. The following documents, which were considered to be relevant for the updated IEE, were reviewed.

- Approved IEE report of the project.
- Route Alignment Survey Report of Hetauda-Dhalkebar- Duhabi 400 kV Transmission Line
- 1:25,000 scale topographical maps prepared by the Department of Survey, GoN;
- GIS map of the transmission line alignment
- Regional Geological Maps and previous geological reports of the Nepal Himalaya,
- Google Earth, the online software for verifying the transmission line alignment.
- National population and Housing Census 2011
- District profiles of concerned District Development Committees.
- Collection and review of National Acts and Rules related to social environment especially the land acquisition, compensation and resettlement.
- Review of the social safeguard policy of World Bank including OP 4.12.

3.2. Data Requirement, Collection Methods and Analysis

3.2.1. Physical Environment

3.2.1.1. Data Requirement and Collection Methods

Information on climate (temperature & rainfall) was obtained from review of data published by Department of Hydrology and Metrology. Topo map of 1:25000 scale and GIS map was reviewed to collect information about land use and other features along the alignment. The information of land use, stability, physiographic condition of the area was supplemented by the field survey conducted by the experts.

The team covered the 288.31 km stretch to investigate the actual site conditions. The team investigated the site conditions of the angle towers, suspension towers and other critical areas along the transmission line. Geographic data, such as topography, land use, soil, stability of the tower locations, key environmental features were studied and collected for the entire study area during the site investigation.

3.2.1.2. Data Analysis

The collected data was analyzed and presented in the prescribed format as per the requirement of the study.

3.2.2. Biological Environment

3.2.2.1. Data Requirement and Collection Methods

Vegetation/Forest Resources

Walkover survey was done by group of expert to make general observation of the forest

along the alignment. Total counting of trees along the transmission line alignment has been carried out with the support of concerned forest officials. During total counting tree and pole sized trees were recorded by measuring diameter at breast height (dbh) with the help of measuring tape. Similarly, their height was estimated simply by observation. In each plot, tree species were identified and all trees exceeding a diameter of 10 cm at dbh were counted.

Consultation with Forest Officials

Since the project is under construction phase, the consultation with the concerned forest officials including FUGs is being carried out regularly. Similarly the consultations were also carried out during updation of IEE report. The consultations mainly focused on the number of tree species to be cut down, management of cut down trees, compensatory plantation, management of plantation sites and other issues.

Wild life

Data on wildlife is collected by direct observation along the project area, interaction with the forest officials, members of FUGs and local villagers. Major habitat types were identified by direct field observation and using topographic maps. Different signs (e.g. scats/droppings, scratches, calls, pugmarks, carcasses, scales) were also used for identification of mammals, birds and reptiles. Other indirect indicators such as nests, burrows were also observed in the area.

Interview

Local people from the project area, members of Forest User Groups (FUGs), authorities of Koshi Tappu Wildlife Reserves, officials from concerned Range Post and Division Forest Office were interviewed in order to collect information on floral species, wild fauna, their distribution, behaviours, movement pattern etc.

Wildlife species found in the project area were grouped into different threat categories based on IUCN (1978), CITES (1985) and GoN's act such as Forest Act 1993 and National Parks and Wildlife Conservation Act 1973.

3.2.2.2. Data Analysis

The plant species at site were identified in consultation with the forest officials, members of FUGs and local people.

Based on this information, the wood volume, biomass and crown coverage were calculated. Diameter at breast height was measured at 1.3 meter from the ground level and the tree, pole, sapling and seedling were classified on the basis of following criteria.

- Tree class above 30 cm dbh
- Pole class 10-30 cm dbh
- Sapling 4-10 cm dbh
- Seedling less than 4 cm dbh

Basal Ares is the trunk cross-sectional area. The basal area of each of trees was calculated on the basis of diameter at breast height.

Wood volume = 1/2 BA x h where BA is Basal area and h is height of tree

The formula for Basal Area is BA = πr^2 , where r is the radius

Biomass = wood volume× wood density

3.2.3. Socioeconomic and Cultural Environment

3.2.3.1. Data Requirement and Collection Methods

Socioeconomic and cultural data, such as population of affected rural/ municipality, household size, male- female ratio, infrastructures, ethnicity, language and religion data were derived from Central Bureau of Statistics (CBS) 2011. District Profile of the project districts were referred for the socioeconomic data such as population, infrastructure etc.

Literature review, survey of affected households (HHs), key informant interviews (KIIs), group discussions, market survey in the affected R/Ms and informal discussion/meeting with district level government officials were the methodology applied for socioeconomic survey.

Altogether 609 household were affected by land and house acquisition. Appropriate questionnaire (Annex 3 a) was developed in Nepali language and the HH survey was conducted.

Meetings/Consultations

Informal meetings/consultations were also conducted with the relevant government officials, NGOs, CBOs, CFUGs of the project districts to collect information about the project area, their concerns/expectation and inform them about the project and its ongoing activities.

3.2.3.2. Data Analysis

The HH survey data was processed using computer software whereas the other data was processed manually. The output tables were produced as required by the expert.

3.3. Impact Identification and Prediction

Matrix method was used to assess impact of the project on physical, biological and socio-economic & cultural environment. The significance of both identified and predicted impacts was evaluated. Based on the evaluation each significant impact was further categorized as high, medium and low in terms of magnitude, short term, medium term and long term in terms of duration and local, site specific and regional in terms of extent. The magnitude, extent and duration were categorized as per National EIA Guideline 1993.

3.3.1. Significance of Impacts

I. **Significant:** If the impact is considerable and changes the baseline condition it is considered significant impact.

II. **Insignificant:** If the change is so minor that baseline condition is not affected considerably it is called insignificant.

3.3.2. Magnitude of Impacts

I. Low Impact (L): If the value of the resources could be used with no or minimum inconvenience to the public. Household loosing 10% of their total land and 25% of their agriculture income are also categorized under this category.

II. Medium/Moderate Impact (M): If the value of the resources could be used with inconvenience to the public. Household loosing up to 50% of their total land and up to 50% of their agriculture income are also categorized under this category

III. High Impact (H): If the value of the resources reduced far below publicly acceptable level. Household losing more than 50 % of their total land and 50% above of their agriculture income are also categorized under this category.

3.3.3. Extent of Impacts

I. Site Specific (S): If the impact is limited to the project area then it is a site specific one.

II. Local (L): If the impact of the work extends to the watershed then it is termed as local.

III. Regional (R): If the impact of the work extends beyond the watershed then it is termed as regional.

IV. National (N): If the resources are affected at national scale, it is known as a national impact.

3.3.4. Duration of Impacts

I. Short Term (ST): If the impacts last for 3 years after project initiation it is classified as short term. The construction phase impacts are mostly categorized under this category.

II. Medium Term (MT): An impact that continues for more than 3 years but less than 20 years is considered as medium-term. The construction phase impacts which carry over 1-2 years of operation phase falls under this category.

III. Long Term (LT): An impact that lasts beyond 20 years is considered to be long term. The operation phase impacts are mostly categorized under this category.

3.4. Public Notice

Notice with regards to updated Initial Environmental Examination study has been published in Gorkhapatra daily newspaper on14th Mangsir 2075 and 24th Falgun 2075 (Annex 5a). As per clause 7 (2) of the amendment version of Environment Protection Rule 15 days has been given to local people for providing written concerns/issues regarding the project The copy of notice has been affixed at the Rural Municipality/ Municipality, local schools, villages, health post and other public places. The Muchulka (Indeed) of the notice display has been collected (Annex 5b). The recommendation letter of concerned R/M has also been collected and presented in this report (Annex 5c).

3.5. Team Members

The following manpowers involved for this updated IEE study.

Team Leader: Mr. Raju Gyawali – Environmentalist

Environmental Expert: Mr. Bijaya Mishra and Mr Arjun Subedi

Socio-Economist: Mr. Janak Bdr. Shahi, Mr. RR Chaudhary and Mr Sunil Kr. Kalwar

Engineer: Mr. Amit Kumar Karna

4. Review of Relevant Policies, Acts, Rules, Guidelines and Conventions

4.1. General

Environmental management is relatively a new subject in Nepal. This chapter focuses on brief description of the policy, legal and administrative framework within which Hetauda- -Dhalkebar- Duabi 400 kV Transmission Line Project will be implemented. The proponent will comply the legal requirement of Government of Nepal (GoN) as well as the World Bank Environmental and Social Safeguard Policies and will be responsible for fulfilling provisions of all relevant acts while implementing the project.

Some of these national and international policies, acts, rules, guidelines and conventions relevant to the project are described below. The proponent will obey and follow if any other laws besides those already mentioned in the document are attracted due to various activities that will be undertaken as the part of the project.

4.2. National Plan/Policies, Acts, Rules and Guidelines

4.2.1. Plan, Policies and Strategies

4.2.1.1. Constitution of Nepal

In the Article 30 of Part 3 of the Constitution of Nepal states about 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 have the right to obtain compensation. In the same way, Article 51(g) explains Policies relating to Protection, Promotion and use of Natural resources under the Policies of the State as follows;

- to protect, promote, and make environmental friendly and sustainable use of, natural resources available in the country, in consonance with national interest and adopting the concept of intergenerational equity, and make equitable distribution of fruits, according priority and preferential right to the local communities,
- to make multi-purpose development of water resources, while according priority to domestic investment based on public participation,
- to ensure reliable supply of energy in an affordable and easy manner, and make proper use of energy for the fulfillment of the basic needs of citizens by generating and developing renewable energy,
- to develop sustainable and reliable irrigation by making control of water-induced disasters, and river management,
- to conserve, promote, and make sustainable use of forests, wildlife, birds, vegetation and bio-diversity, by mitigating possible risks to environment from industrial and physical development, while raising awareness of general public about environment cleanliness,
- to adopt appropriate measures to abolish or mitigate existing or possible adverse environmental impacts on the nature, environment or biological diversity,

- to pursue the principles of environmentally sustainable development such as the principles of polluter pays, of precaution in environmental protection and of prior informed consent,

to make advance warning, preparedness, rescue, relief and rehabilitation in order to mitigate risks from natural disasters.

4.2.1.2. Fourteenth Plan (2016- 2019)

This plan has emphasized to priority on electricity development, sustainable development and pollution prevention. The plan highlighted support for indigenous peoples, inclusive development of IPs (Indigenous people) and other disadvantageous groups inclusive development of IPs and other disadvantageous groups by (i) creating an environment for social inclusion; (ii) participation of disadvantageous groups in policy and decision making ; (iii) developing special programs for disadvantaged groups; (iv) positive discrimination or reservation in education, employment, etc. (v) protection of their culture, language and knowledge, (vi) proportional representation in development and (vii) making the country's entire framework socially inclusive.

4.2.1.3. Hydropower Development Policy, 2001

The Hydropower Development Policy 2001 emphasizes the need of implementation of mitigation measures in project affected area. The policy states that Resettlement and Rehabilitation works shall be conducted as per approved criteria of the GoN. The policy clearly states that hydropower development shall be emphasized with due consideration of environmental conservation and as an alternate of bio and thermal energy. Section 6.3 deals with the provision for investment in generation, transmission and distribution where as section 6.1.2.3 (a) deals with different kind of license required at different level of project development. The policy also recommends riparian release of 10% of the average minimum monthly flow or as recommended by the study.

4.2.1.4. National Biodiversity Strategy and Action Plan 2014-2020

The GoN prepared and implemented Nepal Biodiversity Strategy in 2002 and Nepal Biodiversity Strategy Implementation Plan in 2006. Useful experience and lessons have been learnt from the implementation of the strategy and the plan. Moreover, substantial changes have taken place in the socio-political and environmental contexts of the country over the last decade. Several new themes and issues have emerged or gained prominence since 2002. In light of these changes, MoFSC has prepared this revised 'National Biodiversity Strategy and Action Plan (NBSAP) 2014-2020'. It has been prepared to meet the national needs for managing biodiversity on a sustainable basis for the benefit of present and future generations, and also to fulfill the country’s international obligations. It has a long-term (i.e. 35 years) vision, and includes specific short-term (up to 2020) strategies and priorities for action.

4.2.1.5. National Conservation Strategy (1988)

As a signatory of the World Conservation Strategy and a member nation of IUCN, it was obligatory for the GoN to formulate a national conservation strategy. To meet this obligation, the NPC with technical support from IUCN developed National Conservation Strategy in 1988. The NCS 1988 was endorsed and well received by the government. NCS 1988 was developed based on past successes and the need to sustainably manage resources in order to

maintain ecosystem quality, reclaim degraded resources and restore cultural heritage.
The NCS (1988) was developed within a conceptual framework of "Conservation for Development". This framework included four objectives: i) satisfy the basic needs of the people, ii) ensure the sustainable use of land and renewable resources, iii) preserve the biological diversity, and; iv) maintain essential ecosystems. The NCS (1988) had six major thematic areas, 28 sub-areas and 310 actions agenda to be implemented. It also proposed 15 activities under four vanguard programmes - i) Mountain, ii) Hills, iii) Inner Terai, and iv) Terai as initial steps in field implementation of integrated resource management programmes.

4.2.1.6 Water Resources Strategy 2002

The GoN, through the Water and Energy Commission Secretariat (WECS), formulated its first comprehensive *Water Resources Strategy* (WRS) in 2002. To contribute to the national goal of improving the living conditions of the Nepali people in a sustainable manner, the WRS has formulated short-term (five year), medium-term (15 year) and long-term (25 year) strategies for the water resources sector.

4.2.1.7 Forestry Sector Policy, 2071 (2015)

The long term vision of Forest Policy, 2071 (2015) is to contribute towards local and national welfare through sustainable management of forest, biological diversity and watershed. The main goal of the policy is to conserve, promote and utilize forest, flora, fauna, conservation area, biological diversity and watershed and generate job employment, increase income, improve livelihood of vulnerable people and balance the ecosystem. The objectives of the policy is to conserve and manage forest, flora, fauna, conservation area and watershed to bring environmental balance, increase the forest productivity and production of forest products for fulfilling local and national needs and enhance exports to contribute towards national economy, develop and promote CF and other community based forest management options, involve private sector in forest area conservation, promotion and management for income generation and generate job employment and enhance the forest governance. To achieve above vision, goals and objectives, policies for increasing productivity and forest products through sustainable forest management, increasing benefits from biological diversity, resource conservation and environmental services and fair distribution of these resources, increasing productivity of water and land conservation through united conservation and management of watershed, enhancing CFs, leasehold forests, religious forests, protected forests and buffer zone CF for ecological, economic and social benefits and fair distribution, involving private sector in forest area conservation, promotion and management for income generation, applying climate change mitigation and adaptation measures and strengthen management for forest sector governance, inclusion and social law promotion.

4.2.1.8 National Agriculture Policy, 2061 (2004)

The National Agriculture Policy, 2061 follows an objective of creating enabling environment for agriculture-led rural development. The policy aims at increasing productivity and promoting natural resources to utilize them in the interest of farmers. The long-term vision of the agriculture sector is to bring improvement in the living standards through sustainable agricultural development by transforming subsistence agricultural system into a commercial

and competitive agricultural system.

The policy intends to facilitate the farmers of both types: (a) the farmers who have access to means and resources, and (b) the farmers who have comparatively low access to the means, resources and opportunities. Emphasis is given for enhancing agriculture production and productivity, developing commercial and competitive agriculture system, and protecting as well as promoting the use of natural resources without adverse effect to environment.

4.2.1.9 Nepal Environment Policy and Action Plan, 2050 and 2055 (1993 and 1998)

The five policy principles a) to manage efficiently and sustainably natural and physical resources; b) to balance development efforts and environmental conservation for sustainable fulfillment of the basic needs of the people; c) to safeguard natural heritage; d) to mitigate the adverse environmental impacts of the development projects of the development and human actions; and e) to integrate environment and development through appropriate institutions, adequate legislation and economic incentives, and sufficient public resources.

4.2.1.10 Climate Change Policy, 2067 (2011)

This policy envisions a country spared from the adverse impacts of climate change, by considering climate justice, through the pursuit of environmental conservation, human development and sustainable development all contributing toward a prosperous society

4.2.1.11 Land use Policy, 2074 (2017)

The main aim of this policy is to bring balance between population, environment and development. According to this policy, land use programs must be linked with the activities that would lead to increase in productivity of the land, conservation of environment, social and economic prosperity, poverty alleviation etc. The policy tries to manage the different types of uses of the land resource by incorporating ways to minimize soil erosion, landslide, forest degradation and soil infertility. Its overall goal is to simultaneously promote and conserve physical infrastructure and biodiversity.

4.2.1.12 National Policy on Land Acquisition, Compensation and Resettlement, 2015

The National Policy on Land Acquisition, Compensation and Resettlement in Development Projects in Nepal was prepared by the National Planning Commission (NPC) with ADB assistance. The Policy has the following guiding principles:

- "Appropriate and adequate compensation for the loss of assets or income is a fundamental right of all project affected persons. Physically displaced people must be relocated with basic amenities such as school, health posts and other facilities.
- All affected persons should be assisted to restore at least their pre-project income and livelihood sources.
- The absence of legal title to land should not be a bar for compensation, resettlement and rehabilitation assistance.
- Vulnerable groups such as *Janajati/Adivasi*, Dalits, landless, women, especially women-headed households, differently-abled, poverty groups and senior citizens are entitled to special benefit and assistance packages in addition to compensation and resettlement."

4.2.2. Acts

4.2.2.1. Environment Protection Act, 2053 (1997)

Nepal has enacted a comprehensive and umbrella type Act, the Environment Protection Act (EPA), 1997 which is now enforced through appropriate regulatory measures. The EPA provides a legal basis for the concerned authorities for regulation of IEE or EIA. Section 3 of the Act requires the proponent to conduct an IEE or EIA in relation to the prescribed proposals. The Act uses the word proposal instead of Projects which makes the scope of the Act much broader in relation to environmental studies. Proponent includes any government, semi government or non-government agency or organization submitting an application for approval of a proposal and possessing the responsibility to work according to such a proposal or implementing the proposal.

According to the provision in Section 6 (1) of the Act, the relevant agency is empowered to grant approval for the IEE and EIA 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.

4.2.2.2. Electricity Act, 2049 (1992)

The electricity act 1992 has been enacted to manage the survey, generation, transmission and distribution of electricity and to standardize and safeguard electricity services.

Article 3 - No license is required to survey, generate, transmit or distribute electricity from the projects of capacity ranging from 100 kW to 1000 kW. However, information should be provided to the designated authority about such a project.

According to Section 4 subsection -1 of the act, Any person or corporate body who wishes to conduct survey, generation, transmission or distribution of electricity over 1 MW shall be required to submit an application to the prescribed officer along with economic, technical, and environmental study report. Section 24 of this act states that " While carrying out electricity generation, transmission or distribution, it shall be carried out in such a manner that no substantial adverse effect be made on environment by the way of soil erosion, flood, landslide air pollution etc".

4.2.2.3. Water Resources Act, 2049 (1992)

The objective of the Water Resources Act, 2049 is to make legal arrangements for determining beneficial uses of water resources, preventing environmental and other hazardous effects thereof and also for keeping water resources free from pollution. The Act strives to minimize environmental damage to water bodies, especially lakes and rivers through environmental impact assessment studies and the proponents who wish to use water resources for various purposes should prepare IEE report before a license can be granted. The Act stipulates that soil erosion, flooding, landslides or any significant impact on the environment should be avoided in all uses of a water resource. The provisions made in Water Resources Act, 2049 (1992) is mandatory in case of the implementation of the proposed project. As per the provision, the environmental impact mitigation and enhancement measures have been proposed in view of environment conservation.

4.2.2.4. Land Acquisition Act, 2034 (1977)

It is the main legislation to guide the land acquisition process in the country. Government can acquire land at any place in any quantity by giving the compensation pursuant to the act for the land required for any public purpose or for the operation of any development project initiated by government institution (sections 3 and 4).

The compensation paid under this act will be given in cash. To decide about the amount of compensation the act has made provision for the constitution of Compensation Fixation Committee (CFC). This act is silent about the payment of compensation at market rate, which pose difficulty for the payment of compensation at present value.

4.2.2.5. Forest Act, 2049 (1992)

The Forest Act, 2049 (Amendment 2055) recognizes the importance of forests in maintaining a healthy environment. One of the major objectives of the enhancement and enforcement of the Forest Act is the promotion of a healthy environment. The Act requires decision-makers to take account of all forest values, including environmental services and bio-diversity. It emphasizes the development and implementation of an approved work plan for different categories of forest, i.e. Community Forests, Leasehold Forests, Private Forests and religious forests.

4.2.2.6. Soil and Water Conservation Act, 2039 (1982)

In order to manage watersheds of Nepal, the Soil and Watershed Conservation Act (SWCA), 1982 was enacted. The act is devoted to the protection of watersheds. Under Section 10 of SWCA, power is extended to the Watershed Conservation Officer to grant permission to construct dams, drainage ditches and canals, cut privately owned trees, excavate sand, boulders and soil, discharge solid waste and establish industry or residential areas within any protected watersheds. The Act outlines the essential parameters necessary for proper watershed management.

The article 2 (B) of the act defines the soil and water conservation. According to article -3 GoN can acquire area/land by giving written notice for the purpose of water conservation. But for such acquisition, compensation shall be paid, in case of private land, in consultation with local authorities. Article 10 of the act elaborates the activities that are considered illegal in the area which are suspected for natural disaster.

4.2.2.7. Labor Act 2074 (2017)

This Act classifies five types of employment: regular, work basis, time basis, partial and immediate employment. The Act has also made provision of labor court and department of labor. 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 6AM to 6PM which clearly restricts to deploy women in night works. It has provision for rest after continual work for 5 hours. The Act also states that equal opportunity shall be given to women as men. Similarly working period for the other employees must not exceed 8 hours a

day and 48 hours in a week. If some people work beyond that period, over-time allowances must be paid which is 1.5% of the normal per hour wages and such over-time must not exceed 4 hours in a day. According to this act, the wage rate of the employees shall not be less than the rate fixed by the concerned offices of GoN.

The Act has provision insurance during work. The facilities for festival, grade upgrading, payment of salary based on the type of work are some features incoroprated in act.

4.2.2.8. Aquatic Animals Protection Act, 1961

This act is amended in 2055 covering wide area including water resources projects. Section 4 empowers the government to prohibit catching, killing and harming of aquatic animals through notification in the Nepal Gazette. This act is in effective because no proper agency has been designated the responsibility of administering and enforcing AAPA. Department level proper agency should be identified and placed with full authority for the enforcement of AAPA -1961

4.2.2.9 CITES Act, 2073 (2017)

(संकटापन्न वन्यजन्तु तथा वनस्पतिको अन्तराष्ट्रिय व्यापार नियन्त्रण ऐन २०७३)

This Act is enacted and enforced adopting Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973 to which GoN is a signatory state. The main objective of this Act is to implement CITES through protection of endangered species and controlling and regulating the wildlife trade. The Act has strictly prohibited the trade, use, farming, breeding or transport (export or import) of endangered species of fauna or flora or their samples. However the Act has provided some flexibility in the above provision by obtaining license.

4.2.2.10 Contribution Based Social Security Act 2017 (2074)

योगदानमा आधारित सामाजिक सुरक्षा ऐन, २०७४

Contribution Based Social Security Act 2017 (2074) (**"Social Security Act"**) was passed by the Parliament on July 24, 2017 (Shrawan 09, 2074) and accorded the assent by the President on 13 August, 2017 (2074-04-29). The Social Security Act will be effective from November 11, 2017 (Kartik 25, 2074) by virtue of Section 1(2) of the Act. Section 1 (2) of the Social Security Act provides that it will be effective from 91 (Ninety One days) from the date of assent by President and has ensured the social security rights to labourers working in the country.

Government notification is required for the Social Security Act to be applicable to any industries, business or service sector. The Social Security Act provides that the government publishes the notice in Nepal gazette prescribing the sector, industries, business, service or employer undertaking certain transaction to whom the Social Security Act applies.

The Social Security Act specifies the Scheme that shall operate. The Scheme Include (a) Medical and Health Protection Scheme, (b) Maternity Protection Scheme, (c) Accidental Protection Scheme, (d) Old-age Protection Scheme, (e) Dependent Family Protection Scheme, (f) Unemployment Protection Scheme. The Fund has also authority to introduce other Schemes.

4.2.2.11 Local Government Operation Act, 2074 (2017)

As the Local Self-Governance Act, 2055 (1999) was scrapped after the implementation of new constitution, this act is enforced by GoN in 2074/06/29 accordingly. This act has paved a strong legal foundation towards institutionalizing executives, legislative and quasi-judiciary practice of the newly formed local government. The legal mechanism has been enacted as per the Article 296 (1) of the Constitution of Nepal so as to leverage local leadership and governance system. It has been introduced by upholding the spirit of local autonomy and full decentralization with the motive to distribute fruits of democracy in a proportional, inclusive and just manner. The act has stipulated several arrangements related to authorities, duties and responsibilities of local government.

4.2.2.12 Civil Code, 2074

The code has for the first time made provisions under which any wrong doer would have to bear the loss resulting from such wrongful act. It also prohibits all sorts of acts capable of causing harm to others. It demands the establishment of good neighborly relations. It contains provisions dismissing the customs and traditions that are against the law.

As per the act no one should damage, hate or insult or other related act on religious belief or holy places or pollute graveyards of any ethnic groups or community intentionally. No one should stab religious sentiments of any caste, community or ethnic groups by using texts, writing, verbal, symbols or any other means. No one should create any kind of obstacles in religious tradition of other faith being practiced since ancient times.

4.2.3. Rules/ Regulations

4.2.3.1. Environment Protection Rule, 2054 (1997)

EPR was endorsed in June 1997 and was made under the provisions of the EPA. The EPR has been amended several times and the recent was done in 2065/11/26. The recent amendment states that TL projects of capacity above 132kV voltage level require only IEE unless it traverses through protected area, buffer zone or national parks. The EPR adopts the environmental assessment criteria mentioned in the EIA guidelines. However, the EPR establishes the administrative framework for assessing, exhibition and determination of the EIA/IEE, in terms of issues needing to be addressed and the format/layout of the EIA/IEE document.

Under section (18) of EPA, any person who contravenes any of the provisions of the Act, or the Regulations or the guidelines issued under the Act, shall be punishable with a fine up to NRs. 50,000. If a proposal is implemented without the approval of the Ministry of Population and Environment (in case of IEE, MoEn) or relevant government agency, or the person implementing the proposal is not complying with the conditions of the approval or license, the authorized official is empowered to close down that activity and may impose fine of up to NRs. 100,000 on such person or organization. This Act is relevant to the proposed project. Under this Rules, the IEE of the proposed project has to be carried out by the proponent and get approval from the MoE prior to the project implementation.

4.2.3.2. Electricity Regulations, 2050 (1993)

Regulations 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 hydro-electricity (Rule 12 and 13).

Rule 12 (f) and Rule (g) are related to the EIA/ IEE process which emphasize that the IEE report should include measures to be taken to minimize the adverse effects of the project on social, biological and physical environments and should also elaborate utilization of local labour, 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.

4.2.3.3. Water Resources Rules, 2050 (1993)

It is mandatory under Rule 17 (e) of the regulation that any person or corporate body, who desires to obtain a license for utilization of water resources must state in his application that appropriate measures will be taken to lessen the adverse effects due to the project on the overall environment. Measures are to be taken for the conservation of aquatic life and water environment and for mitigating social and economic effects of the project in the concerned area.

4.2.3.4. Forest Regulation, 1995

Rule 65 of the Forest Regulation stipulates that in case the execution of any project having national priority in any forest area causes any loss or harm to any local, individual, or community, the proponents of the project itself shall bear the amount of compensation to be paid. Similarly the entire expenses required for the harvesting, logging and transporting of the forest products in a forest area should be borne by the proponents of the projects.

4.2.3.5 Labor Rules, 2075 (2018)

The Labor Rule has been published in Nepal Gazette on June 22, 2018 (Asar 08, 2075) with immediate effect and has repealed the then Labor Rules, 1994 (2050) ("Previous Labor Rules"). Major highlights of the Labor Rules have been briefly described in the following paragraphs.

It has set out the criteria for determining if any dispute arises on whether or not an employment is regular employment. Rule 3 of the Labor Rules provides for such criteria. It has also specified the additional matters to be covered under the Employment Contract. Rule 4 of the Labor Rules requires the Employment Contract to cover (a) nature of employment, (b) primary work of the Employee and his/her position, (c) statement that the Employees' Service Rule will be integral part, (d) date, time, place of contract and its effective date, (e) Other important terms and conditions related to the work or service of the Employee.

The Employer can determine the work hours on the basis of the nature of the work of the entity. The notice of the work hours however, should be given to all the Employees. It also provides that the Employer may put the Employee to work on rotation based on nature of its

work. It seems that the Labor Rules envisages to put the Employee in different shifts.

4.2.3.6 Contribution-based Social Security Regulation 2018 (2075)
(योगदानमा आधारित सामाजिक सुरक्षा नियमावली २०७५)

Nepal government has approved the Contribution-based Social Security Regulations on 11th November, 2018 and ensured the social security rights to labourers working in the country. The Regulations has made arrangements for providing social security to the contributors. As per law, both employers and employees must mandatorily deposit their instalment for the scheme and it is applicable for all types of workers. The scheme is in accordance with the Contribution-based Social Security Regulation. The Regulations has provisions for enlisting in the Social Security Fund, the individuals drawing salary from the government fund, the labourers in the informal sector and self-employed individuals.

The contribution-based social security scheme is funded through the contributions made by the workers and the employers. This is a historical step towards achieving decent work for all. The scheme is set to initially include medical, health and maternity benefit; accidental and disability benefit; benefits for dependent family members and old-age benefit. This is a historical step towards achieving decent work for all. The Government plans to extend the scheme to workers in the informal sector soon.

4.2.4. Guidelines/Procedures

4.2.4.1. National Environmental Impact Assessment Guidelines, 2050 (1993)

The National EIA Guidelines, 1993 set out the process for the environmental review and management of infrastructure projects in all sectors and the respective roles of certain GoN agencies and project proponents. The guideline is part of a comprehensive program to develop the national and sectorial guidelines for establishing a national system for EIA which is part of GoN's National Conservation Strategy. The EIA Guideline was endorsed by GoN on 27 September 1992 and gazette on 19 July 1993.

It is mandatory to follow the National EIA Guidelines, 2050 (1993) during the IEE. 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.

4.2.4.2. EIA Guideline for Agriculture Sector 2003

The EIA Guideline for Agriculture Sector 2003 was developed to minimize impacts on the agriculture sector due to increase in agricultural products and production and the activities of projects implemented by other organizations. Schedule 2 of the Guideline discusses the screening process for environmental studies, Schedule 4 relates to EIA scoping and Schedule 5 describes the requirements for the EIA ToR.

The construction of the transmission line will involve the acquisition of cultivated land for tower sites and may involve the leasing of cultivated land for temporary construction sites, thus standing crops may be affected and therefore the provisions of this Guideline are

relevant to the project.

4.2.4.3. DoED/USAID Hydropower Manuals

The DoED, in collaboration with the United States Agency for International Development (USAID) and the International Resources Group Ltd., prepared seven manuals relating to hydropower environmental studies and monitoring in Nepal. These manuals include:

- Manual for preparing Scoping Document for EIA of Hydropower Projects;
- Manual for preparing Terms of Reference for EIA of Hydropower Projects with notes on EIA report preparation;
- Manual for preparing Environmental Management Plan for Hydropower Projects;
- Manual for Public Involvement in the EIA Process of Hydropower Projects; and
- Manual for Prediction, Ranking and Determination of Significant Impacts in EIA of Hydropower Projects.

The manuals are helpful in preparing EIA scoping documents, Terms of Reference, EIA/IEE reports and environmental management and monitoring plans, and were reviewed during the updating this IEE.

4.2.4.4. Forest Produce Collection, Sales and Distribution Guideline, 2000

The guidelines clauses 3 to 10 have specified various procedure and formats for getting approvals for vegetation clearance, delineation of lands for vegetation clearance, evaluation of the wood volume etc, and government offices and officials responsible for the approval. These provisions have a direct relevance to the development of the projects and need compliance to these provisions.

4.2.4.5. Environmental Management Guideline (Road), 1997

This guideline has been prepared by Geo- Environment Unit of Department of Road (DoR) to ensure that environmental consideration are integrated in project design, tender document, contract document, project supervision and monitoring. The guideline clearly defines the environmental mitigation measures to be incorporated into DoR Projects, procedure for public participation and socioeconomic considerations. The environmental mitigation measures are basically selection of alignment by avoiding landslide prone area, geologically unstable areas, large scale cutting, implementation of suitable drainage and bioengineering measures.

The public participation suggests method for determining how and when the public should be included in the environmental analysis. For socioeconomic impact strategies are proposed for reducing or avoiding the potential negative impacts and for maximizing the beneficial impact to local residents. Regarding the socioeconomic impact land acquisition and compensation, economic impacts and cultural heritage are the prime area to be considered for the study.

4.2.4.6 Working Procedure for the Use of National Forest Land for National Priority Project, 2074 (राष्ट्रिय प्राथमिकता प्राप्त योजनाको लागि राष्ट्रिय वन क्षेत्र प्रयोग गर्ने सम्बन्धी कार्यविधि, २०७४)

Guideline for the use of forest area for development projects of National Priority projects

reiterates the use of the forest area only if other options are not available. The projects requiring the forest land area have to make alternative studies to minimize the forest land use areas. Development project national priority will be allocated such lands on the discretion of the MoFE. To compensate the forest area and resource lost the proponent has to with the following provisions.

The proponent has to afforest the area equal to the forest area lost at minimum, if the forest area occupied by the project is a barren land. The land area for afforestation will have to decide based on the discussion with the district forest office. Or the proponent could deposit the required amount as per forest norm to the district forest office.

The proponent should plant 25 trees for every lost tree of above 30cm DBH in areas designated by the district forest office and look after the plantation for 5 years to ensure their protection and growth of every planted tree. Or the proponent deposit the required amount for plantation and protection for five years to the district forest office.

4.2.4.7 जग्गाको हदबन्दी छुट दिने सम्बन्धी आदेश, २०७४

Nepal Government, Ministry of Land Reform and Management published a notice in section 67 number 29 Nepal Gazette part 5 dated 2064/06/25, by using the authority given in article 12 of Land Reform Act 2021, containing the provision to purchase more than dissociated land by the education or health institution, hydropower, cultural, industrial work, work for agricultural industry and co-operative farming organization, if such industry or institutions need.

4.2.4.8 Guidelines for Licensing of Electricity Project, 2075 (2018)

(बिद्युत आयोजनाको अनुमतिपत्र सम्बन्धी निर्देशिका, २०७५)

GoN has introduced new guideline for licensing power project on Nov 2018. The guideline focuses briefly on the procedures for taking survey license of production, generation and distribution of power project, its amendment, renewable and dissolution.

4.2.5. Convention

4.2.5.1. Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora

Nepal is a party to the CITES that aims to control the trade of certain wildlife species to prevent further endangering of their survival. CITES classifies species according to the following criteria: I – species threatened with extinction, II – species which could become endangered, III – species that are protected (CITES 1983. As Nepal is party to the Conventions related to species conservation attention should be given to evaluate the impacts of the project activities on meeting their obligations.

4.2.5.2. ILO Convention on Indigenous and Tribal Peoples, 1989 (No.169)

Nepal ratified ILO Convention No. 169 on September 14, 2007. In 2007 the UN Declaration on the Rights of Indigenous Peoples was adopted by the General Assembly. The declaration reaffirms the importance of the principles and approaches provided for under Convention No.

169 and its adoption therefore provide afresh impetus for promoting the ratification and implementation of Convention No. 169. ILO Convention No.169 highlights the need to recognize indigenous and tribal people's specific knowledge, skills and technologies as the basis for their traditional economies and self- determined development process. Article -1 of the convention provide definition of the tribal and indigenous people. Article -6 deals the consultation of the peoples concerned through appropriate procedure and in particular through their representative institutions, whenever consideration is being given to legislative or administrative measures which may affect them directly.

In Article 15 the rights of the peoples concerned to the natural resources pertaining to their lands shall be specifically safeguarded. These rights include the right of these people to participate in the use, management and conservation of these resources. The use of the term lands includes the concept of territories, which covers the total environment of the areas which the peoples concerned occupy or otherwise use. The peoples concerned shall wherever possible participate in the benefits of such activities and shall receive fair compensation for any damages which they may sustain as a result of such activities. Article 16 (2) clearly mention that where the relocation of these peoples is considered necessary as an exceptional measures such relocation shall take place only with their free and inform consent. Where their consent cannot be obtained, such relocation shall take place only following appropriate procedures established by national laws and regulations, including public inquiries where appropriate, which provide the opportunity for effective representation of the peoples concerned. Article 16 (3) mention that whenever possible these peoples shall have the right to return their traditional land as soon as the grounds for relocation cease to exist. Article 16(5) elaborated the persons thus relocated shall be fully compensated for any resulting loss or injury.

4.2.6 Standards

National Ambient Air Quality Standard, 2069 (2012)

The National Ambient Air Quality Standards, 2012 enforced by GoN has set maximum concentration limit for nine air quality parameters. These parameters includes total suspended particles (TSP), particulate matter (PM_{10}), sulfur dioxide, nitrogen dioxide, carbon mono-oxide, lead, benzene, $PM_{2.5}$ and Ozone. The standards has also prescribed the test methods for these parameters. The project during its construction and operation will have to comply with the set standards for the ambient air quality.

Nepal Vehicle Mass Emission Standard, 2069 (2012)

In order to regulate the vehicular emission, GoN released the Nepal Vehicle Mass Emission Standard, 2069. This standard has set the limit values on different parameters of emission for petrol and diesel fueled vehicles. These parameters include carbon monoxide, hydrocarbon, oxides of nitrogen particulate matters (PM) and smoke opacity. Furthermore, these standards are based on type approval and conformity of production of the vehicles.

National Ambient Sound Quality Standard, 2069 (2012)

It has set the limit of allowable noise/sound intensity in different areas at different time,

during the day and the night. The limit of sound intensity is different for different area like industrial area, commercial area, settlement areas in rural and urban settings, etc. These standard will be complied.

Standard on Emission of Smoke by Diesel Generators, 2069 (2012)

Emission standards are set for the new and existing diesel generators by the GoN. The standard has set the limits on four parameters of emission including Carbon monoxide (CO), hydrocarbon (HC), oxide of nitrogen (NO_x) and Particulate Matter (PM). This standard is set in accordance with the EURO III and Bharat III standards. The generators to be used during project construction will follow these standards.

The project proponent is committed to fulfill the above mentioned standards

4.3. World Bank Safeguard Policies

World Bank has ten safeguard policies mainly environmental assessment, natural habitats, forest, pest management, safety of dams, involuntary resettlement, indigenous people, cultural property, projects involving international waters, projects in disputed area etc. The objectives of Safeguard policies are to integrate environmental and social issues in to decision making, to support Participatory approaches and transparency, to effective implementation of project for achieve sustainable development etc.

The objective of these policies is to prevent and mitigate undue harm to people and their environment in the development process. These policies provide guidelines for bank and borrower staffs in the identification, preparation, and implementation of programs and projects. Safeguard policies have often provided a platform for the participation of stakeholders in project design, and have been an important instrument for building ownership among local populations.

4.3.1. Environmental Assessment

The main objectives of Environmental Assessment (EA) is to support integration of environmental and social aspects of projects in to the decision making process. It has cover to analyses the potential environmental and social risks and impacts in project area of influences .It has also examines project alternatives and develops Environmental Management Plans(EMP) The Bank requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making. The Bank classifies the project into 4 sub categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

4.3.2. Indigenous Peoples

World Bank defines Indigenous Peoples, as the people, who have self-identification, collective attachment to ancestral lands, customary culture, economic, social, political institution and indigenous language. The Bank recognizes that the identities and cultures of Indigenous Peoples are inextricably linked to the lands on which they live and the natural resources on which they depend. These distinct circumstances expose Indigenous Peoples to

different types of risks and levels of impacts from development projects, including loss of identity, culture, and customary livelihoods, as well as exposure to disease.

As social groups with identities that are often distinct from dominant groups in their national societies, Indigenous Peoples are frequently among the most marginalized and vulnerable segments of the population. As a result, their economic, social, and legal status often limits their capacity to defend their interests in and rights to lands, territories, and other productive resources, and/or restricts their ability to participate in and benefit from development. At the same time, the Bank recognizes that Indigenous Peoples play a vital role in sustainable development and that their rights are increasingly being addressed under both domestic and international law.

4.3.3. Natural Habitats

Natural Habitats seeks to ensure that World Bank-supported infrastructure and other development projects take into account the conservation of biodiversity, as well as the numerous environmental services and products which natural habitats provide to human society. The policy strictly limits the circumstances under which any Bank-supported project can damage natural habitats (land and water areas where most of the native plant and animal species are still present).

Specifically, the policy prohibits Bank support for projects which would lead to the significant loss or degradation of any Critical Natural Habitats, whose definition includes those natural habitats which are either, legally officially proposed for protection, or protected, unprotected but of known high conservation value etc.

4.3.4. Forest

The Bank's current forests policy aims to reduce deforestation, enhance the environmental contribution of forested areas, promote forestation, reduce poverty, and encourage economic development.

Combating deforestation and promoting sustainable forest conservation and management have been high on the international agenda for two decades. However, little has been achieved so far and the world's forests and forest dependent people continue to experience unacceptably high rates of forest loss and degradation. The Bank is therefore currently finalizing a revised approach to forestry issues, in recognition of the fact that forests play an increasingly important role in poverty alleviation, economic development, and for providing local as well as global environmental services.

The new proposed Strategy suggests three equally important and interdependent pillars to guide future Bank involvement with forests are harnessing the potential of forests to reduce poverty, integrating forests in sustainable economic development, and protecting vital local and global environmental services and forest values.

4.3.5. Involuntary Resettlement

Involuntary resettlement may cause severe long-term hardship, impoverishment, and environmental damage unless appropriate measures are carefully planned and carried out. The basic principle of Involuntary Resettlement are; avoid, minimize and mitigate

involuntary resettlement impacts, payment of compensation before taking possession of the property, commensuration at replacement cost and carry out consultation from beginning to end of the project. For these reasons, the overall objectives of the Bank's policy on involuntary resettlement are the following:

(a) Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs.

(b) Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits.

(c.) Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs.

(d) Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher

To address the impacts covered of this policy, the borrower must prepare a resettlement plan or a resettlement policy framework. The framework shall include consultation process, alternatives, compensation at full replacement cost for losses of asset, assistance (such as moving allowances) during relocation, residential housing, or housing sites, or, as required, agricultural sites, offered support after displacement for a transition period to restore their livelihood and standards of living and provide with development assistance such as land preparation, credit facilities, training, or job opportunities in addition to compensation measures.

5. Description of the Existing Environment

The following chapter outlines the baseline conditions of the physical, biological and socio-economic & cultural environment of the project area.

5.1. Physical Environment

5.1.1. Watershed Conditions

The project traverses through the three physiographic regions mainly the Bhawar Zone, Siwalik Zone and Midland Terai. The last stretch of the line lies in the Gangetic plains of terai region. Although the line traverses through the Siwalik and Bhawar Region which is fragile in nature, the watershed of the transmission route including the substations at Hetauda and Inaruwa is stable and intact. The watershed of the alignment is drained by perennial rivers like Saptakoshi, Bagmati and Rapti and other major tributaries like Trijuga, Lakhandehi, Ratu and Balan. Rivers along the alignment mainly drain towards the south originating from the Siwaliks.

The rivers like Rapti Nadi, Bakaiya Khola, Chadi Khola, Bagmati Nadi, Dhansar Nadi, Lakhandehi Khola and Ratu Nadi drains the watershed of 132 km long Hetauda- Dhalkebar stretch of the proposed transmission line. The latter section from Dhaklebar to Duhabi is drained by rivers like Kamala Nadi, Khuti Nadi, Balan Nadi, Devdhar Nadi, Dumarjo Nadi,

Site for AP 5A/0 and AP13C/1 located on top of hillocks with possibility of sheet and gully erosion (Hetauda- Dhalkebar Stretch)

Mahuli Nadi and Koshi Nadi. The flow in the rivers is influenced by monsoon rains and flash floods are very common in the project area.

5.1.2. Topography and Land use

The alignment runs through several topographic features comprising of hillocks with mild slope, flat agricultural land, small valleys and foothills of the Siwalik hills.

The altitudinal variation of the initial stretch from Hetauda to Dhalkebar substation ranges between 125 masl to 550 masl. The transmission line starts at an elevation of 436m from Hetauda substation

Landuse along the Dhalkebar- Inarwua Stretch

located in Hetauda Sub Metropolitan city and it gradually ascends to the highest elevation of 550 masl at AP-5 located at then Hurnamadi VDC and then gradually descends to the lower elevation at AP -13 B at Nijgadh.

The stretch between Dhalkebar-Duhabi mainly passes through physiographic region of Midland terai almost parallel to north of East-West Highway avoiding settlement areas. The altitudinal elevation along this stretch is not much and ranges from 90 masl to 300 masl.

The route of the right-of-way of this stretch is dominated by flat cultivated plains. The land use of the alignment consists mainly of cultivated fields and forest, road crossings, canal crossings, rivers, sand beaches and barren land. Much of the land within the Right-of-way is currently used for agriculture.

The land of the substations at Bhokraha of Sunsari and Dhalkebar of Dhanusha has already been acquired by NEA and compensation has been paid. Previously the land was used for agricultural purposes. The substation at Hetauda has also been acquired by Hetauda-Bharatpur 220 kV TL Project and thus the land acquisition is not included under the scope of this project.

Substation at Bhokraha of Sunsari

The change in the overall land use due to alteration at some location is given in table 5.1 below:

Table 5-1: Landuse change due to change in alignment.

Description	As per Approved IEE	Current Status	Remarks
Total Line Length	***285.2 km***	***288.31km***	***3.11 km more than in approved IEE***
Length in Forest Land	112.66 km	112.66 km	No change
Length in Private Land	146.94 km	154.85 km	7.91 km added than in approved IEE
Length in Other Land	25.59 km	20.79 km	4.8 km decreased than in approved IEE
Right of Way Land Use			
Total land under RoW (ha)	***1311.93 (100%)***	***1326.23 (100%)***	***14.3 ha more than approved IEE***
a. Private Land (ha)	675.92 (51.52%)	712.33 (53.71%)	36.41 ha more than that of approved IEE
b. Forest Land (ha)	518.25 (39.50%)	518.25 (39.07%)	No change
c. Others Land (ha)	117.76 (8.97%)	95.65 (7.21%)	22.11 ha decreased than approved IEE
Total Permanent Land Area required for Substation and Towers	***29.93 ha***	***51.23***	***21.3 ha more than approved IEE***
Forest Land	5.30	12.15	6.85 more than approved IEE
Private Land	23.14	38.16	15.02 ha increased than approved IEE
Others Land	1.49	0.92	0.57 ha less than approved IEE
Substation Area			
Total Substation Area	***16.25 ha***	***20.9 ha***	***4.65 ha more than approved IEE***
a. Dhalkebar	6.77 ha	6.77 ha	No change
b. Bhokraha	9.48 ha	14.13 ha	4.65 ha more than approved IEE

Tower Pads Area (Permanent Land Required)	***13.68 ha***	***30.33 ha***	***16.65 ha more than approved IEE***
Forest Land	5.30	12.15	6.85 more than approved IEE
Private Land	6.89	17.26	10.37 ha more than approved IEE
Others Land	1.49	0.92	0.57 ha less than approved IEE
Temporary camps	***8 ha***	***5.7 ha***	***2.3 ha less than approved IEE***

The total forest land permanently required for tower pads construction at Makawanpur district is 2.59 ha and the forest land under RoW in the district is 78.57 ha. The details about change in alignment are presented in table 5.2.

Table 5-2: Comparison of Land use in changed alignment.

S.N	District	Stretch from … to….	Length in m	No of towers	Land use of							
					Old alignment (in meter)				New alignment (in meter)			
Hetauda to Dhalkebar					**Cultivated / Pvt Land**	**Forest Land**	**Others**	**Total land**	**Cultivated/ Pvt Land**	**Forest Land**	**Others**	**Total land**
1	Makwanpur	BM1 – AP2	3419	10	2031	640	760	3431	2079	640	700	3419
2	Makwanpur	AP4-AP9	15504	45	10239	10135	112	20476	6011	9172	321	15504
3	Makwanpur	AP12-AP12J	4105	11	1377	1560	378	3315	1553	2174	378	4105
4	Bara	AP12J-AP14	9324	27	0	8844	395	9239	0	8929	395	9324
5	Sarlahi	AP29-AP32	9269	28	0	9269	0	5222	7319	1950	0	9269
6	Sarlahi	AP32C-AP33A	1518	5	3826	0	160	3986	1358	0	160	1518
7	Sarlahi	AP33B-AP33D	944	4	910	0	0	910	944	0	0	944
8	Sarlahi	AP34-AP37	4468	12	3460	0	743	4203	3725	0	743	4468
9	Mahottari	AP50-AP52B	4362	12	560	2093	300	2953	551	3557	254	4362
10	Dhanusha	AP53A-AP57	4702	13	1395	2767	1521	5683	1194	2371	1137	4702
	Dhalkebar to Inaruwa											
1	Dhanusha	AP1-AP2	1938	7	795	0	223	1018	1715	0	223	1938
2	Dhanusha	AP3-AP5	3673	11	1783	1250	446	3479	1784	1443	446	3673
3	Siraha	AP16-AP17	4225	13	5583	0	0	5583	4225	0	0	4225
4	Siraha	AP21-AP22	4932	15	4881	0	0	4881	4932	0	0	4932
5	Siraha	AP23-AP25	2531	8	1896	0	0	1896	2531	0	0	2531
6	Siraha	AP27-AP27C	1690	5	300	0	1390	1690	875	0	815	1690
7	Saptari	AP27C-AP29	4720	13	5530	0	0	5530	4720	0	0	4720
8	Saptari	AP35-AP40	14240	39	4092	5545	501	10138	10107	3632	501	14240
9	Udaypur	AP45-AP46	1755	5	815	70	753	1638	1300	53	402	1755
10	Udaypur	AP48-AP49	1680	6	2231	460	0	2691	1355	325	0	1680

5.1.3. Climate

The entire project area may be described as sub-tropical to tropical area. The project area

experiences strong seasonal variations, with wet monsoons from June to September and dry weather from October to May.

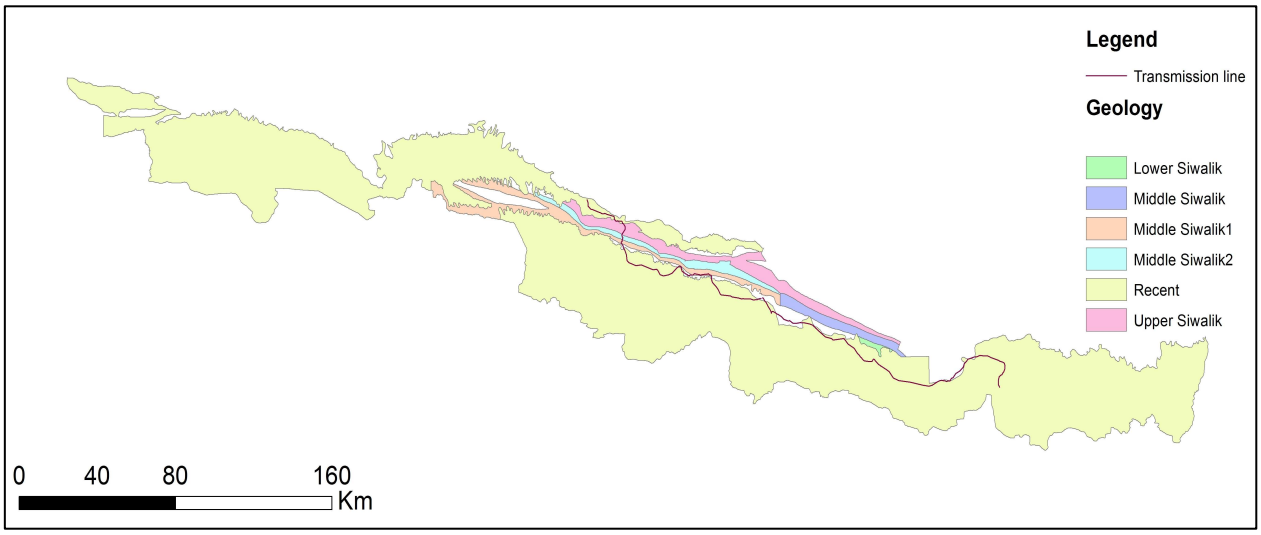
The annual average minimum and maximum temperature ranges from 7.22° C to 46.11° C in Saptari district and from 16.6.° C to 30.3° C in Makwanpur district (District Profile of concerned district). The average annual rainfall of Makwanpur and Sunsari districts is 2535 mm and 1143 mm respectively.

There has been no change in the climate of the project area than mentioned in its approved IEE report.

5.1.4. Geomorphology and Geology

5.1.4.1 Project Geology

Geomorphology of the transmission line corridor is dominated mainly by *Midland Terai* and the *Bhawar zone* along the foothill of Sub-Himalaya. The land system in the Terai can be divided into the flood plains of the rivers, and recent and older terrace deposits. This project starts from the Dun Valley at Hetauda Substation enters the Siwalik range along Bhet khola until it reaches Shreepur-Chhatiwan and crosses Siwalik to reach Terai Zone throughout the region noth-easterly from East West Highway until it reaches Dhalkebar Substation in the Terai. Again it crosses Terai, passes along Siwalik and reaches the Koshi River crossing and turns abruptly to



Geology of the Project Area

the south to enter the Terai before reaching Bhokraha Substation

Geologically, the Sub-Himalaya (Siwaliks) is characterized by the sedimentary rocks of Middle Miocene to Early Pleistocene age, deposited in a fining upward sequence and are generally dipping towards north. The Sub-Himalaya is bounded on the south by the *Himalayan Frontal Thrust (HFT)* and on the north by the *Main Boundary Thrust (MBT)*. From bottom to top Siwalik is divided into three fold classification of the units; these as the follows i) Lower Siwalik ii) Middle Siwalik iii) Upper Siwalik.The Lower Siwaliks consists of finely laminated, siltstone, sandstone, and mudstone. The Middle Siwaliks are comprised of medium to coarse-grained sandstones. The Upper Siwaliks are comprised of conglomerate and boulder beds.

5.1.4.2 Stability of TL Tower Foundation

The chosen tower foundations are placed over the more or less stable ground, except those located above the Siwalik range and over the wide river crossings.

Though there is several erosion scars along the transmission line route while crossing the Siwalik, such places has already been avoided.

Beyond the Siwalik, there is almost constant and uniform topographic as well as geomorphic terrain throughout the TL alignment except over the crossing of major rivers/Kholas, especially the Kamala and the Koshi River crossing, where the transmission line encounters some marshy land and a wide zone of sedimentation. The overall ground condition of the TL tower foundations are more or less stable except those listed in Table 5.1 that needs some precautionary measures.

The approved IEE had identified a total of 12 angle towers susceptible to erosion and instabilities including AP 7, 13A, 20, 51, 52, 57 of HD stretch and AP 3, 46, 48, 50, 51, 52 of DD stretch. This updated study has identified a total of 57 towers (angle and suspension) susceptible to erosion and instabilities including 24 towers in the HD section and 33 towerrs in DD section. The detail of the instabilities of each tower is given in Annex 6.

5.1.5. Air and Noise Quality

As the transmission line passes mainly through interior region consisting of foothills of the Siwalik, forest cultivated land, avoiding highway and the settlements the ambient air and noise pollution can be considered to be negligible. The construction activities will generate the noise upto 85dB at the time of operation of equipments. Besides this no change in noise level is observed. Most of the Settlements in the project affected rural municipality are connected by gravel and earthen roads. During the field observation it was observed that at locations where the line crosses feeder road and earthen road dust generated by moving vehicle was high and a nuisance. But transportation density and frequency along these feeder roads is low.

Whereas, at area with more economic activities near to the alignment like Hetauda, Dhalkebar, Lahan, Birendra bazaar, Nijhgadh, Lalbandi, Odraha, Bandipur, Mirchaiya, Bastipur, Mahendranagar , and Dumraha exposure to air and noise pollution is felt . The sources of air pollution in these areas are mainly from vehicular emissions, dust particles waved by the vehicular movement and domestic emissions. The alignment stretch running close to industries

like Hetauda and Maruti Cement factories experience air and noise pollution.

5.1.6. Water Quality

The linear project facility crosses several rivers like Rapti, Bagmati, Kamala, Trijuga, Saptakoshi and smaller tributaries like Bakiya, Balan, Trijuga and Sunasri etc. Apparently, the water quality close and along the corridor is polluted with animal waste and solid wastes.

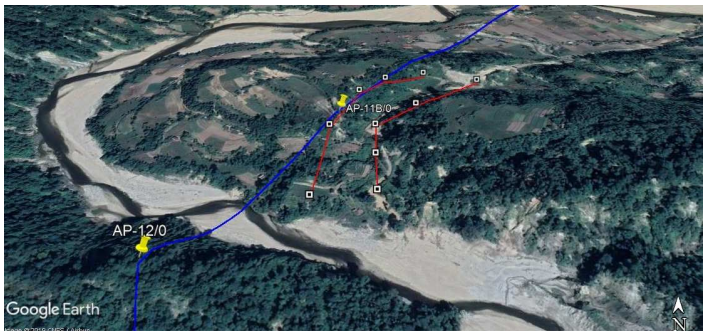
Open defecation, dumping of household waste near the river was also observed during the field survey, although majority of Municipality and Rural Municipality are declared ODF.

People residing along the banks of the river are using river water for household purposes. These water bodies around the settlement area have high potential of microbiological contamination due to the local practice of open defecation.

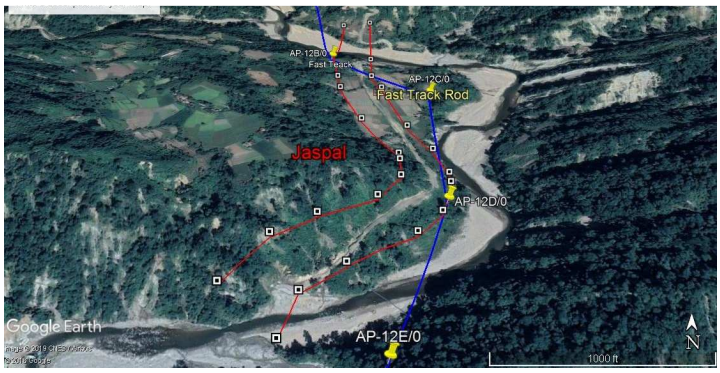
It was observed that the water quality of the river and rivulets are also polluted from soil erosion from nearby cultivated land, bank erosion and disposal of dead bodies of animal in the river channel. Since river channels are wide and dry season flow is limited to only 15-20 % of the total river (for perennial river and no flow in the Khahare khola) in the midland terai region the manmade disturbances such as extraction of sand, temporary roads and cultivation along the bank also causes river pollution.

5.1.7. Crossings of Other Utilities

The Hetauda to Dhalkebar section of the alignment passes through 100m from the compound of Hetauda Cement Factory; existing132 kV transmission line once, 66 kV transmission line once; rivers 4 times and roads 37 times. It crosses Tribhuvan Highway once, Dhulikhel- Sindhuli- Bardibas road between the Hetauda-Dhalkebar stretch. Moreover it also crosses the under-construction Kathmandu-Nijgadh Fast Track 3 times in Makawanpur District. The crossings of the fast track are shown in the google map. Since none of the TL towers are located within the RoW of the Fast Track and the adequate ground clearance is maintained, there is no impact on the project and the Fast Track.



Crossings of Kathmandu-Nijgadh Fast Track at Bakaiya of Makawanpur (The red line is the fast track and green line is the TL)



The Dhalkebar-Duhabi section of the alignment crosses the existing roads 113 times; rivers 38 times; 33 kV transmission line once and several major canals in Sunsari and and Saptari District. At this stretch it crosses the Koshi Nadi. The line also crosses Mirchaiya- Katari-Gaighat and Kadamchok to Gaighat, Kanchanpur Fattepur road once. The summary of the crossings is provided in table 5.3.

Table 5-3: Crossing of River, Road and Other Utilities

Utilities of Crossings	Transmission Line Stretch and Number of Crossing			Remarks
	Hetauda-Dhalkebar	Dhalkebar-Duhabi	Total	
Road	37	113	150	East-West Highway, Under construction Ktm-Nijgadh Fast Track, Dulikhel-Sindhuli-Bardibash, Mirchaiya- Katari road, Kadmaha-Gaighat Road, Kanchanrup-Fattepur Road
Major Rivers	24	35	59	Rapti, Juniya Khola, Bakaiya Khola, Lamaha, Chadi, Thulo Hardiya Khola, Bagmati, Lakhendei Khola, Ratu, Trijuga and Saptakoshi
Transmission Line	2	1	3	66kV,132 Kv,
Other Structures	0	3	3	pond, canal
Total	**63**	**152**	**215**	

5.2. Biological Environment

5.2.1. Vegetation/Forest Resources

The forests of Nepal are classified into National Forests and Private Forests. According to the Forest Act 1993, there are five sub-categories of National Forest namely Government managed forest, Community forest, leasehold forest, religious forest and protected forest. In addition Government of Nepal started collaborative forest in Terai area to provide benefits to wide range of people.

The transmission line passes through 112.66 km of forest area among which 93.37 km (82.88%) lies on Hetauda Dhalkebar section while 19.29 km (17.12%) lies on Dhalkebar Dubahi section. The total forest land falling along the alignment is 518.25 ha which is equal to that of approved IEE

The project is located in the subtropical to tropical vegetation zone. The IEE report has mentioned a total of 67 affected forests along the line alignment, however currently a total of 99 forests have been identified (Table 5.4).

Table 5-4: Number of Forest in Project Districts

S.N.	District	Number of Forests User Groups along the TL Alignment		Change in Number
		As per approved IEE	Current Scenario	
1.	Makawanpur	17	18	1
2.	Bara	5	7	2
3.	Rautahat	6	13	7
4.	Sarlahi	9	11	2
5.	Mahottari	5	7	2
6.	Dhanusha	7	12	5

7.	Siraha	2	4	2
8.	Udaypur	2	3	1
9.	Saptari	10	19	9
10	Sunsari	4	5	1
Total		**67**	**99**	**32**

5.2.1.1. Vegetation/Forest Type

Sal forest, riverine forest, mixed forest and pine forest are the major forest type in the project area (Table 5.5).

Table 5-5: Vegetation Types in the RoW

Vegetation Community	Vegetation Type
Hardwood Forest	Sal Forest Riverine Forest Mixed Sal forest
Coniferous Forest	Pine forest

Sal (*Shorea robusta*) is the dominant tree species found in the project area. Sallo (*Pinus roxburgii)* is other main tree species found in the area mainly in Makawanpur district (Hetauda to Nijgadh section). Khayar (*Acacia catechu*) and Sissoo (*Dalbergia sissoo*), are dominant tree species found in riverine forest throughout the alignment. Bot Dhayero *(Lagerstroemia parviflora),* Sindure *(Mallotus philippinesis),* Asna *(Terminalia alata)* are the major co-dominating tree species found in the project area.

Other associated tree species available in the project area are Tik, Tanki *(Bauhinia variegate),* Masala *(Eucalyptus spp),* Aanp *(Mangifera indica),* Satisal *(Dalbergia lalifolius)* etc. The shrub species available in the area are Bhimsenpati, Chutro *(Berberis aristata),* Sajiban *(Jatropha curcas),* Asuro *(Justicia adhatoda),* Ainselu *(Rubus spp*) etc.

The crown cover of forest along the line was found from 50 to 85 percent. The existing forest condition in the Churiya region is found to be degraded due to human activities. All the tree, shrubs and herbs species occurred along the transmission line are listed in Appendix-7a.

Although the transmission line passes from nearby the buffer zone of Koshi Tappu Wildlife Reserve and Parsa National Park, it does not cross these protected areas. The details of types and numbers of National Forests available along the TL alignment are given in table 5.6 (annex 7b).

Table 5-6: Details of Forest along the TL alignment

District	Details of Forest Affected by TLP						
	No. of Community forest	**No. of Collaborative forest**	**No. of Leasehold forest**	**No. of Natonal Forest**	**Total No.of Forests**	**Length (m)**	**Forest within RoW (Ha)**
Makawanpur	16	0	2	0	18	17081	78.57
Bara	5	0	0	2	7	14412	66.30
Rautahat	11	0	0	2	13	25657	118.02
Sarlahi	9	2	0	0	11	16200	74.52
Mahottari	4	3	0	0	7	15408	70.88
Dhanusha	10	0	2	0	12	7093	32.63
Siraha	4	0	0	0	4	1246	5.73
Udaypur	3	0	0	0	3	6755	31.07
Saptari	19	0	0	0	19	3940	18.12
Sunsari	5	0	0	0	5	4870	22.40
Total	**85**	**5**	**4**	**4**	**99**	**112662**	**518.25**

5.2.1.2.1. Vegetation in Different District of Transmission Line

Community, collaborative and private forest are found in different stretch of the transmission line. Altogether 518.25 ha forest is found in RoW.

The total number of trees & pole is 139059 out of which 53334 has been cut; while 55690 and 146646 were number of trees and pole class respectively in approved IEE. The major species are sal, Khayer, Simal and others (Table 5.7).

Table 5-7: Distribution of existing Vegetation Types in different stretch of Transmission Line

District	Species Available
Makawanpur	Sal *(Shorea robusta)*, Asana (*Terminalia alata)*, Jamun (*Syzygium cumini)*, Karma (*Adina cordifolia)*, Khaire (*Acacia catechu)*, Bodhiyaro (*Lagerstroemia parviflora)*, Sisau (*Dalbergia sissoo)*, Aap (*Mangifera indica* , Chilauna (*Schima wallichii*), Satisaal (*Dalbergia latifolia)*, masala, Siris (*Albizi alebbeck)*, Peepal (*Ficus religiosa)*, Saagon, Vait, Gumhair, Badhaar (*Artocarpus lakoocha)*, Botdhairo (*Lagerstroemia parviflora)*, Chatani, Konaar, Kyamuna (*Cleistoca lyxoperculata)*, Gonaar, Tejpaat (Cinnamomum tamala), others
Bara	Sal *(Shorea robusta)*, Asana (*Terminalia alata)*, Jamun (*Syzygium cumini)*, Karma (*Adina cordifolia)*, Khaire (*Acacia catechu)*, Bodhiyaro (*Lagerstroemia parviflora)*, Sisau (*Dalbergia sissoo)*, Aap (*Mangifera indica* , Chilauna (*Schima wallichii*), Satisaal (*Dalbergia latifolia)*,Barro (*Terminalia bellirica)*, Rajbricha (*Cassia fistula* , Sadaan , Tatari, Baajhi (*Anogeissus latifolius)*, Bakaino (*Melia azedarach)*, Asare (*Lagerstroemia reginae)*, Padakey, Bhurkut, Bhalayo *(Semecarpusana cardium)*, Dudhey , Paan, Simal (*Bombax ceiba)*, Sindure (*Allotus philippensis)*, Siris (*Albizi alebbeck)*, Pithuwa, Pipal (*Ficus religiosa)*, Kusum (*Cleistoca lyxoperculata)*, Kyamuna(*Cleistoca lyxoperculata)*, Harro (*Terminali achebula* Retz.), Bel (*Aegle marmelos)*, Gumhaar, Dudhey (*Ficus neriifolia* , Tikul (*Wendlandia exserta)*, Katikath, Chhatiwan (*Alstonia scholaris)*, Agaley, Painati, Kukath, Kharaaney, Dhuraa, Amara (*Spondia spinnata)*, Padheri, Puchhiya, Mashala, Bachakarai, Dhamann, Haludey,

	Kadum (*Anthocephalu schinensis)*, Bhelar, Chheurura, Dumari (*Ficus racemosa)*, Badkuley (*Caseari agraveolens)*, Botdhairo (*Lagerstroemia parviflora)*, Dabdabey (*Garuga pinnata)*, Ater, Parijaat (*Nyctanthes arbor-tristis)*, PutaliKatha, Simtaraa, SindoJinger Piyaari Tileykath tatikaat AnayaJaat (Kukath) kaaiyo others
Rautahat	Rajbrich (*Cassia fistula)*, Sal (*Shorea robusta)*, Sindure (*Allotus philippensis)*, Satisaal (*Dalbergia latifolia)*, Barro (*Terminali abellirica)*, Bajhi (*Anogeissus latifolius)*, Asana (*Terminalia alata)*, Asare (*Lagerstroemia reginae)*, Amala (*Phyllanthus emblica)*, Jamun (*Syzygium cumini)*, Siso (*Dalbergia sissoo)*, Simal (*Bombax ceiba)*, Siris (*Albizi alebbeck)*, Epil (*Leucaena leucocephala)*, Kusum (*Cleistoca lyxoperculata)*, Karma (*Adina cordifolia)*, Kamila, Kukath, Sarifa (*Annona squamosal)*, tatari, Teak (*Tectona grandis*) , Dumari (*Ficus racemosa)*, Kalikath, Badhar (*Artocarpus lakoocha)*, Bakaino (*Melia azedarach)*, Khair (*Acacia catechu)*, Amba (*Psidium guajava)*, Parari, Pithawa, Firfire (*Acer oblongum)*, Kutimire (*Litsea monopetala)*, Katahar (*Artocarpus heterophyllus)*, Kadum (*Anthocephalu schinensis)*, Gular, Khaniya (*Ficus semicordata)*, Halude, Aap (*Mangifera indica)*, Chhatiwan (*Alstonia scholaris)*, other kukath, Kyamuna (*Cleistoca lyxoperculata)*, Jinger,Tikul, Bhurkur, Masala, Bahera, Bel (*Aeglemarmelos)*, Saj (*Terminalia elliptica)*, Barkauley (*Caseari agraveolens)*, Dhori, Kumbhi (*Ochlospermum religiosum)*, Pipal (*Ficus religiosa)*, Harro (*Terminali achebula* Retz.), Tuni (*Toona ciliate)*, Ghataring, Deri, Badare, Dabdabe (*Garuga pinnata)*, Amara (*Spondia spinnata)*, Auley, Murkut, Madhumara, Bhalayo (*Semecarpusana cardium)*, Padake, Paineti, Jingad, Ppithari, itauji, khira , Chamre Kaichal Gobre, Bohari, Anak, Bhurkur, Payar, Kharani, Khasare, Dhataring, Tatela Badargedi, Famaaikath, dudhey kira, Areli (*Mimosa rubicaulis)*, Jalama, pair paeley Tilakey, Dhawa, Barkauley (*Caseari agraveolens)*, Ashok (*Saraca asoca)*, Maijel litchi (*Litchi chinensis)*, Goldmot
Sarlahi	Sal (*Shorea robusta)*, Khayer (*Acacia catechu)*, Simal (*Bombax ceiba)*, Masala, Teak (*Tectona grandis*), Sisau (*Dalbergia sissoo* , Tatari , Bajhi (*Anogeissus latifolius)*, Hallude , Jamun (*Syzygium cumini)*, Kusum (*Cleistoca lyxoperculata)*, Satisal (*Dalbergia latifolia)* , Siris (*Albizi alebbeck)*, Bel (*Aeglemarmelos)*, Rajbrkchye (*Cassia fistula)* , Tilke , Pipal (*Ficus religiosa)* , Deri, Chamre , Bhalayo (*Semecarpusana cardium)*, Asare (*Lagerstroemia reginae)* , Aamala (*Phyllanthus emblica)*, Sindure (*Allotus philippensis)* , Aap (*Mangifera indica)*, Seula , Dumre , Maitalu , Bar (*Ficus benghalensis)*, Badhar (*Artocarpus lakoocha)* , Gimar; Khirro, Harro (*Terminali achebula* Retz.), Hade, Saj Saj (*Terminalia elliptica)*, Chhatiwan (*Alstonia scholaris)*, Neem (*Azadirachta indica)*, Jimar, Gidari, Karma (*Adina cordifolia)*, Kaiyo, Barro (*Terminali abellirica*), vudkul, Kamuna (*Cleistoca lyxoperculata)*, Kumbhi (*Ochlospermum religiosum)*, Datarang, Pajan, Others
Mahottari	Sal (*Shorea robusta)*, Khayer (*Acacia catechu)*, Simal (*Bombax ceiba)*, Masala/ sapheta, Teak (*Tectona grandis*), Sisau (*Dalbergia sissoo)*, Tatari , Bajhi (*Anogeissus latifolius)* , Hallude , Jamun (*Syzygium cumini)*, Kusum (*Cleistoca lyxoperculata)*, Satisal (*Dalbergia latifolia)*, Siris (*Albizi alebbeck)* , Bel (*Aeglemarmelos)*, Rajbrikchye (*Cassia fistula)* , Tilke , Pipal (*Ficus religiosa)*, Deri, Chamre , Bhalayo (*Semecarpusana cardium)*, Asare (*Lagerstroemia reginae)*, Aamala (*Phyllanthus emblica),*, Sindure (*Allotus philippensis*) , Aap (*Mangifera indica)*, Seula , Dumre , Maitalu , Bar (*Ficus benghalensis)*, Badhar (*Artocarpus lakoocha)* , Gimar, Khirro, , Pyari , Tune , Hade , Asana (*Terminalia alata)*, Barkauley (*Caseari agraveolens)*, , Barro (*Terminali abellirica*), Faldedo , Karma, Sandan, Harro (*Terminali achebula* Retz.), Amala, Kyamuna (*Cleistoca lyxoperculata)*, Bhudkhut , Parijat , Dabdabe (*Garuga pinnata)*, Datranga, Tikuli , Gayo, Khamari , Kumbhi (*Ochlospermum*

	religiosum), Kalikath Amara (*Spondia spinnata),* Aaule , Sahora, Odal, Firfire, Khasre, Others
Dhanusha	Sal (*Shorea robusta),* Khayer(*Acacia catechu),* Simal (*Bombax ceiba),* Masala/ sapheta, Teak (*Tectona grandis*), Sisau (*Dalbergia sissoo* , Tatari , Baghi , Hallude , , Jamun (*Syzygium cumini),* Kusum (*Cleistoca lyxoperculata),* Satisal (*Dalbergia latifolia*), Siris (*Albizi alebbeck),* Bel (*Aeglemarmelos),* Rajbrikchye (*Cassia fistula)* , Tilke , Pipal (*Ficus religiosa)* , Deri, Chamre , Bhalayo (*Semecarpusana cardium)* , Asare (*Lagerstroemia reginae),* Aamala (*Phyllanthus emblica),* Sindure (*Allotus philippensis*), Aap (*Mangifera indica),* Seula , Dumre , Maitalu , Bar (*Ficus benghalensis),* Badhar (*Artocarpus lakoocha)* , Gimar, Khirro Harro (*Terminali achebula* Retz.), Hade, Saj (*Terminalia elliptica,* Chhatiwan (*Alstonia scholaris),* Neem (*Azadirachta indica),* jimar, Gidari, Kaiy, Others
Siraha	Sal (*Shorea robusta,* Khayer (*Acacia catechu),* Simal (*Bombax ceiba),* Masala/ sapheta, Teak (*Tectona grandis*), Sisau (*Dalbergia sissoo),* Tatari , Bajhi (*Anogeissus latifolius),* Hallude , Jamun (*Syzygium cumini)* , Kusum (*Cleistoca lyxoperculata),* Satisal (*Dalbergia latifolia*) , Siris (*Albizi alebbeck),* Bell, Rajbrkchye (*Cassia fistula),* Tilke , Pipal (*Ficus religiosa),* Deri, Chamre , Bhalayo (*Semecarpusana cardium)* , Asare (*Lagerstroemia reginae,* Aamala (*Phyllanthus emblica),* Sindure (*Allotus philippensis*), Aap (*Mangifera indica),* Seula , Dumre , Maitalu , Bar (*Ficus benghalensis),* Badhar (*Artocarpus lakoocha),* Gimar, Khirro, , Pyari, Tune , Hade , Asana (*Terminalia alata),* Barkauley (*Caseari agraveolens),*, Barro (*Terminali abellirica*), Faldedo , Karma (*Adina cordifolia),* Sandan, Harro (*Terminali achebula* Retz.), Amala (*Phyllanthus emblica),* kamuna (*Cleistoca lyxoperculata),* Bhudkhut , ,Parijat , Dabdabe (*Garuga pinnata),* Datranga, Tikuli , Gayo , Khamari , Kumbhi (*Ochlospermum religiosum),* Kalikath , Amara (*Spondia spinnata),* Aaule , Golden, Katahar (*Artocarpus heterophyllus),* Neem (*Azadirachta indica),* Others
Saptari	Sal (*Shorea robusta),* Asana (*Terminalia alata),* Jamun (*Syzygium cumini)* , Karma (*Adina cordifolia),* khair (*Acacia catechu).* Bodhiyare, Sisau (*Dalbergia sissoo),* Aap (*Mangifera indica),* Chilauna, satisaal (*Dalbergia latifolia),* Simal (*Bombax ceiba),* botdhairo, others
Sunsari	Sal (*Shorea robusta),* Saj (*Terminalia elliptica),* Barro (*Terminali abellirica*), Datranga, Jamun (*Syzygium cumini),* Kadum (*Anthocephalu schinensis),* Masla, Siris (*Albizi alebbeck),* Kusum (*Cleistoca lyxoperculata),* Kyamuna, Khayar (*Acacia catechu),* Hade, Halude, Bel (*Aeglemarmelos),* Simal (*Bombax ceiba),* Rajbrichhe (*Cassia fistula),* Both, Khamari, Sindure (*Allotus philippensis),* Dhamun, Barro, Pipal (*Ficus religiosa),* Halure, Saush, Tatri, Phaphi, Kamuna (*Cleistoca lyxoperculata),* Jijar, Kukath, Karma (*Adina cordifolia)*
Udaypur	Sall (*Shorea robusta),* Saj (*Terminalia elliptica),* Others

5.2.1.1. Rare, Endangered and Protected Species of Plants

Sal (*Shorea robusta*), and Khayar are protected species found in the project area. These species are banned for felling, transportation and export for commercial purpose as per section 70 (Ka) of the Forest Act 1993.

Tarul *(Discorea deltoidea)* is a climber, which is commercially threatened species of IUCN list commonly found in RoW. Similarly Sarpagandha (*Rauvolfia serpentine),* endangered species by IUCN and CITES II category is present as scattered form in Sal forest of Rautahat, Saptari and Sunsari section of transmission line. Chattiwan *(Alstonia scholaris)* classified as rare species in

IUCN list is present in scattered population in Makwanpur section of transmission line. Khayar(*Acacia catechu)* is commercially threatened and under CITES II category is found in most of the section of alignment as well as in adjoining forest. Similarly Satisal (*Dalbergia latifolia*), is listed in vulnerable species in IUCN is scattered in distribution in Saptari, Siraha, Mahotari, Udyapur, Sunsari stretch of the line (Table 5.8)**.**

Table 5-8: Species of conservation significance in the RoW

Species	Forest Type	Location	Distribution	IUCN Conservation Significance	CITES, 1995	Gon Category
Acacia Catechu (Khayar)	Riverine	Makwanpur, Bara, Rautahat etc.	Common	Commercially threatened		Protected
Alstonia scholaris (Chhatiwan)	Sal, riverine	Makawanpur	Common	Rare		
Dalbergia latifolia (Satisal)	Sal, Riverine	Saptari, Siraha, Mahhotari, Udyapur, Sunsari	Scattered	Vulnerable		
Discorea deltoidea (Tarul)	Sal, Riverine	Makawanpur, Rautahat, Mahhotari, Sarlahi, Siraha, Udyapur, Sunsari	Common	Commercially threatened	II	
Rauvolfia serpentina (Sarpagandha)	Sal	Rauthat, Saptari, Udyapur	Scattered	Endangered	II	
Shorea robusta (Sal)	Sal	Throughout the alignmnet	Common			Protected

CITES Status Categories: Appendix II: Species not yet threatened, but which could become endangered if trade is not controlled.

5.2.1.2. Ethnobotany / Plant resource use pattern

All the people interviewed during field survey reported that they use plant resources from local forests. In total, 27 plant species are used by the people of the villages adjoining the transmission line route, with several of these species having multiple use value. Ten species were preferred for timber, 11 species for firewood, 5 for fodder, 17 medicinal herbs, 7 edibles, 1 spices/oil and 10 species for handicrafts and other uses (Table 5.9).

Table 5-9: Plant Species Uses by Residents along the Transmission Line Route

S.N	Species	Uses in different category							
		Timber	Firewood	Medicine	Food	Spices, Oil, etc.	Handicraft & Other	Fodder	Trade
1	*Acacia catechu*	+	+	+			+		+
2	*Asparagus racemosus*			+					+
3	*Bauhinia purpurea*		+		+			+	
4	*Bauhinia vahlii*				+		+		

5	Bombax ceiba						+		
6	Cassia fistula			+					
7	Cleistocalyx operculata	+	+	+	+		+		
8	Costus speciosus			+					
9	Curculago orchioides			+					
10	Dalbergia sissoo	+							
11	Dioscorea deltoidea			+	+				
12	Imperata cylindrical						+	+	
13	Mallotus philippensis		+	+				+	
14	Murraya koinigii		+			+			
15	Myrsine semiserrata	+							
16	Phyllanthus emblica			+	+		+		+
17	Pinus roxburghii	+	+				+		+
18	Pogostemom benghalensis			+					
19	Rauvolfia serpentine			+					
20	Shorea robusta	+	+	+			+	+	+
21	Swertia sp.			+					+
22	Syzygium cumini	+	+	+	+		+		
23	Tectona grandis	+							
24	Terminalia alata	+	+					+	
25	Terminalia belerica	+	+	+					+
26	Terminalia chebula		+	+					+
27	Zyzyphus mauritiana			+	+		+		

5.2.2. Wild Life

The transmission line route and adjoining areas have distinct ecological and vegetation characteristics associated with Siwalik and Terai which provide diverse natural habitats and range of wildlife species. The wildlife habitats consisting of forests, shrub land, grassland and riverine features are crossed by the route. Altogether 27 species of mammals, 116 Species of birds, 18 species of reptiles (Annex 8) and 15 species of fishes are recorded in the project area during the field survey.

The project area does not lie in the national park, wildlife reserve and buffer Zone. However, the GoN has declared Chure as a conservation zone in June 2014, which falls in the project area. The transmission line passes from 1.2 km from nearest point to farthest 9.4 km of Koshi Tappu Wildlife Reserve and is about 50 meter away from the Buffer zone of Parsa National Park.

5.2.2.1. Mammals

Hetauda- Dhalkebar Section

The alignment passes through edge of forest and near to the settlement areas hence this is not the core region for wild mammals. Although Parsa Wildlife Reserve lies few kilometres away from the route, minimal migration of mammals is reported from the protected area. Altogether 20 species of mammals are reported in this stretch. The common mammal species are Rhesus Macaque (*Macca mulatta*), Jackal (*Canis aureus*), Spotted deer (*Axis axis*), Wild boar (*Sus scorfa*), Barking deer (*Muntiacus muntjak*), Northern Palm Squirrel (*Funambalus pennanti)*, Porcupine (*Hystrix indica*), Small Indian Civet (*Viverricula indica)* etc. Bats (*Preropus spp*) were seen flying in the evening time. Rhesus Macaque and Wild boar were observed during the

field visit and the calls of jackal were heard. Remaining species were identified based on local information supplemented by indirect evidence and literature reviews. A trans-boundary herd of wild elephants moves from India to Nepal and reach up to Nijgadh section from Southern part of Chitwan National Park. (WCN 2007)

No change has been identified in terms of availability and abundance of mammals during the updated IEE phase in comparison to the approved IEE Report.

Dhalkebar - Duhabi section

Altogether 17 species of mammals are reported in this section. The common mammal species are Spotted deer (*Axis axis*), Barking Deer (*Muntiacus muntjak*), Indian Crested Porcupine (*Hystrix indica*), Rhesus Monkey (*Macaca mulatta*), Eurasian Wild Boar (*Sus scrofa),* Jackal (*Canis aureus*), Northern Palm Squirrel (*Funambalus pennanti),* Porcupine (*Hystrix indica*), etc.

No change has been identified in terms of availability and abundance of mammals during the updated IEE phase in comparison to the approved IEE Report. .

5.2.2.2. Birds

Mixed hardwood forests, bamboo grove, agricultural fields, villages, rivers, streams, along the transmission line route provides a variety of habitats for different bird species. Area from Kanchanpur to Bhokra is the potential site for birds as it includes KTWR and Koshi Barrage. Out of 116 bird species reported in the entire project area, most prefer forest and bushes and the remaining prefer wetland habitats. Areas considered to have high habitat value for birds were not identified in the RoW, however some important birds habitats occur in the locality. These include KTWR, Koshi barrage, Kamala River Barrage and their wetland areas.

Hetauda- Dhalkebar Section

Parsa Wildlife Reserve lies south west of the transmission line route, in the Makwanpur and Bara district. Although 32 species of birds are recorded in this section, the number may vary considering that Parsa Wildlife Reserve has got more than 259 different bird species representing 51 families (Chaudhary, R.D.2006).

The common species reported are Red Vented Bulbul (*Pycnonotus cafer),* House Sparrow *(Passer domesticus),* Spotted Dove (*Stretopelia sengegalensis),* Common Myna *(Acridotheres tristis)* and Cattle Egret (*Bubulcus ibis).* Among the list, 13 species were observed at field and rest were identified on the basis of local information and literature.

Dhlakebar Duhabi Section

This section provides a variety of habitats for different bird species. The major habitat areas are Broad leaved Sal dominated forest, Riverine, mixed hardwood forests, bamboo groves, agricultural fields, village area and rivers & streams. Kamala barrage and its wetland area is the major habitat for wet land birds in the section. Likewise, Koshi Tappu Wildlife Reserve (a Ramsar site) and Barrage which are Important Bird Areas (IBA) of Nepal where a total of 485 bird species including residents and migrants has been listed representing 61 bird families of the world (Baral & Inskipp, 2005) lies in this section. The common bird species reported in this section are Common Kingfisher (*Alcedo athis,),* Northern Pintail *(Anas acuta),* Mallard *(Anas platyrynchos),* Cattle Egret (*Bubulcus ibis),* House Crow (*Corvus splendens),* Woodpecker (*Dendrocops macei),* House Sparrow (*Passer domesticus),* Rose Ringed Parakeet *(Psittacula*

krameri), Common Hoopoe (*Upupa epops)* and Indian Pond Heron (*Ardeola grayii*). The important bird species of Koshi Tappu Wildlife Reserve are Swamp Francolin (*Francolinus gularis*), Baer's pochard *(Aythya baeri*), Pallas's fish eagle *(Haliaeetus leucoryphus),* Greater spotted eagle *(Aquila clanga),* Lesser adjutant *(Leptoptilos javanicus)* and Spot-billed pelican *(Pelecanus philippensis).*

As per information provided by staffs of Kamala barrage, the density and diversity of birds are very high during winter season due to migratory birds coming from different areas including KTWR.

Bird Migration

Several bird species visit Nepal, seasonally coming from different parts like India, Arab, China, Tibet, Russia and Northern Himalayas to escape from scorching heat and chilling cold. These birds again return to their homeland when the climate is favourable. These migratory birds are mainly water birds. It is said that about 150 bird species migrate to Nepal from the northern side during summer (Giri, 1999) and about 148 species visit Nepal in during winter (Inskipp & Inskipp, 1991).

Birds follow a certain migratory routes usually following a river system like Koshi in the east, Bagmati and Narayani in the central and Karnali in the western part of Nepal. Migration of birds starts in late December, reaches peak between mid-February and mid-March. Koshi River in the eastern Nepal and Bagmati River in the central Nepal are the major bird migratory routes of the project area (Nepali, 1980). In addition, Kamala and Koshi wetland provide winter habitat as well as resting and breeding grounds for some wetland dependent bird species.

Migratory birds moving to Koshi Tappu and Kamala areas have to cross the transmission line to reach wintering sites and while returning to their breeding grounds.

No change has been identified in terms of availability, abundance and migration of birds during the updated IEE phase in comparison to the approved IEE Report.

5.2.2.3. Reptiles

The subtropical climate in the route provides a favorable condition for reptiles. A total of 18 reptile species are recorded in the project area in which 9 species are found to prefer forest habitats and the remaining 9 prefer rivers and river banks. Swamp places, grass lands, forests and agricultural land provide a good habitat for reptiles. The presence of reptiles in different stretch of transmission line is given below:

Hetauda- Dhalkebar section

Among 18 species of reptiles, 11 species are reported in this section. The common species reported are Buff-striped Keelback (*Amphiesma stolatum),* Common Karait (*Bungarus caeruleus),* Banded Krait (*Bungarus fasciatus),* Common Garden Lizard *(Calotes versicolor)* Bengal Monitor *(Varanus bengalensis),* House Gecko *(Hemidactylus spp),* White Lipped Pit Viper *(Trimeresurus albolabris) and* Golden Monitor *(Varanus flavescens). .*

Dhalkebar -Duhabi section

This stretch of transmission line especially the Gauribas area provides habiat for reptiles preferring underground habitat. Since lots of burrow were observed thai is considered good for

snake hibernation. The dead specimen of Burmese Rock Python *(Python molurus)* was observed in the Bardibas - Sindhuli Highway, nearby the transmission line route. The transmission line route also crosses the Koshi River which is the suitable habitat for water dependent reptiles. In addition, the Sal forest at the base of Siwalik provides a good habitat for other reptiles too. The common reptiles reported are Common Karait (*Bungarus caeruleus),* Banded Krait (*Bungarus fasciatus),* Common Garden Lizard *(Calotes versicolor),* Bengal Monitor *(Varanus bengalensis)* and House Gecko *(Hemidactylus spp).* The other species found in this stretch are White Lipped Pit Viper *(Trimeresurus albolabris),* Golden Monitor *(Varanus flavescens),* Turtles *(Melanochelys spp.)* and *(Pangshura flaviventer).*

No change has been identified in terms of availability and abundance of reptiles during the updated IEE phase in comparison to the approved IEE Report.

5.2.2.4. Fishes

The transmission line crosses many rivers and rivulets. Among them the three major rivers Bagmati, Kamala, and Koshi provide a major habitat for fishes. The common fishes observed in the project areas are Fresh water shark (*Wallago attu*), Jalkapoor (*Clupisoma spps*.), Pothi (*Puntius spps*.), Catla (*Catala catala*), Rohu (*Labeo rohita*) and Raj Bam (*Anguilla bengalensis*).

5.2.2.5. Endangered, Rare, Threatened and Protected Faunal Species

Only 39 species of mammals, birds and reptiles are legally protected by the Government of Nepal, whereas CITES lists 114 species that occur in Nepal. Among them 52 species are listed under Appendix I, 23 under Appendix II and 39 under appendix III. Similarly, IUCN threatened category enlists 61 species that occur in Nepal.

Mammals

Out of 27 mammal species present in the project area, 15 fall under different conservation status. Six species are legally protected under National Park and Wildlife Conservation Act. These species include Gaur *(Bos gaurus),* wild water Buffalo *(Bubalus arnee),* Asian Wild Elephant (*Elephas maximus*), Chinese Pangolin (*Manis pentadactyla*), Ganges River Dolphin (*Platanista gangetica*), One-Horned Rhinoceros (*Rhinocerus unicornis*). These species are occasionally seen in the project area.

Twelve species falls under CITES list of different appendices and 7 species fall under different IUCN threatened category. Although classified under CITES and IUCN categories, these species are common and widely distributed throughout Nepal.

Birds

Out of 116 bird species present in the project area, 22 species fall under different conservation status. Four species are legally protected under NPWCA. These species include Great Hornbill (*Buceros bicornis),* Sarus Crane *(Grus antigone),* Bengal Florican *(Houbaropsis bengalensis*) and Lesser Florican *(Sypheotides indica).* Nineteen species falls under CITES list of different appendices and 6 species fall under different categories of IUCN.

Reptiles

Among 18 reptile species found in project area, 7 fall under different category of conservation

status. Among them 3 species are legally protected under the NPWCA, 7 fall under different Appendix of CITES and 4 fall under different category of IUCN. Burmese Rock Python *(Python molurus),* Golden Monitor *(Varanus flavescens),* Gharial (*Gavialis gangeticus*) are the NPWCA protected species.

5.3. Socio-economic and Cultural Environment

5.3.1. Socio-economic Features of the Project Districts

The Hetauda- Dhalkebar -Duhabi 400 KV Transmission Line Project covers ten districts (Udayapur and Sunsari) of Province No 1, seven districts (Saptari, Siraha, Dhanusha, Mahottari, Sarlahi, Rautahat and Bara) of Province No 2 and only Makawanpur district in Province No 3.

The total area of ten districts is 14054 Sq. km. According to National Population census 2011, the total population of the ten project districts is 63,04,624 with 31,33,205 male and 31,71,419 female. The average population density of the project districts is 448.60 persons/sq. km. There are 11,51,863 households and the average household size is 5.47. Similarly, the average literacy rate of the (Population of five years and above) ten project districts is 54.91%. The male and female sex ratio is 98.21

5.3.2. Socio-economic features of the Project RM/Municipalities

5.3.2.1. Project Districts and RM/Municipalities

The alignment traverses through the ten districts, one sub-metropolitan city, twenty five municipalities and four Rural Municipality of three provinces of Nepal.

5.3.2.2. Demography

According to the National Population Census 2011, the total population of the project affected rural/Municipalities is 773209 with 375,989 male (48.63%) and 397, 220 female (51.37%). This implies that the population of the project Rural/Municipalities covers 52.07% of the total population of the project districts.

The total number of household in affected Rural/Municipality is 152,364 with average household size 5.04 while total number of HHs in project district is 295,890 with average HH size 4.98.

5.3.2.3. Settlement Pattern

Dense settlements are found in the project area. Houses are mostly thatched roofed together with corrugated sheets (jasta) particularly in the village areas. Few RCC buildings are also found in each settlement basically in the market area. The major settlements near the transmission line route (within 100m and 500m) are given in Annex 9.

5.3.2.4. Caste and Ethnicity

The project area is a heterogeneous mixture of different origins, cultures, language and ethnicity. Altogether 105 castes/ethnic groups are found in the project area. The Major caste/ethnic groups of the project area are Brahmin Hill and Terai (11.70%), Tamang (11.46%), Chettri (9.96%), Tharu (9.18%), Muslim (4.87%), Koiri (5.25%), Yadav (4.94%), Magar (4.74%), Dalits (Kami, Damai, Sarki-4.04%), Teli (2.81%), Newar (4.05%), Baniya (1.05%), Rai (2.12%), Danuwar (0.53%) and others 23.29%. The other category includes Haluwai, Barae, Gharti/Bhujel, Kewat, Kayastha Sanyasi, Kalwar, Musahar, Hajam/Thakur, Dhobi, Sherpa/Bhote, Chepang, and

Dhanuk (CBS 2011).

Government of Nepal categorized 59 castes into indigenous group. About 32.08% of the total population of the project VDCs/Municipalities falls under the category of Indigenous and Tribal people which occupies 4.68% of the total population of the project districts.

5.3.2.5. Mother Tongue

Nepali (35.60%) is the main language widely spoken for communication in the project area. Besides Nepali, the second most spoken language in the project area is Maitheli (31.65%) followed by Tharu (10.87%), Tamang (9.89%), Urdu (0.78%), Bhojpuri(1.36%), Newari (1.73%), Gurung (1.45%), Danuwar (0.20%), Hindi(0.46%) and others (6.00%) (CBS, 2011).

5.3.2.6. Religion

Hinduism (80.09%) is the dominant religion in the project area. Buddhism (13.74%), Islam (4.64%), Kirat (0.76%), Jain (0.004%), Christianity (0.35%) and Sikha (0.01%), are the other religions practiced in the project area (CBS 2011).

5.3.2.7. Festivals, Cultural and Religious Practices

The major festivals of the project area are Vijaya Dashami, Tihar, Maghe Sankranti, Holi, Ram Nawami, and Teej in both hill and Terai. Lhosar is the major festival of the Sherpa, Tamang, Gurung and Magar communities. Likewise *Ied* and *Ramjan* are the major festivals of Muslim communities.

Popular cultural activities in the area are Teej mela (fair), Bhailo and Deushi (singing and dancing activities) in Tihar, Holi (colour festival), Bhajan – Kirtan in Ram Nawami and Kirshnajanmastami (praying by singing), cultural programs in Shripanchami and Dhami and Jhankri Naach (dance performed during various religious activities and festivals). Other religious activities in the project area are Pasni (rice feeding ceremony for newly born babies), Bratabandha (thread wearing ceremony of teenage boys), marriage and Sharaadha (worship for the soul of the dead people) etc.

5.3.2.8. Education and Literacy

According to 2011census, the total population (6 years and above) of the project area is 642322 with Male 50.73% and Female 49.27. Out of which about 45.40% population can't read and write, 5.42% can read only and 48.57% population can read and write The average literacy rate of the project area is 55.80% consisting 66.05% male and 46.13% female literacy (CBS 2011).

5.3.2.9. Migration

Due to presence of infrastructures, better facilities, fertile cultivated land the in-migration from nearby hilly districts like, Bhojpur, Dhankuta, Okhaldhunga, Khotang, Solukhumbu and Sindhuli is common in the project area. The out- migration specially the young generation migrate to neighboring country and abroad seeking for employment is also common. India, Malaysia, Qatar and Dubai are the main destination in abroad to most of the migrant. Migration to the cities such as Janakpur, Jaleshwor, Bardibas, Hetauda, Nijgadh, Lalbandi, Kathmandu etc for various purposes like business, employment, study and medical services is also common in the project area.

5.3.2.10. Occupation

Agricultural is the main occupation (75%) of people in the project area. The remaining 25% people are engaged in business, service, labor, small scale industries, transportation and foreign employment.

5.3.2.11. Cultivated Land and Average Landholding

The average land holding of the project RM/Municipalities is 0.64ha/hh which is lower than the average land holding (0.71ha/HH) of the project districts. The average landholding of Makwanpur, Bara, Rautahat, Sarlahi and Mahottrai districts are 0.58 0.8, 0.75, 0.76 and 0.71 ha per household respectively. Likewise the average land holding of Dhanusha, Siraha, Udayapur, Saptari and Sunsari districts are 0.65, 0.74, 0.6, 0.79, 0.68 ha per household respectively.

5.3.2.12. Agricultural Production and Livestock Practice

Paddy wheat and millet are the major food crops grown in the project area. The cash crops grown in the project area are sugarcane, tobacco, Jute, maize, pulses, vegetables, and potato and oil seeds. The average production of paddy, wheat, sugarcane, maize, millet, pulses, and oilseed are 3.62, 2.58, 30.06, 2.73, 1.08, 0.97, and 0.91 mt/ha respectively.

Irrigation canal, deep tube well, shallow tube well, ponds, private wells and boring are the major irrigation facilities in project area.

Goats, cows, bulls, buffaloes, sheep, pigs and poultry are the domesticated livestock found in the project area. These livestock are sold at local market for supplementary income of the household.

5.3.2.13. Public Health and Sanitation

Open defecation along rivers or in open fields is in decreasing practice in the villages and most of the houses in each settlement have toilet facilities. Toilet facilities are found in major market centers of the project area. Hand pipe, well and tube well are the major source of drinking water in Terai area whereas springs and rivulets are used in hill section of the alignment. Tap water facility is also available in some of the settlements.

Firewood is the major source of cooking followed by cow dung cake. However, improved stoves, LP gas and kerosene are also being used by some households in the market area. The in - house sanitation facilities in most of the houses are not good.

Health posts and sub- health posts are providing health services in the project area. The health posts/ sub-health posts are mostly located more than 5 km distance from the transmission line alignment. The entire population depends upon the facilities available in the District Hospitals of the concerned districts. Regional level hospitals are available in Hetauda, Lahan and Rajbiraj respectively.

Medical shops are available in the market area like Hetauda, Nijgadh, Chandranighaipur, Lalbandi, Harion, Bardibas, Dhalkebar, Janakpur, Jaleswor, Mirchaiya, Lahan, Birendra Bazaar, Kanchanpur, Itahari and Inaruwa; and in most of settlements near to the Highway..

Diarrhea, skin disease, acute respiratory infection, chronic bronchitis, gastritis, diabetes, abdominal pain, *Kalazar* and eye ear problems are the common diseases reported from the project area.

5.3.2.14. Infrastructure

Transportation

East-West Highway is the main road access to the project area. The district and village road also provide access to the line. Hetauda-Hatiya- Rai Gaun road (Makwanpur district), Mirchaya-Katari- Okhaldhunga (Siddhicharan highway-Siraha and Udayapur district), Inaruwa-Bhokraha-Prakaspur road (Sunsari) are the few major road Access to the transmission line alignment. Daily bus services in the main highway are available throughout year. The nearest airports from the project area are Janakpur, Simara and Biratnagar.

Communication

Communication services such as mobile, CDMA and landline phone facilities are available in most of the Rural /Municipalities. Modern communication facilities like television, cable-network, e-mail, internet and fax are available in the market areas. Accesses of some local and national newspapers are also available in the district headquarters, settlement close to east-west high way and Market areas.

Others

Heatuda, Nijgadh, Chandranighaipur, Harion, Lalbandi, Bardibas, Dhalkebar, Mirchaya, Lahan, Gaighat, Birendra Bazaar, Kanchanpur and Bharadha are the major market and trade centers of the project area. These market and trade centers are located about 500m to more than 15 km distance from the transmission line.

The other service facilities available in and around the project area includes sub-health post, health post, health care centers, agriculture service centre, veterinary center, postal service, educational institutions, police office, cooperative office and banking service.

Industrial Activities

Heatuda (Makwanpur district), Simara (Bara district) Duhabi, Sonapur (Sunrari district) are the major industrial area of the project districts. Heatuda cement factory (Makwanpur) is located at 100m from the transmission line and remaining others industrial area are far from the alignment.

5.3.2.15. Religious, Historical and Archaeological Sites

Ram Janaki Mandir of Janakpur, Ramdhuni of Sunsari, Rupani mai of Saptari, Kamalamai of Dhanusha are the main temples found in project area.

Gram Dewata Dewhar Than of Dhalkebar & Badarmal; Religious tree at Hariwon, small temple at Daulatpur are located within RoW. Similarly, Nunthar of Rautahat, Shiva temple at Hariwan and Tapewshwori lies close to the Transmission line.

5.3.3. Socio-economic Profile of the project Affected Families

The family loosing their land, structure and other private property are defined as Project Affected Families (PAFs). As mentioned in Chapter-3, 609 households will be affected by the project due to acquisition of land and residential structures. These households were surveyed to collect socio-economic information. The household survey was carried out in eight districts, except Udayapur and Bara. In Udayapur and Bara no private land is affected by the project.

5.3.3.1. Population and Households

The total population of 564 surveyed households is 3439 with male 1819 (52.9%) and female 1620 (47.10%). The average male and female sex ratio of PAFs is 112.3 and the average household size is 6.1 people.(Table 5.10).

Table 5-10: Distribution of Households and Population of PAFs

Districts	Population				Households	
	Male	Female	Total	Sex Ratio	Total	Average HH Size
Dhanusa	289	234	523	123.5	109	4.8
Makwanpur	91	78	169	116.7	28	6.0
Rautahat	8	11	19	72.7	2	9.5
Saptari	568	520	1088	109.2	175	6.2
Sarlahi	126	127	253	99.2	47	5.4
Siraha	531	448	979	118.5	135	7.3
Sunsari	206	202	408	102.0	68	6.0
Total/Ave.	1819	1620	3439	112.3	564	6.1
Percentage	52.9	47.1	100			

Source: Household Survey, 2016 & 2018

5.3.3.2. Distribution of Population by Age Groups

The surveyed population comprises 24.3% children (0-14 years), 65.3% people in the economically active category (15-59 years) and 10.5% aged people (above 60 years).

The overall dependency ratio is 53.18% with child dependency ratio 32.01% and aged dependency 16.04% (Table 5.11).

Table 5-11: Distribution of Surveyed Population by Broad Age Groups

Districts	Broad Age Groups			Total Population
	0-14 Years	15-59 Years	60 Years and Above	
Dhanusa	146	315	62	523
Makwanpur	52	108	9	169
Rautahat	3	13	3	19
Saptari	223	742	123	1088
Sarlahi	69	164	20	253
Siraha	260	621	98	979
Sunsari	81	282	45	408

Total	834	2245	360	3439
Percentage	24.3	65.3	10.5	100.0
Dependency ratio	32.01	53.18	16.04	

Source: Household Survey, 2016 & 2018

5.3.3.3. Type of Family

Nuclear family is common in the core project area. The field study shows that among the project affected families 57.11 % are nuclear families and 42.89% are Joint families (Table 5.12).

Table 5-12: Family Types of PAFs

Districts	**Family Type**	
	Nuclear	**Joint**
Dhanusa	41	33
Makwanpur	1	1
Saptari	106	62
Sarlahi	12	15
Siraha	49	50
Sunsari	40	24
Total	**249**	**187**
Percent	**57.11**	**42.89**

Source: Household Survey, 2016 & 2018

5.3.3.4. Caste/Ethnicity

The project area is diverse in caste/ethnicity. The project affected households comprises of 22 different caste/ethnic groups of hill and Terai origin. These caste/ethnic groups have been further broadly categorized as Terai origin caste groups (advance), Janajati, Brahmin/Chhetri/Thakuri, Dalit and Muslim (ethnic minority). Of the affected households 28.72% are Terai origin caste groups, 44.68% are Janajati, 17.91% are Brahmin/ Chhetri, 3.37% are Dalit and 5.32% are Muslim (Table 5.13).

About 44.68% of surveyed households fall under the category of indigenous and tribal people listed by the Government of Nepal. The listed indigenous people found among the PAFs are Newar, Magar, Tamang, Bhujel, Tharu, Danuwar and Majhi. The percentage of indigenous and tribal people of PAFs is relatively similar as compared with the percentage of project affected VDCs/Municipalities.

Table 5-13: Caste/Ethnicity

Caste/Ethnic Group	**No. of HHs**	**Percent**
Terai Origin Caste Groups (Yadav, Thakur, Kalwar, Haluwai, Kapar, Shah)	162	28.72
Janajati (Magar, Tamang, Newar, Tharu, Bhujel, Danuwar, Majhi)	252	44.68
Brahmin/Chhetri	101	17.91
Dalit (Kami, Damai, Sarki, Musahar. Chamar.)	19	3.37

Muslim	30	5.32
Total	564	100

Source: Household Survey, 2016 & 2018

5.3.3.5. Religion

According to household survey, Hinduism (86.2%) is the dominant religion among the affected households (Table 5.14). The other religions practiced by the PAFs are Buddhism (8.2%) and Islam (5.7%).

Table 5-14: Distribution of PAFs by Religion

Districts	Religion						Total Households
	Hinduism		Buddhism		Islam		
	No.	%	No.	%	No.	%	No.
Dhanusa	95	87.2	13	11.9	1	0.9	109
Makwanpur	9	32.1	18	64.3	1	3.6	28
Rautahat	2	100.0	0	0.0	0	0.0	2
Saptari	149	86.1	0	0.0	24	13.9	173
Sarlahi	37	78.7	7	14.9	3	6.4	47
Siraha	126	93.3	8	5.9	1	0.7	135
Sunsari	68	97.1	0	0.0	2	2.9	70
Total	**486**	**86.2**	**46**	**8.2**	**32**	**5.7**	**564**

Source: Household Survey, 2016 & 2018

5.3.3.6. Language

Maithali is the main spoken language in the family of the surveyed households of the project area (Table 5.15). Of the households, 55.3% speak Maithali in their family. Similarly, the other spoken languages in the family are Nepali (36.2%), Tamang (6.0%)and Tharu (1.4%). Maithali is the spoken language of Terai origin caste/ethnic groups.

Table 5-15: Distribution of PAFs by Religion

Districts	Language										Total HHs
	Nepali		Maithali		Urdu		Tharu		Tamang		
	No.	%	No.	%	No.	%	No.	%	No.	%	
Dhanusa	57	52.3	50	45.9	0	0	0	0.0	2	1.8	109
Makwanpur	7	25.0	0	0.0	0	0	0	0.0	21	75.0	28
Rautahat	1	50.0	1	50.0	0	0	0	0.0	0	0.0	2
Saptari	30	17.1	133	76.0	6	3.4	6	3.4	0	0.0	175
Sarlahi	42	89.4	2	4.3	0	0	0	0.0	3	6.4	47
Siraha	37	27.4	89	65.9	0	0	1	0.7	8	5.9	135
Sunsari	30	44.1	37	54.4	0	0	1	1.5	0	0.0	68
Total	**204**	**36.2**	**312**	**55.3**	**6**	**1.1**	**8**	**1.4**	**34**	**6.0**	**564**

Source: Household Survey, 2016 & 2018

5.3.3.7. Education and Literacy

According to household survey, aged five years and above, nearly 13.7% is illiterate. The gender

gap in literacy is wide. The illiteracy among women is 19.3% whereas the illiteracy among men 8.9% (Table 5.16).

Table 5-16: Literacy Status - 6 Years and Above of the PAFs

Literacy Status	Male		Female		Total	
	No.	%	No.	%	No.	%
Illiterate	150	8.9	283	19.3	433	13.7
Literate	1539	91.1	1187	80.7	2726	86.3
Total	**1689**	**100**	**1470**	**100**	**3159**	**100**

Source: Household Survey, 2016 & 2018

The educational attainment among the 2533 people is not satisfactory, with about 29% having no formal education and a further 16.9% achieving a primary level education only. Of the literate population, 16.10% had passed the School Leaving Certificate (SLC) and nearly 12.4% the intermediate level; and 10.5% had a bachelor's or higher degree (Table 5.17). The educational status of the project affected population is quite good as compared with the educational status of the project Rural/Municipalities.

Table 5-17: Educational Attainment among the Literate Population of the PAFs.

Educational Attainment	Male		Female		Total	
	No.	%	No.	%	No.	%
Literate only	343	25.3	391	33.2	734	29.0
Primary level	245	18.1	183	15.5	428	16.9
Lower secondary	172	12.7	125	10.6	297	11.7
Secondary	157	11.6	110	9.3	267	10.5
SLC	248	18.3	160	13.6	408	16.1
Intermediate	185	13.7	129	10.9	314	12.4
Bachelor's and above	184	13.6	81	6.9	265	10.5
Total (Literate)	1354	100.0	1179	100.0	2533	100.0

Source: Household Survey, 2016 & 2018

5.3.3.8. Gender Status

According to households' survey, about 47.1% of the total population are women. The average literacy status of women among the surveyed population is 72.78% which is comparatively equal as compared with the average literacy of Male (74.44%). About 21.5% of the total surveyed households are women headed and 7.58ha land is belonged to them. About 44.4% women have been involved in household works among the surveyed population. The role of women in agricultural sector is 21.3%. Comparatively; women have over workload in the surveyed household.

5.3.3.9. Occupational Composition

Agriculture is predominant occupation in project area followed by service; business and small industries, labors inside and outside country and services. According to household survey data 67.26% of the project affected population is economically active (Population of 14-59 Years of age).

Among the project affected families 28.5% of population responded that their primary occupation is agriculture. About 21.4% of the affected population is reported that their occupation is household work (Table 5.18).

Share of labor and wages inside and outside the country is 2.7% and 8.1% respectively. About 7.9% of the affected population is service holders while nearly 21.4% of economically active populations are students.

Most of the economically active men, compared to the economically active women, are engaged in non-farm. On the other hand, the economically active women, compared to male are involved in non-income generating activities i.e. household works. This scenario is typical in Nepal where women, traditionally engaged more in household work and men in other non-farm activities.

Table 5-18: Occupational Composition of PAFs (14 to 59 Years) of the Project Area

Main Occupation	Male		Female		Total	
	No.	%	No.	%	No.	%
Agriculture	452	34.8	239	21.3	691	28.5
Business and small industry	86	6.6	21	1.9	107	4.4
Labor/Wage (In Country)	58	4.5	8	0.7	66	2.7
Service	150	11.5	42	3.7	192	7.9
Foreign Employment	187	14.4	10	0.9	197	8.1
Household Works	21	1.6	498	44.4	519	21.4
Student	326	25.1	278	24.8	604	24.9
Others	19	1.5	26	2.3	45	1.9
Total	1299	100	1122	100	2421	100

Source: Household Survey, 2016& 2018

5.3.3.10. Landholdings of the PAFs by Type of Land

The total area of the surveyed households is 645.7ha (including Irrigated, un-irrigated ***Khet***, ***Bar*i** and ***Ghader*i**). Out of which 91.6% is ***Khet***, 4.8% is ***Bari*** and 3.6% is ***Ghaderi***. *(Land for house plots).* The average land holding size of PAFs is 1.1ha/HH (Table 5.19) which is comparatively higher than the average land holding size of the households of project Rural/Municipalities (0.64ha/hh) and the project districts (0.71ha/hh).

Table 5-19: Landholdings of the PAFs by Type of Land

Districts	HH	*Khet* (Ha)	B*ari* (Ha)	*Ghader*i (Ha)	Total	Ha/HH
Dhanusa	109	129.7	6.4	4.5	140.6	1.3
Makwanpur	28	3.5	7.2	1.8	12.5	0.4
Rautahat	2	1.0	0.7	2.0	3.7	1.9
Saptari	175	176.7	5.6	0.3	182.6	1.0
Sarlahi	47	21.0	2.7	7.6	31.3	0.7
Siraha	135	179.3	4.2	7.2	190.7	1.4
Sunsari	68	80.3	4.1	0.0	84.4	1.2

Total /Average	564	591.5	30.9	23.3	645.7	1.1
Percentage		**91.6**	**4.8**	**3.6**	**100**	

Source: Household Survey, 2016v& 2018

5.3.3.11. Major Crops Area and Agricultural Production

Paddy, sugarcane, wheat, maize and millet are the major food crops and cash crops grown by the PAFs. Pulses and sugarcane are the major cash crops grown in the area. Other crops include vegetables, potato and pulses.

In terms of area coverage, paddy cultivation ranks first, sugarcane second, wheat third and maize fourth. Paddy is primarily grown in Khet. Similarly, maize is primarily grown in Bari, however nowadays its cultivation in Khet is also increasing in the project area (Table 5.20).

Table 5-20: Major Crop Area Coverage, Production and Yield in the Project Area

Description	**Major Crops**				
	Paddy	**Wheat**	**Maize**	**Sugarcane**	**Vegetables**
Total area cropped (Bigha)	**447.4**	**160.8**	**62.9**	**48.55**	**15.9**
Total production (MT)	978.9	257.1	97.5	411	61.6
Yield (MT/Bigha)	2.2	1.6	1.6	8.5	3.9
Percentage	54.20	14.24	5.40	22.76	3.41

Source: Household Survey, 2016 & 2018

5.3.3.12. Livestock

About 88.29 % of the total surveyed households (498 out of 564 HHs) are engaged in agriculture and most of the farmers apply traditional techniques in farming. The household survey shows that 8.10% of livestock are cattle, 71.48% are goat/sheep and 20.42% are buffaloes (Table 5.21). The livestock supports the household income of the rural society.

Table 5-21: Livestock Domesticated by PAFS

Districts	**Type of Livestock**					**Poultry**
	Cattle	**Buffalo**	**Goat/sheep**	**Total**	**Average per HH**	
Dhanusa	14	29	72	115	**1.06**	61
Makwanpur	0	1	1	2	**0.07**	0
Rautahat	0	1	1	2	**1.00**	0
Saptari	11	27	97	135	**0.77**	73
Sarlahi	5	13	53	71	**1.51**	44
Siraha	13	36	142	191	**1.41**	79
Sunsari	3	9	40	52	**0.76**	21
Total	**46**	**116**	**406**	**568**	-	**278**
Percentage	**8.10**	**20.42**	**71.48**	**100.00**	-	-

Source: Household Survey, 2016 & 2018.

5.3.3.13. Food Sufficiency Status of PAFs

Due to the lack of irrigation facilities at majority of the places, the average food grain production of the project area is low and affected households are facing difficulty to produce food grain for the whole year. Of the surveyed households 61.9 % have food deficit since their production is not able to meet the year round food requirement of their family (Table 5.22). HHs of Sarlahi (89.4%) and HHs of Siraha (71.1%) are found in poor position regarding food production compared to HHs of other districts. The food deficit households buy food out of income derived from outside the agriculture business. Among surveyed household's 38.1% have sufficient food from their own production for the year.

Of the surveyed households, about 43.3% reported food deficiency of 4-6 months, 16.3% for months than 9 months. Similarly, about 12.6% reported food shortage for less than 3 months. The households were found to be working as wage labour, depend on small business, sell their property and take loan to cope with their food dependency.

Table 5-22: Food Sufficiency Status of PAFs

Districts	Sufficiency				
	Yes		No		Total No. of HHs
	No.	%	No.	%	
Dhanusa	44	40.4	65	59.6	109
Makwanpur	6	21.4	22	78.6	28
Rautahat	2	100.0	0	0.0	2
Saptari	73	42.2	100	57.8	173
Sarlahi	5	10.6	42	89.4	47
Siraha	39	28.9	96	71.1	135
Sunsari	46	65.7	24	34.3	70
Total	**215**	**38.1**	**349**	**61.9**	**564**

Source: Household Survey, 2016. & 2018

5.3.3.14. Annual income of Households

The average annual income of the surveyed households is NRs. 270,323 which consist 23.5% from agriculture, 2.86% from livestock and 73.68 % from non-agricultural sources (Table 5.23). The non-agricultural source includes income from business/trade, service and labors/wage (both inside and outside the country), small scale and cottage industries, and pension etc.

The share of non-agricultural incomes is found highest (73.68%) than agricultural sources (agriculture sharing 23.5% and livestock sharing 2.86%).

Table 5-23: Annual Average Income of PAFs

Districts	Annual Average Income from Different Sources							
	Agriculture		Livestock		Non-Agriculture		Total	
	NRs	%	NRs	%	NRs	%	NRs	%
Dhanusa	71,014	20.51	9,348	2.7	265,950	76.8	346,312	100
Makwanpur	53,550	29.17	25,000	13.6	105,000	57.2	183,550	100

Rautahat	96,200	45.77	17500	8.3	96,500	45.9	210,200	100
Saptari	47,710	22.83	2840	1.4	158,426	75.8	208,976	100
Sarlahi	88,581	27.76	15,592	4.9	214,907	67.4	319,080	100
Siraha	68,593	23.87	9,275	3.2	209,490	72.9	287,358	100
Sunsari	51,685	27.27	8,437	4.5	129,406	68.3	189,528	100
Average	**63,424**		**7,731**		**199,168**		**270,323**	
Percentage	**23.5**		**2.86**		**73.68**		**100**	

Source: Household Survey, 2016 & 2018

5.3.3.15. Health and Sanitation

Toilet facilities are found with 87% of the surveyed households. The data shows that 9.2% households go for toilet in open fields, 2% in river side and 1.4% go for toilet in forest area, (Table 5.24). The use of own toilet is particularly high in Saptari (95%) and least in Makwanpur (75%). Abdominal pain, asthma, diabetes, gastric, typhoid, stone, pneumonia and epilepsy are the major diseases reported during the household survey. Methods of treatment indicate that in most cases patients consult health post, private clinics and pharmacy.

To assess health status of the family members of the affected households, data on seriously sick family members during the last 12 months was collected. From the survey as well as field observation no families are found seriously sick during the period.

Table 5-24: Location for Defecation of the Surveyed HHs

Districts	**Location**							
	Own Toilet		**Open Field**		**River Side**		**Forest Area**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Dhanusa	88	80.7	14	12.8	4	3.7	3	2.8
Makwanpur	21	75.0	3	10.7	0	0.0	4	14.3
Saptari	2	100.0	0	0.0	0	0.0	0	0.0
Rautahat	167	95.4	4	2.3	4	2.3	0	0.0
Sarlahi	36	76.6	10	21.3	0	0.0	1	2.1
Siraha	117	86.7	15	11.1	3	2.2	0	0.0
Sunsari	62	91.2	6	8.8	0	0.0	0	0.0
Total	493	87.4	52	9.2	11	2.0	8	1.4

Source: Household Survey, 2016 & 2018

5.3.3.16. Source of Drinking Water

The major sources of drinking water for the households of the area are tube-well, piped water and public tap. Of the surveyed households, 86.3% have tube well. Similarly, 7.6% households collect water from private taps and 6% from public taps (Table 5.25).

Table 5-25: Source of Drinking Water

Districts	**Sources**					
	Piped Water		**Tube Well**		**Public Tap**	
	N	**%**	**N**	**%**	**N**	**%**

Dhanusa	84	77.1	10	9.2	15	13.8
Makwanpur	17	60.7	9	32.1	2	7.1
Rautahat	2	100	0	0	0	0
Saptari	169	96.6	3	1.7	3	1.7
Sarlahi	30	63.8	12	25.5	5	10.6
Siraha	117	86.7	9	6.7	9	6.7
Sunsari	68	100	0	0	0	0
Total	487	86.3	43	7.6	34	6

Source: Household Survey, 2016 & 2018

5.3.3.17 Key Issues/Concerns Raised

During consultation, meetings with the affected HHs and communities nearby the TL, some issues and concerns have been raised by the people. Although most of the HHs have positive attitude regarding the project, some of the affected HHs from Hatiya of Makawanpur, Jiyajor of Sarlahi, Lahan of Siraha, Birendra Bazar of Saptari are demanding to shift the proposed line alignment at these locations. They are demanding for the high valuation of land at tower pads and sufficient compensation (if possible 100%) for land under RoW. The details of the issues and the response from the Project side is presented in Table

Table 5-26: Issues of Stakeholders

S N	Major Areas of Concern	Issues Raised	Response to the Issues
1	Land /structure acquisition and Compensation	• The compensation amount determined at Padariya Lahan area of Siraha is very less than the current market rate. • The compensation amount as given by the Kathmandu-Nijgadh Fast Track Project (about 66%) is to be given to the Non-title holder land of Chhatiwan, Makawanpur • Compensation of RoW should be given 100% at Hatiya of Makawanpur and other places. • Appropriate compensation to be paid for structuresunder RoW. • Depreciation of value of land under RoW.	• The project has requested to the Chief District Officer of Siraha and then Regional Director at Dhankuta to re-valuate the land price at Padariya of Lahan, but they did not agree. • The Project Manager has committed for providing the compensation to the Non-title holders as given by the Fast Track Project. • Till date there is no any policy for 100% compensation of RoW land. • The compensation shall be paid to the structures under RoW.
2	Alignment Change	• The line alignment to be shifted at Hatiya of Makawanpur, Jiyajor of Sarlahi, Lahan of Siraha and Birendra Bazar of Saptari. Even the locals at Hatiya of Makawanpur and Birnedra Bazar of Saptari are demanding to shift the already constructed towers. Mrs. Sarita Giri is strongly demanding to shift the alignment at Padariya of Lahan.	• Since the final survey has been completed and the project is under construction phase, it is not feasible to shift the alignment at these locations.
3	Employment opportunity	• Local should be given prior consideration for employment based on qualifications and skills of the locals. • Indigenous/vulnerable people should be given priority for the employment opportunity	• The locals/indigineous/vulnerable peopel will be given priority for employment based on their skill and manpower requirement of the project
4	Forest Related	• The compensatory plantation to be carried out in consultation with the affected FUGs	• It is being carried out by the project

		and at their land. • Some of the trainings to be provided to the affected FUGs	
5	Local development	• The project should assist for the electrification at Bakaiya of Makawanpur. • Assistance to be provided to the schools and religious places located nearby the TL.	• It is being done by the Project
6	Enhancement programs	• Should be given skill development training to PAFs	• The skill development training has been provided by the Project
7	Others	• Local should be well informed to each and every activities of the project and information should be disclosed timely. • The complaints of affected HHs to be taken seriously and appropriate action to be taken • The awareness program on electro-magnetic effects on human health should be conducted	• The project is committed for addressing these issues.

The proponent is committed to assure the best and effective ways or methods in order to minimize the negative impacts and maximize the beneficial/positive impacts of the project. The proponent is also concerned about genuine issues of the stakeholders.

5.3.3.18 Overall Comparison

The overall comparison of the environmental condition of the transmission line alignment with respect to that mentioned in its approved IEE report (Feb. 2012) and during the updated IEE study is given in table 5-27.

Table 5-27: Overall Comparison of the Environmental Conditions with Respect to Approved IEE

Description	As per Approved IEE	Current Status (UIEE Phase)	Remarks
Total Line Length	***285.2 km***	***288.31km***	***3.11 km more than in approved IEE***
Length in Forest Land	112.66 km	112.66 km	No change
Length in Private Land	146.94 km	154.85 km	7.91 km added than in approved IEE
Length in Other Land	25.59 km	20.79 km	4.8 km decreased than in approved IEE
Substation Area			
Total Substation Area	***16.25 ha***	***20.9 ha***	**4.65 ha more than approved IEE**
a. Dhalkebar	6.77 ha	6.77 ha	No change
b. Bhokraha	9.48 ha	14.13 ha	4.65 ha more than approved IEE
Tower Pads Area (permanent Land occupied)	***13.68 ha***	***30.33 ha***	***16.65 ha more than approved IEE***
Forest Land	5.30	12.15	6.85 more than approved IEE
Private Land	6.89	17.26	10.37 ha more than approved IEE
Others Land	1.49	0.92	0.57 ha less than approved IEE
Total Permanent Land Area (SS and TPs)	***29.93 ha***	***51.23***	***21.3 ha more than approved IEE***
Total Perm (Forest)	5.30	12.15	6.85 more than approved IEE
Total Perm (Pvt)	23.14	38.16	15.02 ha increased than approved IEE

Total Perm (Others)	1.49	0.92	0.57 ha less than approved IEE
Right of Way Land Use			
Total land under RoW (ha)	***1311.93 (100%)***	***1326.23 (100%)***	***14.3 ha more than approved IEE***
a. Private Land (ha)	675.92 (51.52%)	712.33 (53.71%)	36.41 ha more than that of approved IEE
b. Forest Land (ha)	518.25 (39.50%)	518.25 (39.07%)	No change
c. Others Land (ha)	117.76 (8.97%)	95.65 (7.21%)	22.11 ha decreased than approved IEE
Temporary camps	***8 ha***	***5.7 ha***	***2.3 ha less than approved IEE***
Conductor Type	ACSR Moose (Duplex)	ACSR Moose (Quad)	The Quad conductor will be used
Foundation Area	225 sq. m	DA (272.25 Sq. meter), DB (428.40 Sq. meter), DC (501.76 Sq. meter), DD (665.64 Sq. Meter)	The foundation area differs as per the tower type. The details is given in Annex 13.
Tower height	45 m	45 m	No change
Project Geology and Geomorphology	Midland Terai and the Bhawar zone along the foothill of Sub-Himalaya	Midland Terai and the Bhawar zone along the foothill of Sub-Himalaya	No change
Stability of Towers			
Susceptibility to Erosion	12 tower locations identified as susceptible to erosion	57 towers locations identified as susceptible to erosion	45 more towers locations are identified as susceptible to erosion
Climate	Sub-tropical to tropical climatic zone	Sub-tropical to tropical climatic zone	No change
Number of Crossings (Road, River, TL and Others)	212	215	Under-construction Ktm-Nijgadh fast track is crossed at Makawanpur.
No of Forest User Groups	67 FUGs under RoW	99 FUGs under RoW	32 more FUGs identified
Vegetation	Sal forest, Riverine Forest, Mixed Sal forest and pine forest	Sal forest, Riverine Forest, Mixed Sal forest and pine forest	No change
Wildlife	27 species of mammals, 113 Species of birds, 18 species of reptiles and 15 species of fishes are recorded	27 species of mammals, 113 Species of birds, 18 species of reptiles and 15 species of fishes are recorded	No change
No. of Trees to cut down	158022	139059	No of trees to cut down decreased in totality by 18,963
No of affected HHS due to land acquisition	130 (For AP and substation)	609 (For AP, SS & ST)	Increased by 479 HH
Number of structures under RoW	6	202	Increased by 196 numbers

6. Environmental Impacts

Environmental impacts of the project have been identified for the transmission line and substation covering the physical, biological and socio-economic & cultural environments. This section highlights environmental impacts (adverse and beneficial) of the under-construction TL, with special focus on the additional environmental impacts than predicted in its approved IEE report.

6.1. Beneficial Impacts

6.1.1. Construction Phase

The beneficial impacts of the project during the project construction phase as mentioned in its approved IEE report are

- Local Employment
- Increase in Local Skills
- Increase in Economic Opportunity

Such beneficial impacts are being observed and no significant change has been observed in such impacts during this IEE update phase.

6.1.2. Operation Phase

The beneficial impacts as predicted during the operation phase of the TL mentioned in its approved IEE report are also the predicted beneficial impacts during this IEE updation phase. These are as follows:

- Increased local economic activities due to reliable availability of the electricity
- Enhance power exchange between Nepal and India
- Expansion of Rural electrification
- Low Potential of Lightening in nearby areas

6.2. Adverse Impacts

6.2.1. Physical

6.2.1.1 Construction Phase

6.2.1.1.1. Flood and Natural Drainage

Tower at Patharkot o Sarlahi near the Khahare Khola with Possibility of Drainage Interference

As the area is characterized by rivers, construction of towers may interfere with the natural drainage systems and modify flow of surface water, and these changes can contribute to soil erosion, flooding, downstream scouring and sedimentation in streams and other drainage channels. Given the generally flat nature of the watershed the impact on drainage and soil erosion seems to be low. The extent is local and duration is long term.

6.2.1.1.2. Topography

During the construction of the transmission lines and substations, the topography will change due to excavation and erection of towers. The most prominent impact on the surface topography is due to the removal of trees at the tower pad site and all along the Right of Way (RoW) for construction facilitation. This will lead to change in the surface features. As the line traverses through flatter topography the impact on the topography will be low, site specific and long term.

6.2.1.1.3. Land Take and Land Use

The project requires 51.23 ha of land permanently for tower pads and substation as well as 1326.23 ha of land under RoW except temporary acquired by camps (5.7 ha). The detail is presented in table 6-1. Thus a total of 14.3 ha more area is required under RoW and 21.3 ha more land area needs to be permanenetly acquired for substation and tower pads than mentioned in its approved IEE report (2012).

Construction activities near Mirchiya Bazar

The detail is tabulated in Table 6.1. The angle towers and suspension towers typically requires an area of 16.5*16.5 m^2 to 38.2*38.2 m^2. For the construction of 792 towers (479 suspension and 313 angle towers), a total of 30.33 ha need to be acquired permanently. The construction of 792 towers will permanently change the land use pattern of 30.33 ha area including 12.15 ha in the forest and 17.26 ha in private land (Table 6.1). In Row the land use pattern of cultivated land will not be changed since cultivation is allowed. However land use change is observed in the area occupied by the mango garden and bamboo grooves. The land use has also changed in 20.9 ha area occupied by the substation. The landuse of 5.7 ha land taken for temporary facilities will also be changed. The magnitude of impact is considered to be low, extent is site specific and the duration is long term.

Table 6-1: Component-wise Land Take and Land Use Pattern

Description	As per Approved IEE	Current Status	Remarks
Total Line Length	***285.2 km***	***288.31km***	***3.11 km more than in approved IEE***
Length in Forest Land	112.66 km	112.66 km	No change
Length in Private Land	146.94 km	154.85 km	7.91 km added than in approved IEE
Length in Other Land	25.59 km	20.79 km	4.8 km decreased than in approved IEE
Right of Way Land Use			
Total land under RoW (ha)	***1311.93 (100%)***	***1326.23 (100%)***	***14.3 ha more than approved IEE***
a. Private Land (ha)	675.92 (51.52%)	712.33 (53.71%)	36.41 ha more than that of approved IEE

b. Forest Land (ha)	518.25 (39.50%)	518.25 (39.07%)	No change
c. Others Land (ha)	117.76 (8.97%)	95.65 (7.21%)	22.11 ha decreased than approved IEE
Total Permanent Land Area required for Substation and Towers	***29.93 ha***	***51.23***	***21.3 ha more than approved IEE***
Forest Land	5.30	12.15	6.85 more than approved IEE
Private Land	23.14	38.16	15.02 ha increased than approved IEE
Others Land	1.49	0.92	0.57 ha less than approved IEE
Substation Area			
Total Substation Area	***16.25 ha***	***20.9 ha***	***4.65 ha more than approved IEE***
a. Dhalkebar	6.77 ha	6.77 ha	No change
b. Bhokraha	9.48 ha	14.13 ha	4.65 ha more than approved IEE
c. New Hetauda	The land has been acquired by Hetauda-Bharatpur 220 kV TL, thus no additional land will be acquired		
Tower Pads Area (Permanent Land Required)	***13.68 ha***	***30.33 ha***	***16.65 ha more than approved IEE***
Forest Land	5.30	12.15	6.85 more than approved IEE
Private Land	6.89	17.26	10.37 ha more than approved IEE
Others Land	1.49	0.92	0.57 ha less than approved IEE
Temporary camps	***8 ha***	***5.7 ha***	***2.3 ha less than approved IEE***

Source: Field survey 2018

For the use of forest land and tree clearance, the agreement is done with the Dept. of Forest for nine districts and is due for Makawanpur district. The total forest land permanently required for tower pads construction at Makawanpur district is 2.59 ha and the forest land under RoW in the district is 78.57 ha.

6.2.1.1.4. Air Quality

The construction activities in the transmission line project consists of site clearance, excavation for the tower, concreting, erection of towers, operation of machineries like mixture, and movement of vehicles carrying the construction materials. All these activities give rise to emission of dust particles affecting the air quality, which although will be transitory in nature.

Since no major air pollutants are released, the magnitude of impact is considered to be low, extent is site specific and of short duration

6.2.1.1.5. Noise Levels

The major sources of noise pollution during the construction phase are movement of vehicles transporting the construction materials, operation of vibrator, mixture machine and excavation work by excavators. The noise produced during the construction goes upto 85 dB which is only for short duration. As the generated noise is of short duration, the impact is considered as low in magnitude, site specific and for a short duration.

6.2.1.1.6. Water Quality

During the construction period, water is being used from nearby streams and irrigation canals

and tube wells for construction, as well as for drinking and other purposes. Some of the towers are located at flood plain of the rivers like Bakaiya, Hariwon Khola, Balan, Triguja, Koshi and Sunsari Khola.

Therefore there is a chance of water contamination at these places with constructional materials.

Contamination of water bodies may result due to spilling of construction materials and surface runoff from the construction site joining the water body.

Pond at Kemlipur with possibility of water pollution

Soil disturbances associated with construction activities of tower pads, the improper disposal of solid wastes, cement slurry, construction materials and human wastes may deteriorate the river water quality and other existing water bodies around the construction area in some level.

The impact is expected to be low in magnitude, site specific and for a short duration.

6.2.1.1.7. Waste Disposal

The improper disposal of solid waste like cement bags, other left over construction materials, kitchen waste and waste generated by the temporary labor camp may cause adverse impact to the environment. The spoil generated due to the excavation of tower pad may also deteriorate nearby land and water quality of the area. However, this problem has not been identified at constructional sites since more than 90% of the volume of excavated material is backfilled at the tower base. Thus the magnitude of impact is considered to be low, extent is site specific and duration is short term.

6.2.1.1.8. Land Degradation, Landslide and Soil erosion

The clearance of vegetation and earthwork associated with construction work of tower foundations may potentially exacerbate soil erosion. Since the tower foundations are placed over the more or less stable ground, there is very less landslide potential due to tower construction work.

However, the removal of trees along the TL alignment, improper management of spoil generated may cause soil erosion, land degradation, and landslide. Moreover, 53 towers (given in Annex 6) are identified to be located in susceptible areas that are prone to soil erosion. Proper mitigation measures shall be adopted at those locatons in order to protect the tower and minimize the soil erosion.

6.2.1.1.9. Crossing of Other Utilities

The transmission line crosses existing 132 kV and 66 kV transmission line, major rivers and roads. It also crosses the under-construction Kathmandu-Nijgadh Fast Track 3 times in Makawanpur District. Since none of the TL towers are located within the RoW of the Fast

Track and the adequate ground clearance is maintained, there is no impact on the project and the Fast Track.

Since transmission line is designed with sufficient clearance at the crossings mentioned above, no significant impact is expected during construction of line.

6.2.1.2 Operation Phase

6.2.1.2.1. Topography and Land Use

No significant impact on topography is expected during operation and maintenance of T/L.

6.2.1.2.2. Crossing of Other Utilities

The operation of the project do not cause any interference to road, as 9 m vertical clearance (minimum) will be provided between the road surface and conductors. Similarly, all crossings of existing 132 kV and 66 kV transmission and distribution lines will be designed with standard safe vertical and horizontal clearances for 400 kV lines.

Likewise the nearest distance from the transmission line alignment to nearby airport is more than 3 km and hence no obstruction is expected with regards to flying path.

6.2.1.2.3. Air/ Noise and Vibrations

No significant impact on air/noise and vibration is expected during operation and maintenance of T/L.

6.2.2. Biological

6.2.2.1. Vegetation/Forest Resources

6.2.2.1.1. Construction Phase

Forest Land

Out of 288.31 km transmission length, about 112.66 km of its stretch passes through the forest land. By assuming 46 m RoW, the total affected forestland will be 518.25 ha (Table 6.2). This area includes 0.101% forest area of the project districts. Out of the total forest area under RoW, 12.15 ha will permanently be acquired for the construction to tower pads which is 6.85 ha more than that mentioned in approved IEE report (5.3 ha). This increase is due to increased number of towers in forest area and area occupied by each tower.

Table 6-2: District Wise Forest Area within the RoW

District	Total District Forest Area (Ha)	Details of Forest Affected by TLP		% of District Forest within RoW
		Length (m)	Forest within RoW (Ha)	
Makawanpur	152720	17081	78.57	0.051
Bara	46540	14412	66.30	0.142
Rautahat	26260	25657	118.02	0.449
Sarlahi	25740	16200	74.52	0.290
Mahottari	22230	15408	70.88	0.319

Dhanusha	27090	7093	32.63	0.120
Siraha	18140	1246	5.73	0.032
Udaypur	150120	6755	31.07	0.021
Saptari	20380	3940	18.12	0.089
Sunsari	21880	4870	22.40	0.102
Total	**511100**	**112662**	**518.25**	**0.101**

Source: Department of Forest Research and Survey 2017 & Field Survey 2018

Government managed forest is found along the alignment in Bara district and the major forest area is from community forest followed by collaborative forest. Although registered private forest land is not found in area but private trees of fodder, timber and fruit species are found in farm land.

The magnitude of impact is Moderate, extent is Local and of Long Duration.

Tree Clearance

Altogether 1,39,059 standing trees of various species and sizes (>10 cm dbh) will be felled for the right of way clearance (Table 6.3). This number is less by 18,963 as compared to its approved IEE, where it is estimated to clear fell 1,58,022 trees. The total estimated loss of wood volume is 886195.80 cft. The estimated loss of fuelwood Chatta is 261616.12.

Table 6-3: Loss of Standing Trees along with Wood Volume and Biomass

District	No of Trees (Pole and Tree sized)	% of Trees	Wood Volume	Fuelwood Volume (Chatta)
Makawanpur	28615	20.58	107438.96	723.18
Bara	13771	9.90	14692.5189	277.5954
Rautahat	32666	23.49	257248.675	937.6954
Sarlahi	18277	13.14	187609.3316	368.17529
Mahottari	19152	13.77	172541.19	218797.64
Dhanusha	6651	4.78	25883.27	81.66959
Siraha	452	0.33	4840.47	2.488
Saptari	5541	3.98	44733.437	105.279
Sunsari	10827	7.79	43167.65	40297.38
Udaypur	3107	2.23	31682.16	50.35
Total	**139059**	**100**	**886195.80**	**261616.12**

Sources: Data from respective Forest Offices and Field survey, 2018

Out of the total trees to be felled by the line maximum loss will be from Rautahat district (23.49 %) both in terms number of trees to be felled and area as well. The contribution of Makwanpur, Mahottari Sarlahi, and Bara are 20.58%, 13.75%, 13.14% and 9.90% respectively (Table 6.3). The magnitude of impact is Medium, extent is Local and of Long Duration.

The change in the number of trees to be cut down district wise is given in Table 6-4 as follows:

Table 6-4: Comparison of trees to be cut down District wise

District	No of Trees (Pole and Tree sized)		Remarks
	As per approved IEE	Current Status	
Makawanpur	20236	28615	Increased by 8379
Bara	13656	13771	Increased by 115
Rautahat	38224	32666	Decreased by 5558
Sarlahi	24436	18277	Decreased by 6159
Mahottari	23510	19152	Decreased by 4358
Dhanusha	9060	6651	Decreased by 2409
Siraha	1323	452	Decreased by 871
Saptari	7770	5541	Decreased by 2229
Sunsari	7672	10827	Increased by 3155
Udaypur	12135	3107	Decreased by 9028
Total	**158022**	**139059**	**Decreased by 18963**

The numbers of trees in these districts have been changed due to following reasons

- The forest data during IEE study was taken based on forest sampling, whereas the data presented during IEE update is the total tree counting data under RoW.
- Due to the time difference between the IEE study and now, some of the the sapling sized trees have been changed to pole sized and pole sized to tree sized.

Moreover the number off trees to be cut down has been differed in Bara and Rautahat Districts than mentioned in agreement with DOF in 2073/01/24. As per agreement with DoF, the number of trees to cut down in Bara and Rautahat Districts are 11344 and 27201 whereas during final Chhapan the no. increased to 13771 and 32666 respectively. A Committee has been formed to evaluate the changes in number and the committee submitted the report to Department of Forest, which is attached in Annex 7c.

Floral Diversity

Altogether 95 species of trees need to be felled down for the placement tower pads and for RoW clearance. Among them, Sal is the highly affected species (Annex 7). The magnitude of impact is Medium, extent is Local and of Long Duration.

Community Forest

Eighty six community forest of 10 districts is affected by the forest clearance. Altogether 91602 trees (tree and pole class) are being felled for the implementation of the project. The magnitude of impact is Medium, extent is Site Specific and of Long Duration.

Collaborative Forest

The implementation of the project has affected 5 collaborative forests. Out of the total tree

loss 20.635% will be from the collaboraive forest. Collaborative forest will be affected in Hetauda- Dhalkebar stretch of transmission line. The magnitude of impact is Low, extent is Site Specific and of Long Duration.

National Forest

The implementation of the project has also affected national forest. Altogether 16,762 trees (tree and pole class) will be felled for the implementation of the project contributing 12.23% of total felling. The magnitude of impact is Low, extent is Site Specific and of Long Duration.

Leasehold Forest (LHF)

Four leasehold forests of two districts are affected by the forest clearance. Altogether 407 trees (tree and pole class) will be felled from LHF for the implementation of the project contributing 0.2% of total felling. The magnitude of impact is Low, extent is Site Specific and of Long Duration.

Exploitation of Non-Timber Forest Products (NTFPs)

During the construction time, none of the cases have been heard and observed regarding the collection ans sales of NTFPs by the construction workers. The workers will also have little time for the collection and sale of NTFPs. The problem is thus more socio-economic issue than it is a bio-diversity issue. Therefore, these impacts are considered as low in magnitude, site specific in extent and for a short duration.

Protected Species

Five species of trees listed under different conservation status will be affected by the project. Altogether 137049 trees will be felled by the implementation of the project. The Sal, Khair, Chhatiwan and Satisal are the species of concern as protected species. The impact to protected species are considered to be medium in magnitude, extent is local and of long term.

Increase in Demand of Fuel Wood and Timber

Most of the project workers involved in construction are staying at rented houses and are using LPG or Kerosene for cooking purposes. However, some of the workers at some tower locations are staying at temporary labor camps and using firewood for cooking purpose.

6.2.2.1.2.Operation Phase

RoW Vegetation

The vegetation of the right of way will maintain compatible clearance with safe operation. The trees will be trimmed and cut down in every 2-3 years to maintain these clearances. Since RoW is cleared during construction phase the trimming of trees or felling of few trees found within the RoW will have low impact with respect to forest loss and ethno-botanical use of plant resources. The extent is local and of long duration.

Plant Biodiversity

RoW clearance will not only destroy vegetation directly but also alters ecological conditions which can allow invasion by new species such as weeds in the hills. The impact will be less in slow growing species compares to fast growing plants.

Increased Access to Forest

The clearance of 46-meter RoW of the forest land may provide easy access for the local people for the encroachment of forest and its product. It will provide opportunity for earning cash by selling of timber and non-timber forest. It is expected in Terai area of the alignment that cleared RoW in otherwise forested areas can be colonized by landless families. The RoW itself is cultivated and the presence of the farmers results in rapid degradation of the forest adjacent to the RoW in the vicinity of the new settlement.

The magnitude of impact is low because about 80% of the forest in the project area is community forest, which is managed by local people themselves. Furthermore strict rules and regulation and monitoring by the users group also restrict the unnecessary encroachment. The extent is site specific and duration is long term.

Exploitation of Non-Timber Forest Products (NTFPs)

During the operation phase, there will be an occasional intervention of just a few people maintaining the transmission line. This will have an insignificant affect on the forest itself and the NTFPs along the transmission line alignment.

6.2.2.2. Wildlife

6.2.2.2.1. Construction Phase

Loss of Habitat

Transmission line construction involves the removal of 518.25 ha forest from the RoW, with the conversion of this area to low growing trees (less than 3 m height), shrub land and grassland. The removal of vegetation will fragment forest habitat and reduce the habitat area available to mammals and birds. The vegetation loss will adversely impact monkeys and Langurs as they prefer continuous forest canopy for easy movement.

Similarly, mature trees dependent birds like Hornbills will have to bear the pressure of forest clearance (Inskipp & Inskipp, 1991).

All mammals identified in the project area are mobile, except wild water buffalo at Koshi Tappu, and have a natural range far greater than RoW area. Furthermore Mahottari natural forest of the site is one of the identified as region for the Royal Bengal Tiger. Considering the large areas of continuous forest habitat that the transmission line will cross and the limited extent of RoW clearance (up to 518.25 ha along a total of 112.66 km of forest), the magnitude of the impact on wildlife caused by habitat loss is considered medium.

The excavation works for the tower pad may affect the underground habitat of reptiles. This impact is more significant from Nijgadh to Kanchanpur as lot of burrow were found along the

alignment and nearby areas.

Wildlife Movement, Feeding and Other Activities

Transmission line route lies in the migratory route of Asian Wild Elephant (*Elephas maximus*) in Bara Saptari and Udayapur districts. The seasonal migration of wild elephant is found around Nijgadh, Tapeshwari and Goghanpur area. The reduction in forest area may reduce the available habitat and discontinue the forest area which may affect the movement of wild elephant. The magnitude of impact is considered to be Low in magnitude, extent is local and of long term.

Construction Disturbances

The construction activity will spread over approximately 112.66 km of the alignment through forest area of ten districts. The transportation of construction material, erection of tower and stringing of line require manpower. The movement and activity of human beings influences free movement of wild fauna. The magnitude of impact is considered to be low because the disturbance area is small compare to total available habitat and widely spread and construction at one site will be short lived. The extent is site specific and duration is short term.

Hunting and Poaching by Labour Force

While working in the forest area, the workers are tempted to hunt birds like pheasants, partridges, ducks; mammals like deer and wild boar. The magnitude of impact is considered to be low because most of the forest area likely to be affected by the project is managed by forest users group and due to strict rule and regulation; movement of people is restricted beyond the permitted area (RoW). Furthermore the number of workers at each construction site is limited (20-25) and duration of construction at particular place is short (15-20 days) which also minimize the likely impacts. Thus the magnitude of impact is considered to be low, extent is site specific and duration is short term.

The workers may involve in fishing while working or living in nearby river areas. Such impact is not considered to be significant.

Koshi Tappu Wildlife Reserve

Since the nearest distance to the Koshi Tappu Wildlife Reserve (KTWR) is 1.8 km at Belka Municipality of Udayapur district and farthest distance is 9.4 km at Bokraha of Sunsari district, no significant impact is expected on the conservation efforts of the reserve and wildlife found in the reserve area.

6.2.2.2.2. Operation Phase

Electro-caution of Mammals and Birds

The operation of transmission line may influence bats and arboreal mammals. Bats may strike on transmission line wires at night, while arboreal mammals such as monkeys, Langurs may be electrocuted because of climbing on towers and touching wires.

The operation of 400 kV transmission line may affect birds through the presence of the conductors (wires). The principal problem is the earth wire which being at the highest point and being thin, is harder for birds to detect and avoid. Birds, which do not see the wire or which notice them too late may suffer injury and die from collisions. This type of impact is expected to be high in low visibility condition especially in bad weather and nighttime. Some species like raptors and fruit bats are likely to be affected more due to line collision. Nocturnally active avifauna is more frequently involved in wire strikes, while predatory birds can be killed by electrocution. Medium to large waterfowl are susceptible to wire strikes as they often lack maneuver and have a high incidence of low level flight activity. Wire strikes are likely to be often in the bird migration routes such as adjacent areas of Koshi River, Bagmati River and Kamala River.

The likely rate of bird collision is difficult to quantify, although studies in Europe have identified significant numbers of avifauna may be killed, especially in areas rich in wetland bird habitats (Hellad-Hansen, 1995). The magnitude of expected impact is moderate, extent is site specific and duration is long term.

Changes in Habitat

The vegetation of the right of way will maintain a conductor clearance compatible with safe operation. The vegetation clearance will be carried out manually and clearing crew themselfs have a minor disturbance effect on wildlife. The forest clearance will change 518.25 ha forest area into shrub land and open areas. The magnitude of impact is moderate, extent is local and of long duration.

Wildlife Movement

The RoW will create the barrier for the movement of some wildlife. Since transmission line route lies in the migratory route of Asian Wild Elephant, the reduction in forest area may discontinue their habitat and thus affect their seasonal migration. The impact is considered to be Low in magnitude, extent is Local and of Long term.

Reptiles and Fish

No significant impact is expected on reptiles and fish due to operation of the transmission line.

6.2.3. Socio-economic and Cultural Environment

6.2.3.1. Construction Phase

6.2.3.1.1. Acquisition of Land

The project will acquire 38.16 ha private land permanently including 20.9 ha for substations and 17.26 ha for tower pads. Moreover, 712.33 ha private land will fall under its RoW. The construction of Bhokraha substation and extension of Dhalkebar substation has acquired 14.13 and 6.77 ha private land respectively. This area is 15.02 ha more than that mentioned in its approved IEE report (23.14 ha)

Out of total 792 towers, 455 towers are located in the private land and for this 17.26 ha private land will be acquired permanently.

Out of total 1326.23 ha RoW land, 712.33 ha (53.71%) falls in the private land which is 36.41 ha more than that of approved IEE. The substation area is 100% private cultivated land which has already been acquired (Table 6.5).

Table 6-5: Acquisition of cultivated land for different project components

S.N	Project Components	Total Land (Private, Forest and Others) (ha)	Private Land	Percentage
1	Towers (792)	30.33	17.26	56.91
2	RoW (288.31 km)	1326.23	712.33	53.71
3	Temporary camps and storage area	5.7	5.7	100
4	New Duhabi (Bhokhra) Substation	14.13	14.13	100
5	Extension of Dhalkebar Substation	6.77	6.77	100
	Total	**1383.16**	**756.19**	**54.67**

Source: Field survey, 2018

The impact is considered to be Medium in magnitude, extent is Site Specific and of Long term.

6.2.3.1.2. Impacts on Project Affected Families (PAFs)

The permanent acquisition of land for the tower pads and substation area will affect 38.16 ha private land of 609 households. Out of the total surveyed affected households (493) , 421 HHs (85.40 %) loose less than 10%, 60 HHs (12.17%) loose 10 to 50% and 12 HHs (2.43%) loose more than 50% of their total land holding (Table 6.6).

Table 6-6: Acquisition of Land in Different Land Holding Category

Affected Categories of HHs and Land Loss (%)		Tower Pads		Substation		Total	
		No.	(%)	No.	(%)	No.	(%)
1. Marginally (<10%)		413	89.01	8	27.59	421	85.40
2. Severely	10-50%	45	9.70	15	51.72	60	12.17
	>50%	6	1.29	6	20.69	12	2.43
Total		**464**	**100**	**29**	**100**	**493**	**100**

Source: Field Study, 2016 & 2018

6.2.3.1.3. Loss of Structures

One hundred twenty three families will lose their houses and other structures such as cowsheds, toilets, hand-pumps etc. A total of 110 houses, 36 cowsheds and 56 other structures including toilets are identified which are owned by 123 HHs throughout the transmission line alignment (Table 6.7). The magnitude of impact is considered to be medium, extent is local and duration is long term.

Table 6-4: Acquisition of Structures

District	Total HHs	Houses	Cowshed	Others	Total
Makawanpur	44	24	17	28	69
Sarlahi	18	18	10	9	37
Dhanusha	10	12	7	4	23
Siraha	35	34	0	15	49
Saptari	11	17	0	0	17
Sunsari	5	5	2	0	7
Total	**123**	**110**	**36**	**56**	**202**

Source: Field Study, 2016 & 2018

6.2.3.1.4. Impact on Community Structures

A primary Government school (Yuba Barsha Primary School) has been affected at new Bhokra substation due to land acquisition. This school has already been shifted about 500m west from the previous location. The new building has been constructed from the compensation amount provided for the land and structure.The impact is considered to be medium in magnitude, extent is local and of long term in duration.

The affected Dihibar Mandir located at Mithila Municipality of Dhanusha district and Gram Dewata Dewhar Than located at Karjhana Miniciplality of Sirhah district have been relocated by the project at its own cost. The magnitude of impact is considered low, extent is site specific and duration is long term.

6.2.3.1.5. Loss of Standing Crops

The compensation has been paid for such losses identified to 272 PAFs and will also be continued in the future.

Paddy, Sugarcane, Wheat, Maize, and Millet are the major crops and cash crops likely grown in the project affect areas. The magnitude of impact is considered to be low, extent is site specific and duration is long term.

6.2.3.1.6. Health and Sanitation

The lack of proper sanitary measures in temporary labor camps may affect the health condition of the workers. The lack of proper sanitary measures and increase in waste and

water pollution can lead to an outbreak of epidemics and diseases such as jaundice, typhoid etc. Considering the manpower involved and duration of stay, the magnitude of impact is considered to be low, extent is site specific and duration is short term.

6.2.3.1.7. Occupational, Health and Safety Hazards

Construction related accidents are common in Nepal, primarily because of unsafe construction practices. Construction activities such as working in the hilly areas, riversides, erection of towers and stringing of line may cause accidents and injuries. Work related injuries and vehicle accidents are the likely impact expected due to implementation of the project. The magnitude of impact is moderate, extent is site specific and duration is short term.

6.2.3.1.8. Increase in Economic Activities

Due to increase in economic activity, there might be increase in prices of local consumable goods. Since transmission line is linear facility and construction work is spread over 288.3 km, the impact is considered to be insignificant.

6.2.3.1.9.Livelihoods

About 53.7% of the transmission line alignment passes through the cultivated land and 38.16 ha private land is acquired permanently. Crop farming, livestock farming and labour work are the main sources of livelihood of affected households. Of the surveyed households, 61.9 % have food deficit since their production is not able to meet the year round food requirement of their family. The acquisition of land is expected to reduce crop production. This may add further pressure on the majority of the PAFs household already facing food deficit problem.

The magnitude of the impact is considered low, extent is local and duration is long term.

6.2.3.2. Operation Phase

6.2.3.2.1. Loss of Agricultural Production and Agriculture Income

The project has acquired 38.16 ha private cultivated land permanently for erection towers, extension of Dhalkebar substation and construction of Bhokra substation respectively. Paddy, sugarcane, wheat, maize and millet are the major food grains grown in the cultivated land.

The annual permanent loss of agricultural production from food crops and cash crops is calculated to be to be 68.51 MT (including two seasonal crops) and 113.76 MT respectively.

The income of these crops is calculated to be NRs 1712750 and 1638120 respectively. Therefore, the annual permanent loss of income from the project affected land is NRs 33,50,870.

Table 6-5: Loss of Agriculture Income due to Land Acquisition

S.N	Type of Land and Crops	Total Land(ha)	Total two seasonal Crops loss (MT)	Price/MT	Monetary Value
1	Cultivated Land-food Crops	22.1	68.51	25000	1712750
2	Cultivated Land-Cash Crops, one	16.06	192.72	8500	1638120

	season only				
	Total	**38.16**			**33,50,870**

The magnitude of this impact is considered to be low, extent is site specific and duration is long term.

6.2.3.2.2. Land Use Restrictions

Total of 712.33 ha of private land falls under TL RoW. Due to the safety reason, houses and other permanent structures are not allowed to construct within the RoW as per the Electricity Regulation. As the land will not be applicable for construction of house, the value of land will be depreciated. It is difficult to quantify the level of impact on the pricing of the land because there are other factors too that would play the significant role. Thus, the overall magnitude of impact is moderate, extent is site specific and duration is long term.

6.2.3.2.3. Land Fragmentation and Farming Hindrance

The placement of towers at provateland fragments the land, which will reduce the land value, minimize the land uses and increase the cost of cultivation. The overall magnitude of impact is considered to be low, extent is site specific and duration is long term.

6.2.3.2.4. Electricity Hazards and Electromagnetic Impact

Electrocution

Electrocution can occur from contact with live conductors, flashover from a conductor to a tower or trees, and conductor breakage. Contact with live conductors or flashover to a person or object near a live line is highly unlikely as a minimum vertical clearance of 7.5 m between the conductors and ground level is established. The accidental failure of the transmission line involving a conductor breaking is also highly unlikely to cause electrocution. Very sensitive and 100% redundant transmission line protection is adopted for the line. This protection will detect any fault, including the conductor snapping, and causes the line to be de-energised within three cycles (i.e. 60 milliseconds), thus largely avoiding the potential for electrocution from a breakage.

Electromagnetic Fields

The high voltage and current carried by the 400 kV transmission line will create electric and magnetic fields that will dissipate rapidly with increasing distance from the source. Transmission line tower heights and corresponding conductor heights above ground level, as well as the RoW width, are selected and designed to limit the electromagnetic radiation levels at ground level and at RoW edges to acceptable levels.

Although specific biological responses to the electromagnetic fields (EMF) associated with current-carrying conductors is still unknown, evidence suggests that health hazards may exist due to EMF. As such, the transmission of electrical energy through the conductors of line may pose risks and hazards to the surrounding environment and nearby residents. The overall magnitude of impact is considered to be low, extent is site specific and duration is long term.

Field strengths of EMFs for the 400 kV line set within a 46 m wide RoW are estimated in table 6.9 compared with international health guidelines (National Health and Medical

Research Council, 1989). Field strengths have been estimated for worse case conditions, where the line is at its lowest point (maximum sag) and in hot weather, for a location at the edge of the RoW and directly under the line.

Table 6-6: Magnetic and Electric Field Strength Estimates and Recommended Maximum Exposure Levels

Estimate/Standard	Magnetic Field Strength (magnetic flux density, micro Tesla (μT))	Electric Field Strength (kV/m)
Estimated maximum field strength at the edge of 46 m RoW (midspan, 400 kV line)	7.92	2.78
Estimated maximum field strength at the centre of RoW (midspan, 400 kV line)	11	3.2
Recommended maximum level for 24 hours/day[1] (continuous exposure for the general public)	100	5
Recommended maximum level for 10 hours/day[1] (occupational exposure)	500	10

[1] *International Non-ionizing Radiation Committee of the International Radiation Protection Association.*

Altogether 37 settlements are located within 100m of the transmission line alignment whereas 83 settlements are found within 100 to 500m.

6.2.3.2.5. Occupation Hazards and Safety

During operation phase, the flow of current and the operation of substation make the people, in the immediate vicinity of the line, vulnerable to electrical hazards such as fire and electrical shocks. Furthermore lack of training, operation and maintenance skill and unavailability of the necessary safety equipment may add further risk with safety regards. The public can be affected principally through their own acts, such as children climbing towers, high vehicles attempting to pass beneath the lines, surveyors using metal leveling staffs under the conductors etc. These risks have a low probability of occurrences, but a very high (terminal) significance to the individuals involved. The overall magnitude of impact is considered to be low, extent is site specific and duration is long term.

6.2.3.2.6. Withdrawal of Economic Opportunity

The withdrawal or decrease in economic activity during operation and maintenance may affect the life style of the local people. Local people are habitual for more expenses due to the increased earnings of construction phase. They will face difficulties to manage the lifestyle once the economic activities will reduce and earning will drastically decline. However, due to the linear nature of the project, the local labours will be hired at the different locations only for the short duration of time. Thus, the magnitude of impact is considered to be low because the economic activities are limited and are spread throughout the settlements of the alignment. The extent is site specific and duration is of long term.

6.2.3.2.7. Livelihood

The project will acquire 38.16 ha private land for the placement of towers and substation. Of the surveyed households 61.9 % have food deficit since their production is not able to meet the year round food requirement of their family. The acquisition of land will reduce 68.16 Mt and 192.72 Mt food crops and cash crop respectively. The loss of production will reduce income of local people and further increase the food deficit problem thus affecting livelihood. The magnitude of impact is low, extent is local and of long duration.

6.2.3.2.8. Impacts on Aesthetics

Impacts to visual resources are examined in terms of changes between the existing landscape character and ongoing actions, sensitivity of viewing points available to the general public, their viewing distances and visibility of changes. Although some aesthetic pollution is expected, the magnitude, extent and duration of impact is considered low, site specific and of long duration.

7. Alternative Analysis

7.1 General

As such, a number of alternatives were considered during the detail survey of the Transmission Line and finalization of the alignment. Several subjective judgments like line length, project cost, Koshi Tappu Willdife Reserve and relocation/resettlement were taken while choosing the best alternative. Some of the major alternatives considered were:

- Route alternatives;
- Design alternative;
- Construction alternatives in terms of technology, procedures, schedule and raw materials to be used;
- No action alternative; and
- Operation procedure

7.2 Route Alternative

Since the transmission line is under construction, no route alternative exists. The changed alignment was analyzed and mitigating measures are proposed.

7.3 Location Alternative

Since the land has already been acquired and substations are under construction at 3 places, there is no alternative for substation. Moreover, the RoW of the TL has also been finalized at this stage of construction and no other alternatives will be considered.

7.4 Design Alternatives

In order to choose the better alternative from the design stand point of view as well as the environmental impact for the said transmission line the following aspects are considered.

7.4.1. Tower Structure

The tower structure is designed and is approved from NEA and World Bank. Lattice tower is preferred to guyed tower. Although the later type is economical, the terrain and conditions of Nepal are not suitable for guyed towers. They require large and level space for ground assembly at tower site and access for mobile crane for erection. Even in plain areas this would be difficult since vehicular traffic is very limited due to numerous streams and ridges for containment of water in cultivated fields. As such, use of guyed towers involve more disturbances to land and thus affect more to standing crops. Hence the guyed type is rule out. The option such as assembling towers at remote level spaces and helicopter carrying and erection would be highly costlier.

7.4.2. Ruling Span

The design of the tower and foundation design are very much dependent on the selection of ruling span. In this project it is considered that an economical number of towers are arrived at by adopting optimum standard ruling span. This way unnecessary land and environmental disturbances is kept at minimum.

This is already fixed and is under construction process.

7.4.3. Polymer Insulator

The anti fog porcelain insulator are already determined and hence no alternative are proposed. Polymer insulators are costlier than the glass/porcelain type hence polymer insulators are not to be used.

7.4.4. Foundation and its Protection

The foundations are determined based on soil type, geology and other aspects. The foundations are not changed unless approved by consultant and NEA. So no alternative is proposed.

7.5 Construction Method Alternative

7.5.1. Excavation

Excavation done manually will provide more opportunity for the local employment, will have less impact on topography, low disturbance to surrounding areas and requires no access road. However, this will be a bit costlier and time consuming. Alternatively, this could be done by machines. But because of difficult access, transportation and operation of such machines causes more impact to environment. The use of machines also increases noise pollution in the areas and may destroy the existing trails.

7.5.2. Concreting

As far as possible and based upon the transportation possibility, mixer shall be employed since manual mixing is time taking and will be of low quality.

7.5.3. Erection

The tower erection is being carried out manually. Helicopter stringing is an alternative. But such method would be highly costlier. Moreover use of helicopter will create noise pollution and may disturb the fauna of the area so are not proposed.

7.5.4. Technology

Internationally accepted standard technology will be applied for the installation and procurement of the goods and equipment. One of the major factors for it is to ensure the minimal environmental impact on the project area.

7.6 Construction Materials

7.6.1. Tower

Self supporting galvanized lattice steel towers will be used. Alternatively, wooden poles could be used. But, strong and durable poles for such line requires tremendous amount of forest to be cut. Such type of poles will have to be imported. This will create environmental problem in the global sense, if not in Nepal. Hence, are not used in this project.

7.6.2. Conductor Anchoring

Instead of disc insulator units of glass or porcelain, polymer type insulators could be used. However, they are costlier hence not to be used.

7.6.3. Conductor

ACSR quad bundle conductor will be used for wire stringing. Alternatively, Copper could be employed. Since Copper is very much expensive, it is financially not feasible and will not to be used.

7.6.4. Foundation

Mostly, conventional pad and chimney type concrete foundation shall be employed. However, in Terai or in the flat areas in river valleys the ground water level is normally high and the areas are subjected to seasonal floods. In such areas foundations must often be designed for submerged conditions and should always be RCC pad and chimney type. Moreover, Grillage types normally have shorted life span and are sensitive to corrosion.

7.7 Construction Schedule

7.7.1. Rainy Season

Construction of the transmission line in rainy season causes soil erosion problem, blockage of drain and difficulty to crossing of River and excavation of tower foundation. The construction in rainy season will also delay the project progress due to other disturbances. The indoor works of substation may be carried out in rainy season.

7.7.2. Dry Season

The construction activity is planned in off-season to minimize the un- necessary damage and disturbances. This reduces the project impact on physical, biological and socioeconomic resources of the area. The construction of transmission line work is conducted in dry season and major inland transportation work is conducted in dry season. The stringing work shall be conducted just after harvest of crop, as far as possible, in dry season.

7.8 Operation Procedure

Manual patrolling twice a year shall be conducted and necessary maintenance will be done. For this purpose existing facilities and manpower of NEA will be used. Alternatively, helicopter patrolling of line route could also be used. This will be very costlier and also will create noise pollution thereby disturbing the wildlife of the area.

7.9 No Action Alternative

7.9.1. Without Project

If the project is not implemented then there will be no project induced loss/effects on vegetation, cultivated area and other project induced environmental and socio-economic impacts. No action alternative would result in heavy deficit of power and energy in eastern part of the country where major industries are located. It also affects adversely to the power exchange with India since this line is proposed to transmit the imported power to central and eastern part of the country and thus causes adverse impact on the economy of the country. This would result in significant losses to the production sector like industry, commerce apart from inconvenience to the customers in terms of blackouts and voltage drop. No action alternative shall also pose problems like continuation of power shedding due to lack of higher capacities transmission line.

7.9.2. With Project

The second option seems more suitable. The role of Project is very important in Integrated Power System of Nepal (INPS) and for the transmission of power in eastern and central part of the country. The implementation of project supports the power purchase with India and also provide reliable power to the load centers of Nepal. The construction of the project reduces system loss.

This project is also helpful for the expansion of rural electrification program. The likely increase in electricity supply to local people will help to switch energy consumption trend and pressure on local vegetation will be minimum. Socio-economic conditions of the local people are likely to be increased through employment opportunities and income generation activities. There will also be possibilities of establishment of small-scale industries, different level of Government and Non Government offices etc.

Besides positive impacts the implementation of the project also brings some negative changes. Changes in land use pattern, loss of 1,39,059 trees, acquisition 38.16 ha of private cultivated land and relocation of 144 structures of 123 HHs are the few adverse impacts likely to occur due to implementation of the project.

8. Mitigation and Enhancement Measures

8.1. Enhancement Measures and Social Support Program

The project proponent is implementing the proposed enhancement measures as a prime responsibility. Besides this the proponent is also implementing social support program as mentioned in this report. The support programs are being implemented as per the need and demand of the local affected communities.

8.1.1. Priority to the Local Employment

As much as possible and as per their qualification and skill they possesses, the project will emphasize to hire the local people for the construction work. Due priority will be given to project affected families, disadvantage people and women. Altogether 152064 man days unskilled, 91872 man days semi skilled and 57024 man days skilled manpower is required during construction. The unskilled and semiskilled manpower will be recruited from local. The following priority for the recruitment is proposed:

- Project Affected Families
- Project Affected Rural/Municipalities
- Project districts
- Nepal
- Other countries

8.1.2. Rural Electrification

It is strong demand of local people to electrify the affected rural /municipalities. The field survey shows that almost all rural /municipalities affected by the project are partially electrified with remaining few wards. Since NEA is also in electrification business locals are expecting electrification in their area since they are loosing their land and houses. Approved IEE Report proposed to provide necessary fund to concern district offices of Distribution and Consumer Services to expedite the electrification program in the affected rural /municipalities. Accordingly the project has supported for electrification at some places and the process is underway at other places. The detail is as follows:

- Supported for rural electrification at Belka Municipality of Tapeshwori, Udayapur District.
- Supported for electrification at Ramdhuni temple, Sunsari in coordination with local Distribution and Consumer Services (DCS).
- The budget has been allocated and tender has been announced for electrification at the remaining villages of Bakaiya RM of Makawanpur District.

8.1.3. Community/ Social Support Program

Although these programs are not directly related to the project development but it has indirect consequences with regards to project construction. Since large scale transmission line project is under construction in their area, local people have certain expectation regarding the

assistance in some of the development works. The project and ESSD has received letters from various communities, schools, forest user groups and others requesting for the various type of supports at their respective localities. As per the necessity of local people and availability of the budget, many community/social programs are being implemented by ESSD and others are in pipeline. Such supports will also be continued during the project construction period. Till December 2018, following supports have been provided:

i. Construction of public toilet at Kusmanda Sarovar Tribeni Dham, Hetauda, Makawanpur
ii. Construction of toilet at Shankar Jyoti School, Hetauda, Makawanpur
iii. Distribution of water pump and other accessories for drinking water supply in Harmanadi of Makawanpur.
iv. Embankment of Chisapani Kholsi of Nijgadh, Bara (with gabion boxes) in order to prevent the flood entering from the communities benefiting about 200 HHs there.
v. Construction of temple for highly marginalized Bote Community at Botetole, Karmaiya of Sarlahi.
vi. Construction of 16 toilets to 15 Dalit HH and one HH having physically disabled househead at Maisthan of Bardibas, Mahottari.
vii. Provided gabion boxes for embankment of Baluwa Khola to Saino Bhiman Leasehold Forest in Dhanusha.
viii. Construction of Nagar Dihibar temple at Dhalkebar of Dhanusha in order to relocate the existing temple from the premises of acquired substation area, Dhalkebar.
ix. Provided gabion boxes for embankment of Baluwa Khola to Saino Bhiman Leasehold Forest in Dhanusha.
x. Repair and Maintenace of Public ponds located at Bishrampur of Dhanusha and Chiyabari of Siraha
xi. Construction of 2 public toilets for 5 HHs of Chhaghariya, Dhanusha
xii. Construction of Sthaniya Gramin Dewata (Nagar Dihibar temple) at Bhulke, Siraha
xiii. Fencing of the plantation sites at Rautahat, Sarlahi, Saptari and Udayapur districts
xiv. Construction of 2 public toilets at Bhagwatpur of Saptari
xv. Construction of shallow tube well at Nikuri Hatthileth CF, Saptari
xvi. The gabion wall has been constructed across and along the rivers as per the demand of the community at Tapeshwori of Belaka Municipality, Udayapur.
xvii. Boundary wall of Shree Yuba Barsha Pra. Vi., Sunsari has been constructed.
xviii. Water tank stand has been constructed at Karma School, Bhokraha, Sunsari.
xix. Constructed 12 numbers of tube wells at Dumraha of Sunsari.

8.2. Mitigation Measures

The project proponent is implementing the proposed mitigation measures as a prime responsibility. The adverse impacts that are discovered during the construction and operation phases will be mitigated by the proponent at its own cost. The project will compensate for the loss of life and properties due to activities taken during construction and operation of the

project.

8.2.1. Physical

8.2.1.1. Construction

8.2.1.1.1. Flood and Natural Drainage

Special foundation design like pile foundation (or combined footing type of foundation) are made for the towers located in flood plains and geological fragile areas. Such type of tower pads is designed in the flood plains of Koshi, Balan River which are prone to flash floods.

Gumba danda of HD section with possibility of erosion

The tower pads are placed ensuring well protection of towers; appropriate protection measures will be adopted in case of susceptible areas. Adequate drainage around all the towers will be provided. Likewise drainage system will be provided in substation sites to prevent water logging.

8.2.1.1.2. Topography

The natural slope disturbances are minimized during the construction of tower pads. Erections of tower foundation in the unstable land and/or in steep slopes are avoided unless no option is found. Re-vegetation and slope maintenance will be carried out in the disturbed areas to avoid erosion. Proper landscaping will be done at each tower site.

Tower location at bank of Koshi River

8.2.1.1.3. Land Use and Land Take

Land for temporary facilities will be reclaimed to minimize the land use impacts. The camp sites are mostly in barren land to minimize the impact on land use pattern of cultivated land. The private land acquired for the project is compensated at replacement cost.

8.2.1.1.4. Air Quality

Vehicle utilized for construction comply with GoN mass emissions standards. Regular checkup and maintenance of the equipment are carried out as per the manufacturer's specifications to meet the emission standards. Mask is provided to labor force working in areas susceptible to dust pollution. Dust will be minimized by sprinkling water at required locations like substation areas and others.

8.2.1.1.5. Noise Quality

Regular maintenance for all equipment and vehicles is done as per the Manufacturer's Specification. Construction work shall be schedule in day hours. Working hours are limited at

areas like at Koshi area, Tapeshwori area and Nijgadh area.

8.2.1.1.6. Water Quality

The waste generated from the mixing concrete are disposed in pits and filled with soil. Such pits must be made in barren land at approximately 500 meter distance from the water bodies. Toilets must be made in temporary camps at the rate of approximately 10 people in each toilet. Accidental spillages are cleaned up promptly. Care will be taken to locate the temporary construction worker sheds away from the water bodies. Garbage and solid wastes generated by the workforce are dumped safely away from water bodies.

The project proponent has provided awareness program for the project workers to prevent the water pollution from project related activities.

8.2.1.1.7. Waste Disposal

The organic food waste is major waste in temporary camps. This is easily biodegradable and non-hazardous; it is managed by burying in pits at reasonable distance from water bodies and subsequently covering with soil.

Waste generated from construction activities are usually inert material which are non biodegradable e.g. empty cement bags and containers, rejected material, plastic, wooden planks. These waste materials are stored out and kept separate instead of throwing haphazardly elsewhere. Some of these items (cement bag, plastic drum etc.) are sold to local vendors.

8.2.1.1.8. Storage of Construction Material

The area proposed for storage is taken on lease at the prevailing market price based on the production loss. The temporary yards are fenced properly. Cement has been stored in private storage facilities taken on rent on Maisthan and Kanchanpur. The other materials will be stored properly at the designated storage site. The constructional material deposited in construction site will be cleared and natural condition will be maintained before leaving site.

8.2.1.1.9. Land Degradation, Landslide and Soil erosion

The temporary land degraded due to project activities such as storage area, temporary camp etc will be returned to its original stage before handing over to the concerned land owner. Top soil around the tower pad construction area will be stockpiled and reused for site restoration.

The project proponent will construct slope protection structures such as revetment walls and retaining structures. The study has been carried out for the identification of susceptile towers and appropriate measures are proposed. Bioengineering measures are proposed to stabilize unstable slopes. It includes construction of gabion walls, plantation of Amliso, Napier etc on unstable tower locations. The site selection and proper tower foundation design is done considering the geological conditions and seismicity of the area. Following measures will be adapted to the tower areas which need protection works.

Table 8-1: Proposed Measures for Towers

Tower Number	Proposed Measures
Hetauda- Dhalkebar Stretch	
BM 1	Bioengineering measures with Gabbion wall
2/1 ST	Bioengineering measures with Gabbion wall arounf tower footing is proposed
AP 5A	Compaction of soil along with drainage management in wester part of foundation with bioengineering measures
AP7	Pile foundation with extended footings is proposed
AP 10A	Construction of spur to divert channel, bioengineering measures with gabbion in all side of tower
13A/3	Pile foundation with extended footings
13B/3	Gabbion wall construction at 50m upstream
AP 13C	Bioengineering measures with Gabbion wall
13C/1	Bioengineering measures with Gabbion wall
15/8	Bioengineering measures with Gabbion wall
19/1	Bioengineering measures with Gabbion wall around tower
AP20	Bioengineering measures with gabbion wall
AP 29	Gabbion wall construction of length 15m in right bank of kholsi
AP 30L	Gabbion wall construction of length 20m in road side and bioengineering measures arounf the tower
AP 30P	Spur of length 10 m in right bank of tributory near tower
30P/1	Gabbion wall construction of length 30m in leftbank of Hariwon khola
40/1	Gabbion wall of length 30 m and spur of length 15 at right bank of river along with bioengineering measures around tower
40/2	Gabbion wall construction of length 25m in left bank of river and bioengineering measures around the tower
48/1	Gabbion wall construction around the tower and bioengineering measures around the tower
AP 51 B	Gabbion wall of length 3 m in sourthern slope
AP51	Bioengineering measures with gabbion wall
AP52	Bioengineering measures with gabbion wall
AP57	Normal foundation with extended footings.
Dhalkebar- Duhabi Stretch	
AP2	Gabion wall of length 25m in left bank of Bhasi Khola
AP3	Bioengineering measures with gabbion wall
3/1 ST	Bioengineering measures with gabbion wall
AP 7	Gabbion wall of length 20 m at right bank of river along with bioengineering measures around tower
AP 7A	Gabbion wall of length 20 m at right bank of Baluwa Khola along with bioengineering measures around tower
7A/4	Bioengineering measures with gabbion wall

AP 8	Gabbion wall of length 30 m at left bank of Baluwa Khola along with bioengineering measures around tower
AP 8A	Bioengineering measures with gabbion wall
11/3ST	Bioengineering measures with gabbion wall
11/4ST	Bioengineering measures with gabbion wall
11/5ST	Bioengineering measures with gabbion wall
17/8	Gabion wall of length 20m at Ghurmi khola at a distance of 20 m from Tower
17/9	Bioengineering measures with gabbion wall in all sides of tower
17/10	Gabbion wall in all sides of tower
18/5	Gabion wall of length 30m
AP 27A	Pile foundation
AP 28	Diversion dam with 80m ong gabbion wall at right bank of Sukhiya khola, 30m gabbion wall in west part of diversion dam with bioenginnering measures
28/1	Bioengineering measures with gabbion wall of 10m in right bank of river
33A/1	Bioengineering measures with gabbion wall
36/2	Bioengineering measures with gabbion wall
37B/1	Gabbion wall of 25m length at right bank of Khahare khola with bioenginnering measures
AP 38A	Retention wall with boiengineering measures
AP 45	Gabion wall of length 20m in right bank of river
AP 45A	Gabion wall of length 5m in right bank of river
AP46	Bioengineering measures with gabbion wall
AP 59	Gabion wall of length 10m in left bank of river with bioengineering measure
59A/1	Gabion wall of length 25m in right bank of river with bioengineering measure
62/3	Gabion wall of length 25m in right bank of river with bioengineering measure
62/4	Gabion wall of length 15m in right bank of river with bioengineering measure

8.2.1.2. Operation

8.2.1.2.1. Use of Transformer Oil

The transformer oil will be filtered and reused. The leakage of transformer will be controlled by regular inspection and rectification. The oil sump tank is constructed under the transformer in order to collect the leaked transformer oil and to prevent the contamination of land/water.

8.2.2. Biological

8.2.2.1. Vegetation/Forest Resources

8.2.2.1.1. Construction

Forest Land

The agreement has been signed with Department of Forest (Annex 10) for the use of forest land and tree clearnace under RoW in nine districts namely Bara, Rautahat, Sarlahi, Mahottari, Dhanusha, Siraha, Saptari, Udayapur and Sunsari. The agreement is due for Makawanpur district where 2.59 ha forest land is required permanently for tower pads construction and 78.57 ha forest landwill fall under RoW. A total of 12.15 ha forest land equivalent to permanently occupied by the towers in all ten districts will either be purchased and provided to the concerned Division Forest Offices with plantation or the cost equivalent will be deposited in the government fund.

Compensatory Plantation

As per the agreement done with the Department of Forest for nine districts, the compensatory plantation will be carried out for the cut down trees in 1:2 ratio. For Makawanpur district, the compensatory plantation will be carried out as per the agreement with Dept. of Forest and Soil Conservation. A total of 278118 seedlings will be planted for compensation of 139059 trees which needs to be cut down throughout the entire alignment. Moreover, the forest land equivalent to permanently occupied by the towers (12.15 ha) will either be purchased and provided to the concerned Division Forest Offices with plantation or the cost equivalent will be deposited in the government fund.

Till December 2018, about 102,000 seedlings have been planted at 7 project affected districts and the take care of the plantation sites is being done. The area has been provided by the concerned forest offices for the purpose. It is expected that the total plantation will be carried out during the rainy season of 2019. For the compensatory plantation, the contract has already been signed with the contractors.

Harvesting Costs

The total cost for harvesting, logging and transporting of the forest products in project affected forests is being provided as per the district norms to the concerned agencies. The cost required for the harvesting, logging and transportation of trees is part of construction work and hence not included in this report.

Compensation for Private Trees

The trees need to be removed from the private land has been compensated as per the rate determined by the committee and will also be continued inthe future. Due consultation is being carried with the Division Forest Office and concern stakeholders while determining the rate.

Plant Diversity

Due attention is paid to plant local species, species affected by the project, preferred by the local communities/forest offices/FUGs, income generating and those species which contribute to the improvement of habitats for locally available birds and mammals.

Assistance to Forest Users Group

Training and other assistance program are provided to the FUGs affected by the project. The program basically includes capacity building training, forest conservation and management training, NTFP trainings, Wildlife conservation trainings etc. The status of programs carried out till Dec end 2018 is tabulated in table 8.2. The details is also presented in Annex 11 b.

Table 8-2: Details of programs conducted to FUGs

S.N.	Description of Works	Status	Remarks
1	Forest Conservation Awareness Program	Conducted 11 programs to 275 participants.	
2	Wildlife Conservation Awareness Program	Conducted 10 programs	
3	Compensatory Plantation	102,000 seedlings have been planted in 7 districts	
4	Capacity building training to CFUGs and Collaborative Forest	3 training conducted to 90 participants	
5	Non Timber Forest Product Training along with agro-forestry including distribution of saplings	The contract has been awarded to conduct 4 trainings to 140 participants and distribution of 70000 NTFP saplings.	

Non Timber Forest Products

The project proponent has prohibited project workers for the collection of non-timber forest products. Training for cultivation of Non Timber Forest Products (NTFP) especially medicinal aromatic plants and other herbs and condiments and agro forestry will be given to two members of each FUG.

Approved IEE proposed total 134 people would be trained from the forest affected by the project. Two days field observation program will also be conducted to give firsthand knowledge to the participants. The duration of the program will be 7 days which include 5 days class. After implementation of training, 70,000 saplings of NTF species will be planted in the cleared RoW in the area of each community forest**.**

Supply of Alternative Fuel

The contractor will provide kerosene, LPG to the project workers to minimize the loss of forest. For the construction of temporary camps pole size timber felled by the project will be used.

Awareness for Forest Conservation

NEA has implemented awareness program to aware local people and member of forest users group of the project area about the importance of forest conservation, plantation and economic importance of forest and its role in rural society as proposed in approved IEE.

8.2.2.1.2. Operation Phase

Management of the Plantation Sites

The plantation sites will be managed for the period of 5 years from plantation and handed over to the concerned forest offices. Till date, the plantation sites are being managed by ESSD mobilizing concerned Forest User's Group. The cost incured is being paid to them. Replacement plantation is also being carried out after one year based on the survival result, in cooridnation with the concerned Division Forest Offices and FUGs.

Clearance of Vegetation

During operation of TL, the plant species that grow more than 3 meters height will be cut down/trimmed for the safe operation of the line.The clearance will be carried out manually and at an interval of 2-3 years.

Increased Access to Forest

The Row will be maintained as per electricity regulation. This may increase access to the forest land. However, this action will be carried out in close coordination of DFO and FUGs.

8.2.2.2. Wildlife

8.2.2.2.1. Construction

Habitat Loss

The impact on habitat loss is a permanent phenomenon. However, the compensatory programs of plantation and awareness for forest conservation will help to minimize the impact of habitat loss.

Construction Disturbances

Construction works are labor based in most of the sites. The project proponent/contractor is responsible to avoid the unnecessary disturbances and lighting.

Restrict Hunting and Poaching

The project workers are strictly banned for hunting and poaching and any other kind of illegal activities related to hunting and poaching. The construction work in forest area is conducted in coordinated with DFO and Forest Users Groups (CFUGs).

Migration Activities

Due emphasis will be given for the plantation of saplings in elephant migration area to make a continuous habitat. The towers falls in this area shall be fenced and marked properly to avoid any damages.

Awareness for Wildlife Conservation

Awareness for wildlife conservation is being/ will be implemented to minimize the adverse impacts on local wild fauna. The conservation awareness training is/will be given to project

labors and representative of Forest Users Groups. The program is being/will be implemented in close coordination with Forest Offices/FUGs and other concerned agencies.

8.2.2.2.2. Operation

Habitat Changes

The mitigation measures applied in construction phase will be also applicable for this impact.

Avian Hazards

Measures to minimize bird injury and death associated with the transmission line will be considered in line design. Markers such as colored balls will be attached to wires to improve line visibility for birds. Silhouettes of birds of prey will be attached to conductors to frighten birds. Markers are proposed Koshi River, Bagmati River and Kamala River crossings.

Wildlife Movement

Due emphasis will be given for the plantation work in elephant migration area. The towers falling in this area will be fenced.

8.2.3. Socioeconomic and Cultural

8.2.3.1. Construction

8.2.3.1.1. Compensation for the Acquisition of Land and Loss of Agriculture Income

The private land acquired by the project is compensated as per the rate fixed by the Compensation Fixation Committee. The committee has been formed under the chairmanship of Chief District Officer of the concerned district and includes chairman of affected (then VDCs) Rural Municipality, representative of affected people, representative of Land Revenue Office and Project.

Land will be acquired according to Land Acquisition Act 2034. Considering the limitations of the Land Acquisition Act, 2034 (1977) improvements will be made to the principles of valuation in consultation with the local administration and stakeholders. The compensation determined by the CFC will be at replacement cost. To ensure this, the CFC will take account of prevailing rates in the local market and rate proposed in IEE report. Affected people were asked about the mode of compensation. About 75 % of the surveyed households of the project affected area expressed that they prefer to the cash compensation if they have to leave their place or property for the project. Similarly, 22.22% said that they want land for land compensation. Land for land compensation is not proposed in this project due to the small area of land to be permanently acquired from various affected families. It is impractical and tedious to allocate similar piece of agricultural land in the vicinity of the project.

8.2.3.1.2.Compensation for Acquisition of Structures

Construction of the project will involve the removal of 110 houses, 36 cowsheds and 56 other structures of 123 HHs (Table 8.3). The project proponent will provide compensation at replacement cost for the structures acquired by the project. This will include compensation for land occupied by the structure and cost of the structure and other accessories (hand pump, well). Owners will have the right to use salvage materials from the affected buildings. The

value of salvaged materials will not be deducted from the compensation amount.

Table 8-3: Acquisition of Structure

District	Total HHs	Houses	Cowshed	Others	Total
Makawanpur	44	24	17	28	69
Sarlahi	18	18	10	9	37
Dhanusha	10	12	7	4	23
Siraha	35	34	0	15	49
Saptari	11	17	0	0	17
Sunsari	5	5	2	0	7
Total	**123**	**110**	**36**	**56**	**202**

A house rent allowances for 6 months will be paid to the concerned household losing residential structures. Besides this a onetime dislocation allowance and transportation allowance per household will be provided for transportation of goods and materials.

8.2.3.1.3. Compensation for Loss of Standing Crop

Construction work is scheduled at best to avoid cropping season. People of the concerned land will be informed in advance so that these disturbances can be minimized. Compensation is paid for loss of crops in RoW by measuring the actual disturbances.

8.2.3.1.4. Livelihood Restoration Program

To restore the loss of agriculture income, training program for agriculture production, vegetable farming and livestock was proposed by approved IEE. In addition different type of skill development trainings have been provided to the affected households to restore their income from other sources.

8.2.3.1.5.Occupational Safety Measures

The construction area is declared as hard hat area and all the necessary precaution and warning sign will be placed at work site. This area is restricted for the entry of unauthorised people. The project proponent has provided hard hat, eyeglass, gloves, safety boot, safety belt, fire fighting accessories, caution signals and other safety equipment as required at particular site and work area. First aid kits are maintained, for preliminary treatment in emergencies. For serious injuries especial arrangement has been made to send the injured person to nearest hospitals.

Although approved IEE proposed conduction of 5 safety training for the project workers , 7 trainings were conducted with 129 participants and 4 hotspots awareness programs with 86 participants (project workers and supervisors).. The training program was of one day. Community safety awareness programs about the T/L and potential risks associated with T/L construction too was conducted in eight places with 200 participants. The project workers involved in construction works were also trained for occupational health and safety measures.

8.2.3.1.6.Health and Sanitation

Permanent camps are placed on rented houses with minimum required facilities like toilet, drinking water and other facilities. Toilets are/will be made in temporary camps as per the required. Health check-up of 150 workers has also been carried out in 2017. Drinking water available at the camps will be ensured safe for drinking purpose. Health sanitation awareness program have been implemented in 3 locations for the project workers living in camps.

8.2.3.1.7. Reduction in Agriculture Production

The land required for the placement of project structures are acquired in advance and if there are any crop during the time of acquisition payment will be made for the actual loss of such crop as per current market price. Compensation will also be paid to the affected landowner equivalent to loss of one crop in the affected land.Compensation is proposed for the loss of crop in RoW.

8.2.3.1.8.Community Support

Various community and school support programs as mentioned in approved IEE are being implemented at project affected sites.

8.2.3.1.9. Gender and Vulnerable Group

The project has ensured not to discriminate the local people based on their gender, caste, color and place of origin. The priority to the job opportunity will be provided to the vulnerable group (Dalit and women headed households) affected by the project area based on their skill and interest. Moreover, the skill development trainings on tailoring, driving, wiring, mobile repairing have been provided under VCDP program (Refer: Annex 11). A total of 53 sewing machines have also been distributed to the 53 female participants of 3 months tailoring training.

8.2.3.2. Operation

8.2.3.2.1. Land Use Restriction

The private land falls in RoW will be compensated as per the rate fixed by Compensation Determination Committee headed by Chief District Officer.

The land within RoW will be utilized as usual by the respective landholders except for tree plantation and construction of permanent structures.

8.2.3.2.2. Land Fragmentation and Farming Hindrance

The erection of towers/placement at center of farm land will be avoided to the extent possible. If the remaining land in a parcel is not applicable or difficult for the cultivation the project will compensate the remaining land of the particular land parcel. The project will provide compensation for this land at prevailing market price. The ownership of such land will be transferred in the name of project.

8.2.3.2.3. Occupational Health and Safety

Safety equipment required for the operation of the transmission line will be provided. During the maintenance major area will be restricted for entry of unauthorized person to avoid

disturbances and risk. Hard hat, eye glass, safety boot, ear plugs, good electric light system, good earthling devices, firefighting accessories, caution signals, safety belt and other safety equipment as required at particular site and work area will be provided. 46 meter RoW will be strictly maintained to minimize the likely risks of conductor breakage, induced voltages, etc. Appropriate protection system and equipment will be installed at the substation to ensure the automatic isolation of the line in case of abnormal conditions. A safety awareness program will be implemented at the beginning of project operation to inform the local people about the likely risk and safety measures to be applied. The awareness program also includes awareness regarding not to getting close to the transmission line especially those person who have pacemaker and other similar devices transplanted in their body.

8.2.3.2.4. Livelihood Support Program

The livelihood support program proposed during construction will be continued for first year of project operation. This program will minimize the impact due to reduction in agriculture production and livelihood.

The cost required for the proposed mitigation/enhancement measures is given in Table 8-4

Table 8-4: Implementation of Environmental and social Mitigation Measures and Monitoring Plan as Per approved IEE Report

S.N.	Description	Quantity	Amount (Million NRs)
1	Forest Conservation Awareness Program	10 Programs including hoarding boards	1.647
2	Wildlife Conservation Awareness Program	10 Programs including hoarding boards	0.912
3	Social Awareness Program	20 Programs including hoarding boards	1.267
4	Compensatory plantation Program including five year managemet	278118	21.93
5	Fencing of the plantation sites	10 Districts	10.39
6	Provision of Ban Heralu to Plantation sites (for 18 months)	19 persons	4.104
7	Capacity building training to CFUGs and collaborative forest	3 Programs	0.327
8	Non timber forest products training along with agro forestry including distribution of saplings	1 Program	2.018
9	Agriculture Productivity Intensification Training including support	5 Programs	2.318
10	Skill Development Training for PAFs	90 Participants	3.801
11	Purchase of modern sewing machine	53	1.003
12	Safety Training for the Project Workers	Ref Table 8	0.906

13	Community safety awareness Program	5 Programs	0.433
14	Health and Sanitation Awareness Program	3 Programs	0.991
15	Relocation of temple and school	LS	3
16	Community support Program including health post and school support program, small scale drinking water and irrigation assistance and assistance for the renovation and development of religious and recreational places and capacity building training to local VDCs	LS	20
17	Environmental and social Management (Monitoring and program implementation)		23.898
	Total		89.945

8.2.3.2.5. Electromagnetic Field

The Right of Way shall be maintained as per Electricity Regulation. Very sensitive and fully redundant transmission line protection will be adopted for the proposed line. A precautionary approach for reducing the effect of EMF will be adopted by following the guidelines for limits on magnetic field stipulated by the International Radiation Protection Association (IRPA). No houses or other buildings will be permitted within the RoW, with existing houses and other structures relocated outside the RoW. Awareness programs on safety will be conducted for project staff and local residents at key localities in the project area. Fencing of towers at some locations (e.g. near schools, highway crossings etc), warning signs and metal guard structures on the towers are proposed to dissuade people from climbing or tampering with towers. Phase split will be done in locations where the alignment passes within 100 m from the settlement. Besides this during final survey and design of the alignment it is proposed to rerouting the alignment at least the sites where alignment is within 100m from the settlement.

8.3. Mitigation and Enhancement Measures Cost

The estimated mitigation measures, enhancement measures and social support program cost for the proposed Transmission Line Project is NRs. 89.945million. The detail of this is presented in Table 8.4 above.

Besides this, mitigation program proposed under physical environment are tied up with construction activities and these costs are included in the project cost. The other costs not refered here and included in project cost are harvesting cost for the trees, occupational safety, lease land for storage and other temporary facilities, construction of temporary toilets and camps and drinking water facilities. The contractor will implement these programs on behalf of NEA. However the overall responsibilities for carrying out these mitigation measures lies

with NEA.

The professional staff required for environmental management will be deputed from ESSD and environmental monitor and other support staff will be recruited at local level. The following manpower will be deployed.

- Project Coordinator
- Team Leader/ Unit Chief
- Environmental Expert/ Ecologist
- Sociologist
- Field Supervisor
- Support staffs

The mitigation program will be implemented in coordination with the concerned line agencies. The summary of mitigation/enhancement measures proposed is given in Table 8-6.

Table 8-5: Mitigation/Enhancement measures for identified Impacts

S.N.	Issues	Impacts	Qualifier			Mitigation/ Enhancement Measures
8.1 Beneficial Impacts			**Magnitude**	**Extent**	**Duration**	
1	Local employment	Employment opportunity to local people	M	L	LT	Due priority will be given to the local people affected by the TL.
2	Local skill	Increase in local skill particularly in erection of tower, stringing of line, driving etc.	M	L	LT	Due priority will be given to the local people affected by the TL.
3	Economic opportunity	Increase in economic activity due to project construction	M	L	ST	Project will utilize local material and houses to the extent practicable
4	Local Economic activities	Provide continuous electricity supply, which will provide opportunity for the expansion of the local trade and business which leads employment and other benefits to local people and area.	H	N	LT	None
5	Power exchange	Enhance power exchange thus reduce current load shedding problem	H	N	LT	None
6	Rural electrification	Open the door for expansion of distribution network	H	L	LT	Implement rural electrification program
7	Lightening	Low potential of lightening	H	L	LT	Not required
8.2 Adverse Impacts						
8.2.1	**Physical**					
8.2.1.1	**Construction Phase**					
1	Flood and Natural Drainage	The construction of towers may pose obstruction to natural drainage	L	L	LT	Special foundation design like matt and pile foundation will be made for the towers located in flood plains and geological fragile areas.

2	Topography	Topography will change due to excavation and erection of towers, fill and cut for leveling the tower pad area.	L	SS	LT	Proper land scaping will be done at each tower site
3	Land take and land use	The project will require 1326.23 ha land for the placement of tower pads, substations and RoW of the transmission line.	L	SS	LT	Reclaim the land use affected by the temporary facilities. As for as possible temporary facilities shall be placed in barren land.
4	Air quality	The construction activity and movement of vehicle will generate air which will affect air quality of the near by area	L	SS	ST	Air mask will be provided to labor force working in areas susceptible to dust pollution. Due care will be taken while working in those site
5	Water quality	Likely increase in pollution due to increase in sedimentation ,cement washed out etc.	L	SS	ST	The waste generated from the mixing concrete will be disposed in pits and filled with soil. Awareness program will be implemented
6	Waste disposal	The improper disposal of cement bags, iron bar and other left -over construction materials, kitchen waste and waste generated by the temporary labor camp will land and water quality	L	SS	ST	Left over construction material will be sold in near by market areas where as camp west will be disposed properly.
7	Storage of construction materials and camp	Production loss, changes in land use pattern, degradation of land quality etc.	L	SS	ST	Area required for temporary facilities will be taken on lease and temporary yards will be fenced properly. Permanent camp will be made on rental houses.
8	Land degradation landslide and soil erosion	Landslide and soil erosion problem are expected at susceptible sites	L	SS	ST	Temporary land taken on lease shall be return to its original stage Bioengineering works shall be conducted to minimize landslide and soil erosion problem.

8.2.1.2 Operation Phase						
1	Use of Transformer oil	Contamination of land, water etc	L	SS	LT	The transformer oil will be filtered and reused. The leakage of transformer will be controlled by regular inspection and rectification. The oil sump tank is constructed under the transformer in order to collect the leaked transformer oil and to prevent the contamination of land/water
8.2.2	**Biological**					
8.2.2.1 Construction Phase						
1	Vegetation/forest resources	Clearance of 518.25 ha forest falling under RoW	H	L	LT	The forest land falls in RoW will be taken on lease. Compensatory plantation will be made for loss of trees as per the prevailing legal requirements.
2	Loss of tree	Removal of 1, 39, 059 trees from community, Leasehold collaborative and national forest	H	L	LT	Sapling will be planted in ten project affected districts as per the prevailing legal requirements and agreement with the Department of Forest and Soil Conservation.
3	Floral diversity	Impact on species of plants due to implementation of the project.	M	L	LT	Due attention will be paid to maintain the plant diversity and a combination of income generating, fodder and commercially important species will be selected for plantation.
4	Community/ Collaborative forest	Impact on community forest due to removal of trees	L	SS	LT	Implementation pf training and assistance program for the FUGs affected by the project
5	Protected species of Flora	Removal of trees having conservation significance	H	N	LT	Due emphasis will be given for the plantation of species having conservation significance. Forest conservation awareness program will be implemented in project area

6	Firewood and timber	Increase in pressure on local vegetation due to increase in demand of firewood and timber	L	L	ST	Common dining facility for group, use of LP gas or kerosene for cooking and use of other construction material rather than wood is proposed.
7	NTFP	The implementation of the project will affect NTFP	L	L	LT	Implementation of NTFP training and distribution of NTF species to CFUGs
8	Wildlife Habitat	Reduction in available forest habitat due to removal of forest	M	L	LT	The compensatory plantation in 174 ha area will minimize this impact
9	Wildlife movement	Impact on movement of Asian Wild elephant in Nijgadh, Tapeshwari and Goghanpur area due to fragmentation of forest habitat	L	L	LT	Due emphasis will be given for the plantation of sapling in elephant migration area.
10	Construction disturbances	Movement and activity of human beings may disturb free movement and feeding of wild animals	L	SS	ST	Construction work shall be labor based and unnecessary disturbances shall be avoided
11	Hunting and poaching	Likely increase in hunting and poaching	L	SS	ST	Awareness program is proposed
8.2.2.2 Operation Phase						
1	Row clearance	Trees will be trimmed and cut down to make conductor clearance	L	L	LT	Selective felling will be done manually.
2	Plant biodiversity	Likely invasion of new species in cleared RoW	L	SS	LT	NTF species will be planted to use RoW land and the trees below certain height will not be cleared.
3	Access to forest	Increase access to forest	L	SS	LT	RoW will be strictly managed and awareness program will be implemented
4	Electrocution	Electrocution to monkeys and bird	M	SS	LT	Markers such as colored ball will be attached to wires to improve line visibility. Silhouettes of bird prey will be attached to conductors to frighten birds at Koshi, Kamala and other required places.

5	Changes in habitat	Permanent changes in forest area into shrub land and open areas	M	L	LT	Mitigation measures applied in construction phase will be applicable
6	Wildlife movement	Impact on movement of Asian Wild elephant in Nijgadh, Tapeshwari and Goghanpur area due to fragmentation of forest habitat	L	L	LT	Plantation will focus on the migratory route to avoid the fragmentation habitat. Protection will be done in the tower pads falls in this stretch.
8.2.3	**Socioeconomic and Cultural**					
8.2.3.1 Construction Phase						
1	Acquisition of Land	The project acquire private cultivated land	M	SS	LT	Compensation will be paid on current market rate. Land required for temporary facilities will be compensated based on production loss.
3	Agriculture income	Loss of agriculture income due to acquisition of land	L	SS	LT	Compensation will be paid equivalent to 3 years agriculture loss
4	Community resources and infrastructure	Loss of community and collaborative forest, pressure on local water supply and health services and relocation of school	M	SS	LT	Plantation of income generating species, relocation of school, drinking water assistance etc
5	Temple	Relocation of temple in near by area	L	SS	LT	New temple will be constructed in near by areas with due consultation with local people
6	Crop	Likely damage to standing crop in project area	L	SS	ST	Compensation will be paid for crop loss
7	Health and sanitation	Likely impact on workers health due to poor sanitary situation in labor camps	L	SS	ST	Adequate camping, drinking water and toilet facilities will be provided
8	Occupational health and safety	Likely increase in construction related accidents	M	SS	ST	Hard hat, eye glass, belts and caution sign at work site and other safety devices will be provided

9	Law and order	Likely increase in pressure to maintain the law and order situation	L	SS	ST	Maintain coordination with local administration if any problem occurs. Implement awareness program
10	Life style	Likely changes in life style	L	SS	ST	Implement awareness program
11	Peoples safety	Likely accidents during line charging process while testing and commissioning	L	SS	ST	Implement awareness program
12	Livelihood	Impact on livelihood due to acquisition of land and house	M	L	LT	Implement livelihood restoration program
13	Gender and vulnerable group	Likely discrimination while hiring workers, compensation or other project related benefits	L	SS	ST	Project will not discriminate based on color, origin cast etc. Due priority will be given in employment to vulnerable and poor people.
14	Agriculture production	Loss of food grain and cash crop due to acquisition of land for permanent structures	M	L	LT	Compensation will be paid to the household losing more than 10% of their total land equivalent to their production lost for 3 years.
15	Aesthetic value	Likely disturbances to visitors coming in Nunthar park	L	SS	LT	Coordination will be made with park authority. Information and warning sign will be placed at work site. People will be pre informed through public notification.
8.2.3.2 Operation Phase						
1	Agriculture production	Loss of food grain and cash crop due to acquisition of land for permanent structures	M	L	LT	Implementation of livelihood restoration and agriculture assistance program
2	Land	Deduction of land value falls in RoW especially in semi urban and urban areas	M	SS	LT	Compensation for the land under RoW as per the prevailing legal provisions.
3	Farming hindrance	Placement of tower at center of field pose difficulty for the cultivation	L	SS	LT	Project will acquire the remaining land also in such cases.

		which further increase production cost				
4	Electric and magnetic field	Electromagnetic impact due to long term exposure	L	SS	LT	Compensation for the RoW will be paid and awareness program will be implemented. Construction of house and plantation of trees of large size will be prohibited.
5	Withdrawal of economic activities	Likely impact on local economy due to withdrawal of economic activities	L	SS	MT	Awareness program is proposed
6	Livelihood	Impact on livelihood due to acquisition of land and house	M	L	LT	Continuation of livelihood support program
7	Occupational health and safety	Likely increase in accidents	L	SS	LT	Proper training to operation staff and all required safety gears will be provided
8	Firewood and fodder	Impact on 518.25 ha community and other forest	L	L	LT	Compensatory plantation will minimize this impact.

Note

Magnitude	**Duration**	**Extent**	
L = Low	LT= Long term	SS= Site specific	PAF= Project affected family
M = Medium	MT= Medium term	L= Local	DFO= District Forest Office
H = High	ST= Short term	R= Regional	DAO= District Agriculture Office

9. Environment Management Plan

9.1. Environment Management

9.1.1. Introduction

The Environmental Management Plan (EMP) has been prepared as an integral part of Hetauda- Dhalkebar- Duhabi 400 kV Transmission Line Project to set out the procedural framework to ensure the implementation of mitigation measures and monitoring requirements. The plan specifies the environmental responsibilities of all parties involved in the project, and details the environmental management requirements of the project during the pre-construction, construction and operation phases. The plan also specifies the coordination mechanism with various line agencies, non-project participants and schedule. The monitoring component likewise defines the monitoring mechanism, reporting etc. NEA being the proponent has the prime responsibility for the implementation of environment management plan.

9.1.2. Objectives of EMP

The EMP is an environmental operations manual for use by management and staff employed on the project, and will serve as an advisory document to regulatory authorities such as Ministry of Energy, Water Resources and Irrigation; & Ministry of Forest and Environment.

The EMP has four primary objectives, namely to:

- define environmental management principles and guidelines for the design, construction and operation of the project;
- establish the roles and responsibilities of all parties involved in project environmental management;
- describe mitigation measures that shall be implemented to avoid or mitigate adverse environmental impacts;
- formulate environmental management framework to ensure the implementation of mitigation measures and monitoring programs; and
- establish a supervision and monitoring and reporting framework.

9.1.3. Implementation Approach and Mechanism

The project proponent will be responsible for the implementation of the EMP. The plan will apply adaptive management to accommodate changes in project design during the time. The EMP will follow Plan- Do- Check and Act (PDCA) approach. The EMP will be updated prior to construction of the project to document likely changes in policy and regulatory mechanism and stakeholder concerns.

A site based Hetauda- Dhalkebar Environment Management Units have been established for day to day environment management of the project in Inaruwa, Bardibas and Hetauda. The environmental management plan matrix is given in Table 9.1.

Table 9-1: Environmental Management Matrix

S.N.	Issues	Impacts	Mitigation/ Enhancement Measures	Implementing Agency	Agencies to be Consulted	Monitoring Agency
A. Beneficial Impacts						
1	Local employment	Employment opportunity	Due priority will be given to the local employment	Project		HDD-EMU/Consultant
2	Local skill	Increase in local skill particularly in erection of tower, stringing of line, driving etc.	Due priority will be given to the local employment.	Project		HDD-EMU
3	Economic opportunity	Increase in economic activity due to project construction	Project will utilize local material and houses to the extent practicable	Project		HDD-EMU
4	Rural electrification	Open the door for expansion of distribution network	Implement rural electrification program	NEA/Project		HDD-EMU
B. Adverse Impacts						
B.1	**Physical**					
B.1.1	**Construction Phase**					
1	Flood and Natural Drainage	The construction of towers may pose obstruction to natural drainage	Special foundation design like matt and pile foundation will be made for the towers located in flood plains and geological fragile areas.	Contractor		HDD-EMU/Consultant
2	Topography	topography will change due to excavation and erection of towers, fill and cut for leveling the tower pad area.	Proper land scaping will be done at each tower site	Contractor		HDD-EMU/Consultant
3	Land take and land use	The project will require land for the placement of tower pads, substations and RoW of the transmission line.	Reclaim the land use affected by the temporary facilities. As for as possible temporary facilities shall be placed in barren land.	Project/Contractor		HDD-EMU/Consultant

4	Air quality	The construction activity and movement of vehicle will generate air which will affect air quality of the near by area	Air mask will be provided to labor force working in areas susceptible to dust pollution. Due care will be taken while working in those sites	Contractor		HDD-EMU/Consultant
5	Water quality	Likely increase in pollution due to increase in sedimentation ,cement washed out etc.	The waste generated from the mixing concrete will be disposed in pits and filled with soil. Awareness program will be implemented	Contractor		HDD-EMU/Consultant
6	Waste disposal	The improper disposal of cement bags, iron bar and other left -over construction materials, kitchen waste and waste generated by the temporary labor camp will land and water quality	Left over construction material will be sold in near by market areas where as camp west will be disposed properly.	Contractor		HDD-EMU/Consultant
7	Storage of construction materials and camp	Production loss, changes in land use pattern, degradation of land quality etc.	Area required for temporary facilities will be taken on lease and temporary yards will be fenced properly. Permanent camp are made on rental houses.	Contractor		HDD-EMU/Consultant
8	Land degradation landslide and soil erosion	Landslide and soil erosion problem are expected susceptible sites	Temporary land taken on lease shall be return to its original stage Bioengineering works shall be conducted to minimize landslide and soil erosion problem.	Contractor	District Soil Conservation Office	HDD-EMU/Consultant
B.1.2 Operation Phase						
1	Use of PCBs	Contamination of consumable items, skin races, eye irritation etc	The transformer oil will be filtered and reused. The residue will be incinerated or disposed properly.	NEA Grid Dept		ESSD
B.2 l	**Biological**					
B.2.1		**Construction Phase**				
1	Vegetation/forest resources	Clearance of forest in RoW	The forest land falls in RoW will be taken on lease. Compensatory plantation will be made at the rate of	ESSD/Local Nursery Contractor	Division Forest Office. Forest Users Group	HDD-EMU

			1600 sapling/ha as per the requirement of Ministry of Forest and Environment.			
2	Loss of tree	Removal of trees community, leasehold and collaborative forest	Sapling will be planted in ten project districts @ rate of 1:2 as per the requirement of GoN. Selective felling will be done and forest in deep valleys will not be removed..	ESSD/Local Nursery Contractor	Division Forest Office. Forest Users Group	HDD-EMU
3	Floral diversity	Impact on species of plants due to implementation of the project.	Due attention will be paid to maintain the plant diversity and a combination of income generating, fodder and commercially important species will be selected for plantation.	ESSD/Local Nursery Contractor	Division Forest Office. Forest Users Group	HDD-EMU
4	Community forest	Impact on community forest due to removal of trees	Implementation of training and assistance program for the CFUGs affected by the project	Local NGOs	Division Forest Office. Forest Users Group	HDD-EMU
5	Collaborative forest	Impact on collaborative forest due to removal of trees	Implementation of training and assistance program for management group of collaborative forest	Local NGOs	Division Forest Office. Forest Users Group	HDD-EMU
6	Rare endangered and protected species	Removal of trees having conservation significance	Due emphasis will be given for the plantation of species having conservation significance. Forest conservation awareness program will be implemented in project area	ESSD/Local Nursery Contractor	Division Forest Office. Forest Users Group	HDD-EMU
7	Firewood and timber	Increase in pressure on local vegetation due to increase in demand of firewood and timber	Common dining facility for group, use of LP gas or kerosene for cooking and use of other construction material rather than wood is proposed.	Contractor	Division Forest Office. Forest Users Group	HDD-EMU
8	NTFP	The implementation of the project will affect NTFP	Implementation of NTFP training and distribution of NTF species to CFUGs	ESSD/Local Nursery Contractor	Division Forest Office. Forest Users Group	HDD-EMU
9	Wildlife Habitat	Reduction in available forest habitat due to removal of forest	The plantation in project area will minimize this impact	ESSD/Local Nursery	Division Forest Office. Forest	HDD-EMU

				Contractor	Users Group	
10	Wildlife movement	Impact on movement of Asian Wild elephant in Nijgadh, Tapeshwari and Goghanpur area due to fragmentation of forest habitat	Due emphasis will be given for the plantation of sapling in elephant migration area.	ESSD/Local Nursery Contractor	Division Forest Office. Forest Users Group	HDD-EMU
11	Construction disturbances	Movement and activity of human beings may disturb free movement and feeding of wild animals	Construction work shall be labor based and unnecessary disturbances shall be avoided	Contractor		HDD-EMU
12	Hunting and poaching	Likely increase in hunting and poaching	Awareness program is proposed			
B.2.2 Operation Phase						
1	Row clearance	Trees will be trimmed and cut down to make conductor clearance	Selective felling will be done and herbicide will not be used	Grid Operation Department	Division Forest Office. Forest Users Group	ESSD/NEA
2	Plant biodiversity	Likely invasion of new species in cleared RoW	NTF species will be planted to use RoW land and the trees below certain height will not be cleared.	ESSD/Local Nursery Contractor	Division Forest Office. Forest Users Group	HDD-EMU
3	Access to forest	Increase access to forest	RoW will be strictly managed and awareness program will be implemented	Grid Operation Department	Division Forest Office. Forest Users Group	ESSD/NEA
4	Electrocution	Electrocution to monkeys and bird	Markers such as colored ball will be attached to wires to improve line visibility. Silhouettes of bird prey will be attached to conductors to frighten birds.	Grid Operation Department		ESSD/NEA
6	Wildlife movement	Impact on movement of Asian Wild elephant in Nijgadh, Tapeshwari and Goghanpur area due to fragmentation of forest habitat	Plantation will focus on the migratory route to avoid the fragmentation habitat. Protection will be done in the tower pads falls in this stretch.	ESSD/Local Nursery Contractor	Division Forest Office. Forest Users Group	HDD-EMU
B.3	**Socioeconomic and Cultural**					
B.3.1 Construction Phase						

1	Acquisition of Land	The project will private cultivated land permanently	Compensation will be paid on current market rate. Land required for temporary facilities will be compensated based on production loss.	Project	RM ,CFC DAO	HDD-EMU
2	House	Acquisition structures	Houses will be compensated at replacement cost	Project	RM ,CFC DAO	HDD-EMU
3	Agriculture income	Loss of agriculture income due to acquisition of land	Compensation will be paid equivalent to 3 years agriculture loss	Project	R/M	HDD-EMU
4	Community resources and infrastructure	Loss of community and collaborative forest, pressure on local water supply and health services and relocation of school	Plantation of income generating species, relocation of school, drinking water assistance etc	Project, Local NGOs	R/M	HDD-EMU
5	Temple	Relocation of temple in near by area	New temple will be constructed in near by areas with due consultation with local people	Project	R/M	HDD-EMU
6	Crop	Likely damage to standing crop	Compensation will be paid for crop loss	Project	R/M	HDD-EMU
7	Health and sanitation	Likely impact on workers health due to poor sanitary situation in labor camps	Adequate camping, drinking water and toilet facilities will be provided	Contractor		HDD-EMU
8	Occupational health and safety	Likely increase in construction related accidents	Hard hat, eye glass, belts and caution sign at work site and other safety devices will be provided	Contractor		HDD-EMU
9	Law and order	Likely increase in pressure to maintain the law and order situation	Maintain coordination with local administration if any problem occurs. Implement awareness program	Project, Local NGOs	R/M, Local Administration	HDD-EMU
10	Life style	Likely changes in life style	Implement awareness program	Local NGOs	R/M	HDD-EMU
11	Peoples safety	Likely accidents during line charging process while testing and commissioning	Implement awareness program	Local NGOs	R/M	HDD-EMU
12	Livelihood	Impact on livelihood due to acquisition of land and house	Implement livelihood restoration program	Local NGOs	R/M	HDD-EMU

13	Gender and vulnerable group	Likely discrimination while hiring workers, compensation or other project related benefits	Project will not discriminate based on color, origin cast etc. Due priority will be given in employment to vulnerable and poor people.	Project	R/M	HDD-EMU
14	Agriculture production	Loss of food grain and cash crop due to acquisition of land for permanent structures	Compensation will be paid to the household losing more than 10% of their total land equivalent to their production lost for 3 years.	Project	R/M	HDD-EMU
15	Hetauda Cement Factory	Disturbances to the factory staff due to construction activities	Coordination will be made with factory authority. Information and warning sign will be placed at work site.	Project, Local NGOs	R/M, Local Administration	HDD-EMU
16	Aesthetic value	Likely disturbances to visitors coming in Nunthar park	Coordination will be made with park authority. Information and warning sign will be placed at work site. People will be pre informed through public notification.	Project, Local NGOs	R/M, Local Administration	HDD-EMU
B.3.2 Operation Phase						
1	Agriculture production	Loss of food grain and cash crop due to acquisition of land for permanent structures	Implementation of livelihood restoration and agriculture assistance program	Project	R/M	HDD-EMU
2	Land	Deduction of land value falls in RoW especially urban areas	Compensation has been proposed 40%, 20%and 10% of the land value for the urban, semi urban and rural areas.	Project	R/M	HDD-EMU
3	Farming hindrance	Placement of tower at center of field pose difficulty for the cultivation which further increase production cost	Project will acquire the remaining land also in such cases.	Project	R/M	HDD-EMU
4	Electric and magnetic field	Electromagnetic impact due to long term exposure	Compensation for the RoW will be paid and awareness program will be implemented. Construction of house and plantation of trees of large size	Project	R/M	HDD-EMU

			will be prohibited.			
5	Withdrawal of economic activities	Likely impact on local economy due to withdrawal of economic activities	Awareness program is proposed	Project, Local NGOs		HDD-EMU
6	Livelihood	Impact on livelihood due to acquisition of land and house	Continuation of livelihood support program	Project, Local NGOs		HDD-EMU
7	Occupational health and safety	Likely increase in accidents	Proper training to operation staff and all required safety gears will be provided	Grid Dev Dept		
8	Firewood and fodder	Impact on community forest	Compensatory plantation will minimize this impact.	Project, Local NGOs		HDD-EMU

Note

Magnitude	**Duration**	
L = Low	LT= Long term	PAF= Project affected family
M = Medium	MT= Medium term	DFO= District Forest Office
H = High	ST= Short term	DADO= District Agriculture Office
		DAO= District Administration Office

9.1.4 Institutional Arrangement

9.1.4.1. Institutional Arrangement and Responsibility

i) Project Manager Office

The HDD Project Manager Office is established under the organizational setup of NEA. The project manager has overall responsibility regarding the implementation of EMP including others. He is responsible for acquiring necessary permits for forest clearance from Ministry of Forest and Environment, land acquisition and compensation etc. The Project Manager is responsible to make sure the incorporation of IEE recommendations in tender document and contract agreement and allocation of necessary budget for the implementation of EMP.

He is responsible for the overall coordination of the work and make final decision on environmental, social and public concern issues. The project Manager has authority to issue instruction regarding stop of construction work or penalize the Contractor in case of noncompliance of the tender clauses. The Project Manager may delegate this responsibility to the HDD-EMU but ultimate authority must rest in the Project Managers hand as construction activities and logistic will closely linked to mitigation and monitoring efforts. The organization chart of Hetauda- Dhalkebar- Duhabi 400 kV Transmission Line Project is given in Fig.9.1.

ii) Environment and Social Studies Department

ESSD is one of the three departments of Engineering Services of NEA and executes all the activities related to identifying, conducting and coordinating environmental aspects of project developed by NEA in all stages such as studies, design, construction and operation. This department is responsible for the overall control of Environmental Management Program of the project. This department is also be responsible for the coordination of work of the project at central level management of NEA and central line agencies.

ESSD is implementing monitoring program and some of the mitigation work in coordination with concerned line agencies. The department has implemented the task by placing an independent environment management unit at site. ESSD is working in close coordination with the Project Manager and chief of the HDD-EMU.

iii) Hetauda- Dhalkebar- Duhabi- Environment Management Unit (HDD-EMU)

HDD Environment and Social Management Units have been established for day to day environmental management of the project, implementation of monitoring plan and coordination of work with RMs, DCCs, Division Forest Office and district level line agencies. The units will work under the guidance of ESSD. The units are responsible for the implementation of monitoring plan and implementation of mitigation/enhancement measures.

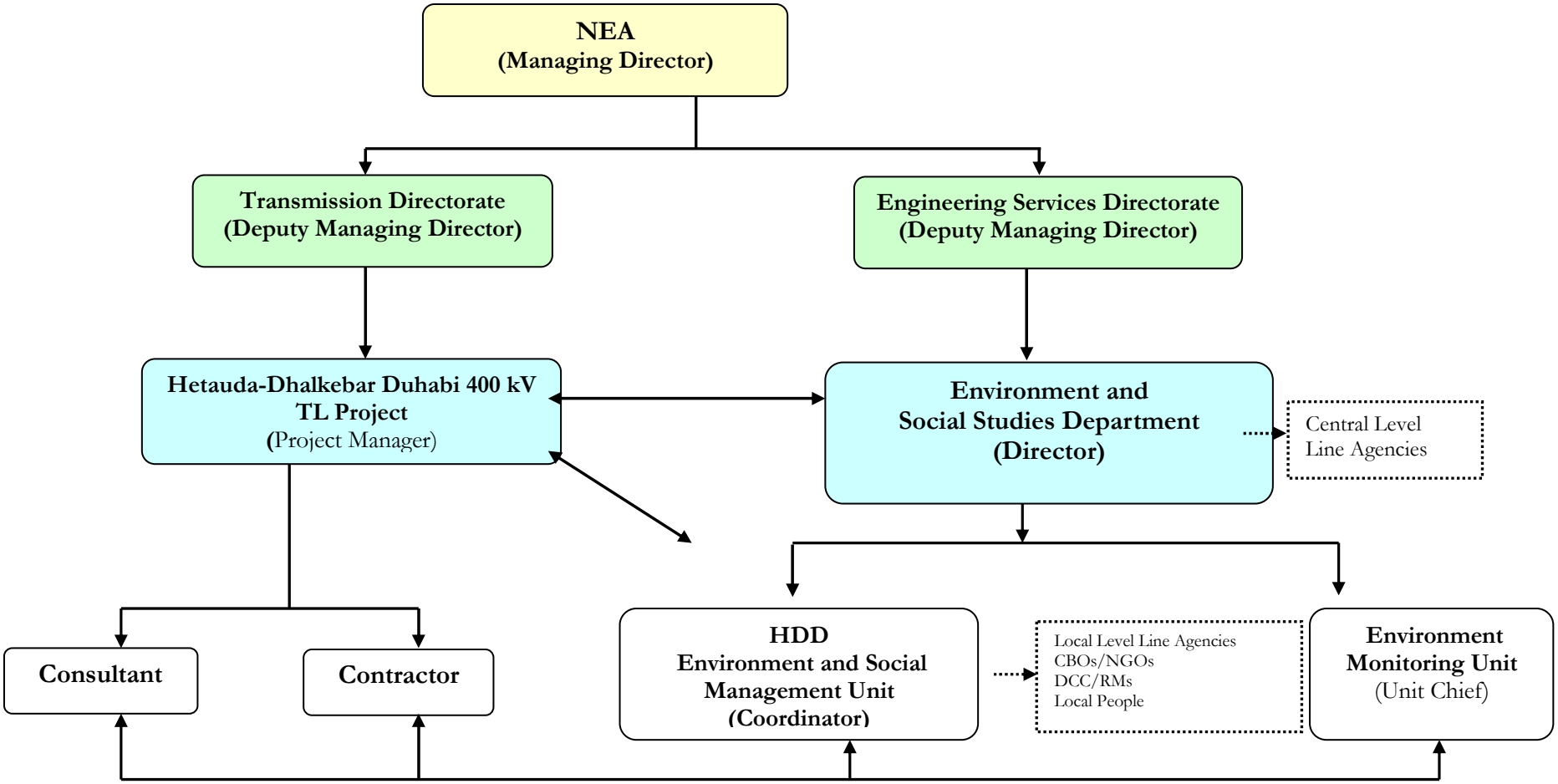


Fig.9.1 : Organization Chart for Environment Management

The units have following staffs in site.

- Program Coordinator
- Environmental Expert/Unit Chief
- Environmental Monitors
- Social Monitors
- Field Supervisors

iv) Construction Management/Supervision Consultant

The coordination of the compliance monitoring and mitigation program allocated under the contractor will be the responsibility of Consultant. Environment Unit of the project will work for the monitoring of compliance issues and report to the Project Manager. The project manager delivers the written message to the Consultant for prompt action. He will have authority to stop work fully or partially; delay in payment or otherwise penalize contractors for of non-performance of environmental tender clauses.

v) Construction Contractor

The construction contractor will be responsible for implementation of mitigation measures specified in his part and compliance with the tender clauses. He will also be responsible for implementation of construction related mitigation measures such as occupational safety, bioengineering measures, water quality protection measures etc.

vi) Joint Inspection Team

A joint monitoring team which consists of representative of Division Forest Office, District Coordination Committee, Rural/Municipality representative and representative of CFUG will be formed. This team will be coordinated by Chief of Environment Unit. This joint team will visit the construction area, mitigation implementation sites fortnightly. The proponent will made necessary arrangement and facilitation for the monitoring of joint team.

vii) Line Agencies

The district level line agencies such as Division Forest Offices, Rural Municipalities, Municipalities, District Soil Conservation Offices and District Plant Resources Office will be consulted during implementation of mitigation measures. The cost for the required technical input for the implementation of program will be born by the project.

Besides, the central level line agencies such as Ministry of Energy, Water Resources and Irrigation, Department of Electricity Development and Ministry of Forestry and Environment shall have responsibility for the monitoring of project activities with regards to Environmental Management, Mitigation and Monitoring Plan. ESSD will coordinate with central level line agencies regarding the monitoring work.

viii) Donor Agency

Donor agency (s) will have specific responsible for the monitoring of compliance of loan agreement. The experts from donor agency will review the project plan and program, and make direct observation at site to make sure the implementation mechanism is going smoothly and public concerns are well considered.

9.1.5 Reporting

HDD-ESMU is responsible for the preparation of quarterly environmental monitoring report and is being submitted to the concerned agencies. Till December end 2019, nineteenth quarterly report has been prepared and submitted.

9.1.6 Environment Management Cost

The total estimated environmental management cost for the proposed project is 113.73 million NRs. This cost is estimated for the implementation of mitigation and enhancement measures, community support program and environmental monitoring during pre –construction, construction and operation phases of the project. The cost breakdown is as shown below and details are given in Table 9.2

Table 9-2: Environmental Management Cost of the Project

S.N.	Description	Quantity	Amount (Million NRs)
1	Forest Conservation Awareness Program	10 Programs including hoarding boards	1.647
2	Wildlife Conservation Awareness Program	10 Programs including hoarding boards	0.912
3	Social Awareness Program	20 Programs including hoarding boards	1.267
4	Compensatory forestation Program @ 80/Sapling including five year management	274089	21.93
5	Fencing of the plantation sites	22 sites	1.39
6	Provision of Ban Heralu to Plantation sites (for 18 months)	19 persons	4.104
7	Capacity building training to CFUGs and collaborative forest	3 Programs	0.327
8	Non timber forest products training along with agro forestry including distribution of saplings	1 Program	2.018
9	Agriculture Productivity Intensification Training including support	5 Programs	2.318
10	Skill Development Training for PAFs	90 Participants	3.801
11	Purchase of modern sewing machine	53	1.003
12	Safety Training for the Project Workers	Ref Table 8	0.906

13	Community safety awareness Program	5 Programs	0.433
14	Health and Sanitation Awareness Program	3 Programs	0.991
15	Relocation of temple and school	LS	3
16	Community support Program including health post and school support program, small scale drinking water and irrigation assistance and assistance for the renovation and development of religious and recreational places and capacity building training to local VDCs	LS	20
17	Environmental and social Management (Monitoring and program implementation)		23.898
	Total		89.945

9.2. Environmental Monitoring

9.2.1. General

Monitoring is an essential aspect of environmental management. It consists of collection of data to measure environmental changes associated with construction and operation of the project. Ministry of Energy is the responsible organization for the environmental monitoring of water resources projects.

Depending on the location or the month of the year certain construction activities may have greater or lesser impacts. NEA has prime responsibility for implementation of monitoring program. Project Environmental Management Unit, Consultant, Project Manager and Contractor are responsible for monitoring of different components.

9.2.2. Types of Monitoring

Based on the study type and size of the project; and monitoring experience of other projects; daily, quarterly and yearly monitoring depending on the parameters are conducted throughout construction period. The monitoring program will be also conducted in operation phase of the project.

9.2.2.1. Baseline Monitoring

Baseline monitoring was conducted to update the baseline condition of the project area prior to construction of the project. The baseline has covered the major components of physical, biological and socioeconomic and cultural environment.

9.2.2.2. Impact Monitoring

Impact monitoring is being carried out to assess actual level of impact. The impact monitoring will be conducted during construction as well as operation phases of the project. The impact monitoring includes:

- Monitoring of the impacts of the project on physical, biological socioeconomic and cultural environment of the area;
- Monitoring of the accuracy of the predicted impacts; and
- Monitoring of the effectiveness of mitigation measures

9.2.2.3. Compliance Monitoring

The compliance monitoring will be conducted to monitor the compliance of the proposed mitigation measures and monitoring activities. The compliance monitoring will mainly focus on:

- Whether the mitigation and monitoring requirements associated with the contractor shall be duly incorporated in tender document and contract agreements;
- Compliance of the tender clause;
- Compliance of the mitigation measures;
- Conservation of the planted trees for 5 years; and
- Whether the allocation of adequate budget is made for the implementation of the mitigation measures and monitoring works.

9.3. Monitoring Parameters, Schedule and Agencies to be consulted

Land use pattern, forest status, settlement, public health, infrastructure and compliance of the tender clauses are the few areas of monitoring. The schedule of monitoring will be daily, quarterly, half yearly and yearly depending on the parameters and type of monitoring. The detail of monitoring parameters, indicators, schedule and location is given in Table 9-3.

Table 9-3: Monitoring Parameters

Types	Parameters	Indicators	Method	Schedule	Location	Agencies to be/ Consulted
1. Baseline Monitoring						
Physical Environment	Land Use	Changes in land use pattern	Site observation	Once prior to construction	RoW and near by areas	
	Slopes	Stability at tower pads	Site observation	Before and after rainy season	Possible unstable slopes such as Ap-7, 13, 20, 51, 52, 57 etc	
Biological Environment	Forest/Vegetation	Changes in Forest/vegetation pattern	Site observation & sampling	Once prior to 3 months of construction	Communityand collaborative forest falling in the RoW	Division Forest Office and CFUGC
	Wildlife habitat	Wildlife habitat and occurance	Site observation	Once prior to construction	RoW and near by areas espcially the crossings of Kamla river, sunkoshi and area close to Koshi Tappu	Division Forest Office, Koshi Tappu Willdife Reserve Office and CFUGC

					Willdife Reserve	
Socioeconomic and cultural environment	Settlement/infastructure	Increase in settlements/infastructure	Discussion with local people, Rural /Municipality and observation	Once prior to construction	RoW and near by areas	
	Population/migration	Structure and migration	Discussion with local people, Rural /Municipality and observation	Once prior to construction	Project affected Rural/ Municipality	
	Development activities	Development activities in the project area	Site observation	Once prior to construction	RoW and near by areas/Project affected Rural / Municipality	District/local development office
	Public health	Types of disease and incidence of disease in the project area	Meeting and discussion with local health posts and district hospitals	Once prior to construction	Project affected Rural/ Municipality	District hospital and local health posts
	Socio-economic/cultural base line	Update socio-economic/cultural base line	discussion with local people and review information	Once prior to construction	Project affected areas	
2. Impact Monitoring						
2.1 Construction Phase						
Physical Environment	Slopes	Degree of slopes, stability of slopes, changes from the baseline	Site observation	Quarterly and before & after rainy season	Possible unstable slopes such as Ap-7, 13, 20, 51, 52, 57 and others	
	Waste disposal	Unpleasant odor and visual impact	Observation	Weekly	Temporary camps /Construction sites	
Biological Environment	Loss of trees and shrubs	Number of trees removed	Observation and discussion	Daily	Row	Division Forest Office and CFUGC
	Loss of trees and shrubs from private land	Number of trees removed	Observation and discussion	Daily	Row	Division Forest Office and CFUGC
	Wildlife	Occurrence of wildlife species	Observation and discussion	Quarterly	Construction area	Division Forest Office, Koshi Tappu Willdife Reserve Office and CFUGC
Socioeconomic and Cultural Environment	Water supply	Chemical and bacteriological parameters such as E. Coli.	Sampling and laboratory analysis	6 months	Temporary camp and near by hotels, settlement etc.	
	Public health	Types of disease and incidence of disease in the project workers and local community	Meeting and discussion with local health posts and district hospitals	Quarterly	Project affected Rural/ Municipality	District hospital and local health posts

	Land Acquisition	Acquisition of land, lease of land and temporary disturbances in land	Cross checking the list of compensation	Quarterly	Tower pad , RoW and leased area	Project affected Rural/ Municipality
	House Acquisition	Relocation of house, compensation, use of construction material etc	Observation of new construction area, cross checking the list of compensation etc.	Quarterly	Affected area and relocation sites	Project affected Rural/ Municipality
	Crop	Actual damage to standing crop or loss of cropping season for the particular area	Observation and discussion	Weekly	Tower pad , RoW and leased area	Project affected Rural/ Municipality
	Social and Cultural practices	Likely disturbance in traditional cultural ways	Observation and discussion	Quarterly	Project affected Rural/ Municipality	Project affected Rural/ Municipality
	Economy	Local employment, rental, sell of consumable goods	Meeting and discussion with local communities	Quarterly	Project affected Rural/ Municipality	Project affected Rural/ Municipality
2.2. Operation Phase						
Physical Environment	Slopes	Stability at tower pads	Site observation	Before and after rainy season	Possible unstable slopes such as Ap-7, 13, 20, 51, 52, 57 etc	
Biological Environment	Vegetation/Forest	Survival of the plantation and RoW clearance, method of clearance	Observation and discussion	Annual	Plantation sites and RoW	Division Forest Office and CFUGC
	Wildlife	Alteration of habitat	Interview and discussion	Annual	RoW and near by areas	Division Forest Office, Koshi Tappu Willdife Reserve Office and CFUGC
Socioeconomic & Cultural Environment	Local employment	Priority for the local employment	Cross checking the list of employment	Annual	Project site	VDC
	Economic status	Changes in economic condition of local people due to withdrawal of economic opportunity	Interview and discussion	Annual	Project affected families	VDC
	Occupation and safety	Safety equipments, warning sign etc.	Interview and discussion	Annual	Substation	
3. Compliance Monitoring						
3.1 Construction Phase					**Location**	**Agencies to be Consulted**
	Integration of mitigation measures in the design and tender document	Yes/No	Review/cross-checking of tender and design documents	Before the start of constructi on work	Kathmandu Office	Project/TL Department
	Integration of the report as a part of project	Yes/No	Review	During approval process	Kathmandu Office	Project/TL Department

	adminstration					
	Allocation of adequate budget for the implementation of the environment mitigation measures and monitoring works	Yes/No	Review, enquiry and consultation	Pre-construction phase	Kathmandu Office	Project/TL Department
	Priority of employment	Yes/No	Record review, observation and enquiry	Monthly basis	Site Office	Project
	First Aid	Avability of first Aid	Observation and record review	Periodic as per construction schedule	Project site	Project
	Losing of life and disability	Compensation to losing of life and disability	Interview/observation	periodic	Project site	Project
	Occupational safety	Adequacy of occupational safety measures (helmets, boots, warning signs etc.)	Interview/observation	Periodic as per construction schedule	Project site	Project
	Trainings and trainees	Number of trainings and trainees	Interview/Survey	Periodic as per construction schedule	Project affected areas/Rural municipality	Project
3.2 Operation Phase						
	Conservation of the planted trees for 5 years	Survival of the saplings	Observation and samplings	Periodic	Plantation sites	Grid Operation Department/DFO/CFUGs
	Priority of employment to locals	Yes/No	Record review, observation and enquiry	Periodic	Project site	Grid Operation Department
	Occupational safety	Adequacy of occupational safety measures (helmets, boots, warning signs etc.)	Interview/observation	As required	Project area	Grid Operation Department
	Disposal of construction wastes/spoils	Checking up of the wastes/spoil produced from construction work	Site observation	Once during first year of project operation	Disposal site	Grid Operation Department
	Losing of life and disability	Compensation to losing of life and disability	Interview/observation	Periodic	Construction area	Grid Operation Department

9.4. Monitoring Cost

The estimated monitoring cost is 23.79 million NRs. including manpower, report production, transportation, rent for site offices and others for pre-construction, 60 months construction phases which is same as mentioned in approved IEE. This cost includes baseline monitoring during pre-construction phase and compliance and impact monitoring during construction and operation and maintenance phase.

10. Conclusion

The updated Initial Environmental Examination (IEE) of Hetauda- Dhalkebar- Duhabi 400 kV is conducted based on field survey and review of secondary information. This report is an outcome of the study conducted adhering to the existing acts, rules, regulations and guidelines pertinent to the study.

Changes in land use pattern, land degradation and soil erosion are the impacts identified in physical environment. In biological environment impact on 518.25 ha forest land, removal of 1,39,059 trees of 47 species, loss of species having conservation significance, increase demand for fuel wood and timber and alteration of wildlife habitat are the main impacts identified in biological environment . The major socioeconomic and cultural environmental impact includes acquisition of 38.16 ha private land, relocation of 202 structures of 123 HHs including 110 residential houses, loss of standing crop, occupational safety and land use restrictions in RoW.

Mitigation measures have been proposed for all identified/predicted adverse impacts and enhancement measures are developed for maximize the project benefits. Bioengineering measures, proper disposal of waste, water quality protection measures are the major mitigation measures proposed in physical environment. In biological environment compensatory plantation, assistance to FUGs, NTFP program are proposed. In socioeconomic and cultural environment compensation for the private land and structures, relocation of temple and school and compensation of crop damage and compensation for RoW land as per their locations are proposed.

The finding of study shows that additional adverse impacts on physical, biological as well as socioeconomic and cultural environments due to implementation of the project are minimal and can be mitigated adopting appropriate measures. Moreover, the proponent is also carrying out these measures at project affected areas.

The project proponent is committed to comply with the applicable legal requirements, implementation of the mitigation/enhancement measures at the project site. The efforts are being/will be made by the project to limit adverse impacts on the environment and the society. The appropriate mitigation/enhancement measures being carried out will also be continued in the coming days till the completion of the project.

ANNEXES

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