# CHAPTER-I

## NAME AND ADDRESS OF THE INDIVIDUAL/INSTITUTION PREPARING THE REPORT

### 1.1 Proponent

Nepal Electricity Authority (NEA) is the proponent of this project. The primary objective of NEA is to generate, transmit and distribute adequate, reliable and affordable power by planning, constructing, operating and maintaining all generation, transmission and distribution facilities in Nepal's power system both interconnected and isolated.

NEA is a national level Government of Nepal undertaking organization established in 2042 B.S (1985). It is responsible for generation, transmission and distribution of electricity in the country. The contract address of the proponent is as follows:

**Contact Address**

Nepal Electricity Authority
Durbar Marg, Kathmandu, Nepal
Phone No.: 4153025; Fax: 4153040

### 1.2 Organization responsible for IEE report preparation

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. This department is commercial working in close association with national and international consulting companies in conducting EIAs, IEEs, monitoring and implementing mitigation measures and environmental auditing of hydroelectric, transmission line and distribution line projects.

Being the concern department, ESSD has prepared Initial Environmental Examination (IEE) Report of this Project. The IEE report of this project has been prepared ESSD to fulfill the provisions made in Environment Protection Rules, 1997 (Schedule 5). The IEE report is prepared as per Terms of Reference approved by Ministry of Energy on 2071/03/22 (6th July, 2014) (Appendix-1). Contract address is as follows:

***Contact Address:***

Enviornment and Social Studies Department
Engineering Services, Nepal Eelectricity Authority
Kharipati, Bhaktapur
Phone: 6-611580; Fax: 6-611590
Email: neaessd @ wlink.com.np

### 1.3 Survey License

The project proponent has obtained survey license from the Ministry of Energy (MoEn) to carry out the feasibility study including IEE of the proposed project. The survey license for feasibility and environmental studies was issued on B.S.2069/09/16 and is valid till B.S.2071/09/15. Copy of survey license is presented in Appendix-I. .

### 1.4 Rationality for Conducting IEE

Schedule -1 of Environment Protection Rules, 1997 lists proposal requiring an IEE. As per the EPR, 1997 and the recent amendment, an IEE is required for 132 kV or above voltage transmission line. Since 132/220 kV Chilime Sub-station and Chilime-Trishuli 220 kV Transmission Line Project is of 220 kV capacities, it needs an IEE for execution. The project area does not lie in the national park, wildlife reserve, buffer Zone, conservation Area, wetlands, historically and archaeologically important sites and or environmentally sensitive/ fragile areas.

### 1.5 Structure of the Report

The IEE report is prepared into two volumes. Volume-1 is the main report and volume two consist appendices. The volume -1 is divided into ten chapters. Chapter-2 contains a brief description of the project, including the transmission line and substations, construction planning and project area delineation. Chapter-3 discusses about the data requirement and the methodology adopted for the collection of data on physical, biological, socioeconomic and cultural environment of the area. This chapter also highlights the techniques used for data analysis and impact assessment. Chapter-4 deals with the national acts, policies, rules and guidelines referred while peparing the report.

The existing environmental conditions of the project area with respect to physical, biological and socioeconomic and cultural environment is given in Chapter-5. Chapter-6 highlights the positive and adverse impacts likely to occur due to implementation of the project. Alternative assessment for the substation and route alignment is presented in chapter-7. The mitigation and enhancement measures are presented in chapter-8. Chapter-9 deals with the environmental management plan, chapter-10 conclusion of the study.

# CHAPTER-II

## GENERAL INTRODUCTION OF THE PROJECT

### 2.1 Background

132/220 kV Chilime Sub-station Hub and Chilime Trishuli 220 kV Transmission line project has been recommended to evacuate power from Upper Sanjen (14.6 MW), Sanjen (42.5 MW) and Rasuwagadhi (111. 0 MW) in total 168.1 MW of Rasuwa district. The scope of services is limited to Chilime hub to Trishuli hub section consisting of approximately line length of 26.5 km in Rasuwa and Nuwakot district of Bagmati zone, Nepal and passes mainly through middle mountains and hill side.

### 2.2 Objectives of the IEE Study

The general objective of the study is to prepare an IEE report in order to implement the proposed 132/220 kV Chilime Sub-station Hub and Chilime-Trishuli 220 kV Transmission Line Project in an environmentally sound manner. The specific objectives of the study are:

- to establish the physical, biological and socioeconomic & cultural baseline conditions of the project area;
- to identify beneficial and adverse environmental impacts of the project during construction and operation phases;
- to analyze the impacts in terms of the magnitude, extent and duration ;
- to suggest mitigation measures for the adverse impacts and enhancement measures for beneficial impacts;
- to prepare environmental management plan;
- to involve public in the decision-making process related to the environment; and
- to provide information to the decision makers regarding further action and about the environmental implications due to the development of the proposed project.

### 2.3 Project Description

#### 2.3.1 Project Location

The proposed 132/220 kV Chilime Sub-station Hub and Chilime-Trishuli 220kV Transmission Line Project is located in Rasuwa and Nuwakot District of the Bagmati Zone of Center Development Region, Nepal. In total 6 VDCs namely Goljung -uf[]Nh'a_, Gatlang -uTnfa_, Haku -xfs'_, Dandagau -8fF8fufFp_, Thulogau -7"nf] ufFp_ and Manakamana -dgsfdgf_ will be affected by the project. The project location map has been presented in Figure-3.1.

### 2.3.2 Project Accessibility

Some sections of the 132/220 kV Chilime Sub-station Hub and Chilime-Trishuli 220kV T/L Project is accessible by Betrawati- Syprubesi highway. The initial stretch of the alignment from Chilime headwork of Rasuwa district to 3(B) Hub Sub-station is accessible by gravel road on the right bank and by the access road of Chilime khola. Some stretches in between are located at higher altitudes and are not easily accessible by roads. So, study will be carried out thought walk-over approach and the project will be implemented by upgrading existing trails, wherever necessary so as to transport construction materials.

### 2.3.3 Transmission Line Route

The proposed 132/220 kV Chilime Sub-station Hub and Chilime-Trishuli 220kV Transmission Line Project starts from proposed Substation site at Thambuchet village, Goljung VDC of Rasuwa district. The proposed substation site is accessible by Chilime HEP road.Then the transmission line alignment passes over many streams, Kholsis, cultivated land, forest land of Gatlang, Haku, Thulogaun, Dadagaun VDC of Rasuwa district and finally terminates to the proposed Trishuli 3B hub substation at Manakamana VDC of Nuwakot district. The proposed 26.5 km in length Transmission Line Project has been selected avoiding the settlement areas, inbuilt structures, religious places, schools and other community infrastructures wherever possible. Refer to Figure-2.2. The description of the proposed route has been discussed below considering nine sections:

**Substation at Thambuchet, Goljung to Nasin Dada (AP-0 to AP-8)**

This section of the proposed route primarily traverses through scattered forest area, some small streams and some cultivated area. The alignment starts from proposed Sub-station site at Thambuchet village, Goljung VDC of Rasuwa district. From the starting point, the alignment climbs up to the south west and passes over some forest area, cultivated land small steams of Chilime, Goljun and Gatlan VDC of Rasuwa district and most of them are accessible from Chilime HEP road. AP-0, the starting point of the route is located at south west side of the proposed substation, however within the boundary of substation area.

**AP-8 to AP-25 (From Nasin Dada to Gogane Forest)**

From AP-8, the route heads to south west, passing over dense forest and Nasin Khola, which is the boarder line of Haku and Gatlan VDC and descends rapidly to AP-9 which is located on cultivated land at Hechambradada-1, Haku VDC. From AP-9, the line passes over forest area and settlement of Nasin village lies on the right side of

the alignment. From AP-10 to AP-14, the alignment passes over the cultivated land of sano Haku and Thulo Haku village. The settlement of Thulo Haku lies right and Trishuli river at the left side of the right of way. AP-14 the terrain is very steep; the alignment runs along the forest crossing a kholsi in right of way. AP-16, 17 and 18 are located at the cultivated land at Haku VDC and west from foot track to Gogane village. AP-19 and AP-20 are located at the forest land of Nepal Government. AP-21,22 and 23 are located at the cultivated land at Gogane village. In this stretch, the alignment runs through undulating forest terrain with dense trees, barren land and patches of bushes area. From AP-23, the alignment again runs over great sloping terrain with dense forest with heavy trees and goes down left bank of Mailung river at AP-25. The alignment has to divert through Mailung river, which have no any accessible from the main road. In this segments also all the angle poings are accessible by existing track from Mailun Dobhan and altogether there is only one Haku VDC of Rasuwa district within this stretch.

**AP-25 to AP-39(From Gogane Forest to S/S, Shanti Bazar)**

From Gogane Forest (AP-25), left bank of Mailung river, the alignment turns south, to cross the Mailun river. After crossing Mailung river, the alignment passes towards Dadagau VDC. There is no any heavy settlement around the area. After AP-25, all angle points are located at the cultivated land of public. However, from AP-27 to AP-29, the alignment passes over scattered forest with shrub area, gently slopping terrain with maize and corn fields and scattered trees. All the villages along the alignment are accessible from Betrawati-Mailung highway. AP-36 and AP-37 are located at the private cultivated land at Archale village, Manakamana VDC of Nuwakot district. There is also access road from Shanti bazaar to this point. From AP-37 at Arcale village, the alignment turn to AP-38 at Jumle bhir, Manakamana VDC, Nuwakot district and then goes to Kokhegau, AP-39, about 100m up stream from Trishuli river. Finally the alignment goes to Trishuli Hub by crossing a small stream. Altogether there are 3 VDCs; Dadagau and Thulogau of Rasuwa district and Manakamana of Nuwakot district within this stretch.

## 2.4 Salient Features

### 2.4.1 Salient Features of the Transmission Line Components

The total length of the proposed T/L is 26.5 km and the voltage level will be 220 kV. The proposed transmission line will be double circuit comprising with ACER BISON, duplex.

The vertical double circuit configuration tower will have an average height of 42.45

m and the standard tower base dimensions will be 15 m x 15 m ( for 220 kV ) from centre to centre of each tower leg foundation/ footing. Steel tower leg and body extensions will be utilized to reduce foundation excavation on slopes and provide greater tower foundation structural security. The ruling span between tower structures is 300 m. The right of way (RoW) of the proposed transmission line is 15 meters on each side from the centerline from 220 kV TL as per the Electricity Regulation, 2050 (1993). The transmission line design features are given in Table below:

**Table: 2.1The salient features of the Transmission Line Components**

| S. No. | Description | |
|---|---|---|
| 1 | Name of Project | 132/220 kV Chilime Sub-station Hub and Chilime- Trishuli 220 kV TL Project |
| 2 | Affected VDCs | 6 VDCs<br>Goljung -uf]Nh'a_, Gatlang -uTnfa_, Haku -xfs'_, Dandagau -8fF8fufFp_, Thulogau -7"nf]ufFp_ and Manakamana -dgsfdgf_ |
| 3 | Number of angle points | 39 |
| 4 | System Voltage | 132/220KV |
| 5 | Type of circuit | Double circuit |
| 6 | Length of TL | Approximately 26.5Km |
| 7 | Nominal span | Average 300 m |
| 8 | Tower type | Steel Lattice Structure, self supported (DA, DB, DC, DD) |
| 9 | Tower Height | 42.45m |
| 10 | Tower Foundation Area | 15m (approx. average per foundation) |
| 11 | Conductor | ACER BISON, Duplex |
| 12 | Right of way | 30m |
| 13 | Minimum Clearance with ground | 8m |
| 14 | Minimum clearance for road, river crossing lines and other utilities | 8m |
| 15 | Project construction period | 24 months |
| 16 | Estimated Project Cost | USD 30 million |
| 17 | Funded by | Kfw, GoN and NEA |

### 2.4.2 Project Features of Sub-station Hub Components

The proposed 132/220 kV Chilime sub-station hub site is in proximity to the all expected hydroelectric project (HEPs) now under construction or planned to construct in near future. As this site for the substation lies parallel to the river, in other word it is the situated on the right bank of the Chilime river need some protection work. The proposed substation site is shown overlaying in topographic map (Refer Fig 2.2).

The main components of the 132/220 kV Chilime sub-station Hub Project includes:

(a) Construction of seven nos. 220/132/11 kV, 33.33 MVA single phase power transformer.
(b) Construction of 220 kV, 132 kV and 33 kV switchgears.
(c) Construction of 220kV, 132 kV and 33 kV bus bar, construction of staff quarter, control building and miscellaneous civil works.

Power evacaution scheme of proposed projects in the Chilime and Bhotekoshi river basin from the proposed Chilime Hub Substation Project is shown by a single line diagram in Fig 2.3.

As per International Standard the following safety working clearances shall be maintained for the bare conductors and live parts of any apparatus in the proposed sub-station. An earthed system comprising of an earthing mat buried at a suitable depth below ground and supplemented with ground rods at suitable points is provided in the Sub Stations.

The Power Transformer shall conform to the latest edition of the appropriate IEC specifications and/or other recognized international standards.

**(a) System electrical parameters**

Rated service voltage: 220/132/33/11 kV
Highest system voltage: 245/145/36/12 kV
Impulse voltage withstand level: 950/650/170/75kV
Number of phase: 3
Frequency: 50 Hz

**(b) Climatic conditions**

All plant and equipment shall be entirely suitable for the climatic conditions prevailing at site. Between June and August low-lying areas are subject to flooding. All structures designed with the seismic factor of 0.15 g. Atmospheric pollution is low and special insulator design or washing is not considered.

Max ambient shade temperature: $45^0$C
Min ambient shade temperature: $0^0$C
Annual average temperature: $32^0$C
Max wind velocity (10 min average gust speed): 33 m/sec
Rainfall: 1,000 mm/annum
Monsoon season: June August
Relative humidity: max.100%, min. 20%
Altitude: 500 MSAL (Max.). No ice or snow expected

**(C) Technical Particulars of 220/132/11 kV Power Transformers**

Rated capacity: 33.33 MVA
Quantity required: 7 nos.
Type: Outdoor, Oil-immersed
Type of cooling: ONAN/ONAF
Number of phase: 1
Number of winding: 3
Maximum voltage:

- Primary 245 kV
- Secondary 132 kV
- Tertiary 12 kV

The proposed Chilime Hub subsation design features are given in Table below:

**Table 2.2 Salient Features of the Chilime Sub-station Hub Components**

| **Features** | **Description** |
|---|---|
| *General* | |
| Project | Chilime Hub Substation |
| Development region | Central Development Region |
| Zone | Bagmati |
| District | Rasuwa |

| VDC | | Goljung |
|---|---|---|
| 1 | Rated capacity | 33.33 MVA |
| 2 | Quantity required | Seven 7) nos. |
| 3 | Type | Outdoor, Oil-immersed |
| 4 | Type of cooling | ONAN/ONAF |
| 5 | Temperature rise above 40 degree C ambient Temperature | |
| | a) In oil by thermometer | 50 degree C |
| | b) In winding by resistance | 55 degree C |
| 6 | Number of phase | 1 (one) |
| 7 | Number of winding | 3 (three) |
| 8 | Maximum voltage (line to line) | |
| | a) Primary | 245 kV |
| | b) Secondary | 132 kV |
| | c) Tertiary | 12 kV |
| 9 | Rated Voltage (line to line) | |
| | a) Primary | 220 kV |
| | b) Secondary | 132 kV |
| | c) Tertiary | 11 kV |
| 10 | Insulation level of winding | |
| | a) Basic impulse level as per IEC 76 | |
| | - Primary | 1050 kV (crest) |
| | - Secondary | 650 kV (crest) |
| | - Tertiary | 75 kV (crest) |
| | b) Power frequency induced over voltage (1 minute) | |
| | - Primary | 460 kV |
| | - Secondary | 275 kV |
| | - Tertiary | 28 kV |
| 11 | Connections | |
| | - Primary | Star |
| | - Secondary | Star |
| | - Tertiary | Delta |
| 12 | Vector group reference | Ynynd |
| 13 | Type of tap changer | On – load |
| 14 | Number of taps | ± 10 % |

| | | |
|---|---|---|
| 15 | Number of taps | 17 |
| 16 | Method of tap changer control | |
| | - Mechanical local | Yes |
| | - Electrical local | Yes |
| | - Electrical remote | Yes |
| | "MASTER-FOLLOWER-INDEPENDENT" and "AUTO -MANUAL" selection | Yes |
| 17 | Percent impedance voltage at rated MVA and 75 °C | >12% (at normal tap) |
| 18 | System grounding | |
| | - Primary | Solidly grounded |
| | - Secondary | Solidly grounded |
| | - Tertiary | delta |
| 19 | Terminals & BCT | |
| | - Primary | Required |
| | - Secondary | Required |
| | - Tertiary | Required |
| 20 | Bushing Current Transformers | |
| | a) Number of core & current ratio (HV Phase & Neutral) | 2 core & required as per rating |
| | b) Number of core & current ratio (LV Phase & Neutral) | 2 core & required as per rating |
| | c) Accuracy class | 5P20/PS class |
| | D) Burden of BCT (HV/LV) | 15/15 |

As per International Standard the following safety working clearances shall be maintained for the bare conductors and live parts of any apparatus in the proposed sub-station. An earthed system comprising of an earthing mat buried at a suitable depth below ground and supplemented with ground rods at suitable points is provided in the Sub Stations.

The Power Transformer shall conform to the latest edition of the appropriate IEC specifications and/or other recognized international standards.

## 2.5 Project Area Delineation

The project area for the IEE of the proposed project is defined as the area for the construction of a 220 kV transmission line alignment, 132/220/kV Substation as well as the area that will be impacted due to the construction and operation of the project. This area includes 6 VDCs of 2 districts. Out of these 6 VDCs, 5 are lied in Rasuwa district and 1 VDC of Nuwakot District. 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.

### 2.5.1 Core Project Area

The “Core Project Area” consists of the 30 m Right-of-Way (RoW), encompassing 15 m on each side of the alignment measured from its center line. The nearest settlement from the transmission line alignment and area occupied by the substations are also considered as the core area. This area is also defined as the ‘’direct impact zone’’.

### 2.5.2 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 VDCs of 2 districts excluding areas mentioned under core project area. This area is also defined as the “indirect impact zone”.

The term “project” indicates the 132/220 kV Chilime Sub-station Hub and Chilime Trishuli 220 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 IEE. The affected VDCs are shown in Figure 2.2

## 2.6 Construction Planning

The implementation of the proposed project comprises construction of a new 220kV transmission line. It comprised of foundation and erection of transmission towers, wire stringing, testing and commissioning of 220kV transmission line with sub-station. The estimated years of project completion is two years.

### 2.6.1 Tower Foundation

The construction of tower foundation will be undertaken by manual labor assisted by the mechanical plant wherever possible. The Mechanical plant will be limited to

small demountable steel kids framed concrete mixers, air compressors, air drills/ chisels and tamping/compaction tools.

Excavation and the concreting of the tower foundations will be carried out as per the design requirements and after necessary curing, the foundations will be backfilled with suitable material.

### 2.6.2 Erection of Galvanized Steel Towers

Galvanized steel lattice towers manufactured in the factory will be transported to the individual tower locations and are erected manually by employing pulleys, wenches, etc. into the tower foundations.

### 2.6.3 Insulator Fittings, Conductor and Ground Wire Stringing

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.

### 2.6.4 Transportation

Primary site access for the project construction will be gained from the Pasang Lhyamu highway, Syaprubeshi-Chilime HEP road and Betrawati-Mailung road. No permanent access roads will be constructed to tower sites from existing road. Existing feeder roads and tracks will be used for construction and maintenance where available. The construction material up to the nearest road head will be carried out through vehicle and latter it will be transported manually up to the individual tower location.

### 2.6.5 Spoil Dumping Site

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

### 2.6.6 Construction Materials

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

- Steel reinforcement
- Cement
- Coarse aggregate
- Fine aggregates (sand)

Steel reinforcing bars and cement can be acquired from local manufacturers or can also be imported. Coarse aggregates will be produced at site from excavated materials or purchased from the nearby market. Likewise, fine aggregates will be collected from major quarries along riverbanks, the excavated foundation material can be used as a backfill material required for the foundation construction.

### 2.6.7 Employment

Local people, those are affected by the project implementation, will be encouraged for employment. As far as possible, local semi skilled and unskilled labor will be used for construction activities and transportation of materials. Altogether about 300 people will be employed during the construction of the project, which includes 200 unskilled, 50 semi skilled and 50 skilled manpower.

## 2.7 Project Implementation

The estimated completion period of the project is 2 years. Implementation will consist of 6 month pre-construction phase and 1.5 years construction and commissioning phase.

The construction work of transmission line will primarily be 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. Construction activities during the monsoon season will primarily be restricted to stringing of conductors, although this activity may also be restricted by the weather. However, the construction work of the substation will be conducted throughout the year.

## 2.8 Land Take

The project will require 84.556 ha land for the placement of tower pads, substation, camps, RoW of the transmission line and temporary facilities. Out of this, 5.518 ha land will be acquired permanently and 79.038 ha will be used temporarily. The total number of angle towers will be 40, where one angle tower (AP-0) is erected on substation area and an angle tower will typically require an area of 15m x 15 m. Considering this area a total of 0.878 ha will be acquired permanently for

construction of 39 tower pads. The substation will acquire 4.64 ha area.

The permanent land take consists of 3.288 ha of the agricultural land, 0.248 ha forest area and 0.113 ha other land uses. The temporary land-take consists of 34.497 ha of cultivated land, 40.608 ha forest and 3.933 ha of other land utilities. The summary of the land-take and land-use are given in the tables below.

**Table-2.3 Land-use of the Land-take**

| SN | Type of land take | Land-use | | | | Total Area, ha |
|---|---|---|---|---|---|---|
| | | Cultivated Area, ha. | Forest Area, ha. | Barren & Cliff | River/ Rivulet | |
| 1 | Sub-station | 2.77 | | | | **4.64** |
| 2 | Row | 34.047 | 40.608 | 2.703 | 1.23 | **78.588** |
| 3 | Tower Pads | 0.518 | 0.248 | 0.113 | | **0.878** |
| 4 | Camps | 0.45 | | | | **0.45** |
| | **Total** | **37.785** | **40.856** | **2.816** | **1.23** | **84.556** |

Source: Field Survey 2014

# CHAPTER-III
# STUDY METHODOLOGY

## 3.0 General

The IEE process follows the Environment Protection Rules 1997, and its amendments 2009 (2065/11/26) and National EIA Guidelines 1993.This IEE report is prepared in accordance with the legal requirements of GoN, based on approved ToR (Appendix-II), field study, consultation with local people/stakeholders and officials.

## 3.1 Desk Study and Literature Review

While carrying out the IEE, literature, review on topographic maps, land use maps, CBS publications, project technical reports and other transmission line project related environmental reports have been extensively carried out.

The following documents which were considered to be relevant for the study were reviewed:

- 1:25,000 scale topographical maps prepared by the Department of Survey, GoN.
- 1:100000 scale district map of Rasuwa and Nuwakot Districts
- Survey Report of Chilime-Trishuli 220 kV TL project prepared by Engineering Services, Project Development Department, NEA
- Initial Environmental Examination Report of Koshi corriodor 400 kV Transmission Line, Rahughat-Modi 132 kV T/L and Dumre-Damauli 132 kV T/L projects.
- Terms of Reference of 132/220 kV Chilime Sub-station Hub and Chilime Trishuli 220 kV Transmission line project.
- Regional Geological Maps and previous geological reports of the Nepal.
- Population Census, Central Bureau of Statistics, GoN/ Nepal, 2011.
- District Profile of Affected District, District Information Centre.
- Profiles of Concerned VDCs.
- Forest Act, 2049, & Forest Regulation, 2051
- Guidelines for Community Forestry Development Program, 2009
- Google Earth, the online software for verifying the TRL alignment.

On the basis of the reviewed information with respect to the project, data gaps were identified and the methodology described in following sections of this chapter was developed to collect other relevant information required for IEE study.

## 3.2 Data Requirement, collection methods and analysis

### 3.2.1 Physical Environment

#### 3.2.1.1 Data requirement and collection methods

The following data were collected during the IEE study:

- Meteorological data: Maximum and Minimum Temperature and rainfall of the project area;
- Topographical data: Altitude and landscape
- Air, water and noise quality of the project area
- Physical setting: Physiographic location, river system, etc. of the project area
- Geological data: Rock type, soil type, slope stability, erosion, landslides, etc. of the project area
- Spoil materials: Total volume, volume to be used for construction, disposal volume, etc.
- Significant crossings along the alignment
- Land use pattern of the project area.

The following methodology has been used to collect the baseline data on each environmental domain:

- Collection of secondary data and review
- Field survey and investigation by the team of experts
- Observation
- Expert's judgments
- Checklist and households' survey
- Public/stakeholders consultation through group meetings/key person interview
- Impact assessment

An intensive field investigation from BS 2071/03/23 to BS 2071/04/06 along the proposed alignment was conducted to collect information on existing physical environment. During the field visit inspection of site condition of the angle points and other critical areas along the transmission line were done. Documents and other relevant literature were collected and reviewed.

The data on climate (temperature, rainfall, and moisture) was collected through secondary source; District Profile of Nepal, 2007/2008. The data on air, noise and water quality of the area has been collected through observation by subject expert during site visit. Geographic and geological data, such as topography, rock type and

soil type, stability of the Angle Tower locations, soil erosion and other key environmental features were investigated and obtained from the Regional Geological Maps and previous geological reports of the Nepal and by general observation. Physical settings, land-use pattern and significant crossings were adopted from topographical maps and detail plan and profile of the alignment.

The type of land use and area calculation has been prepared with reference to the topographical maps, survey report provided by the Survey Department with field verifications. The obtained data of land-use pattern, river system and significant crossings along the alignment from the review of the topographical maps and plan and profile of the alignment has further been verified at site. Similarly, the numbers of structures under RoW, at substations area and near angle points were determined with the help of the plan and profile of the Final Survey Report with verifications at site.

During the field visit the data on occurrences of slides and other information related to the physical environment were gathered by observation, group discussion and inquiring the local people.

#### 3.2.1.2 Data Analysis

The collected data from the field visit was analyzed by the study team in coordination with the Project Engineers and experts. The beneficial and adverse impacts have been predicted and appropriate mitigation measures proposed to reduce the impacts.

### 3.2.2 Biological Environment

#### 3.2.2.1 Data Requirement and Collection Methods

Data and information collected on biological environment of project area during field study included occurrence of flora and fauna including avi-fauna, wildlife habitat, endangered, threatened or rare species as listed by government of Nepal, plant resource use pattern, etc.

The proposed alignment and the substation were visited by the Environmental and Forestry experts to collect baseline information and for impact prediction. Approximate number and types of plants likely to be affected by the project were identified.

Similarly, occurrence and distribution pattern of shrubs and herbs species available in and around the sample plots and along the route alignment were recorded.

Based on this information, density, relative dominance, basal area, relative basal area, relative dominance and wood volume were calculated. In this report, trees having more than 30 cm diameter at breast height (dbh) are referred as tree sized, trees having 10 to 29.9 cm dbh are referred as pole sized, trees having 4.0 to 9.9 cm dbh are considered as saplings and having less than 4.0 cm dbh are considered as seedlings (Forest Rule 2051). Diameter at breast height was measured at 1.3 meter from the ground level.

**Interaction and Group Discussion with Forest User Groups**

Similarly, meetings, interviews and discussions were held with the members of Community Forest User's Groups, local peoples, officials of concerned District Forest Office and Range Posts to collect information on the availability of flora & fauna, dependency of local people on forest resources, availability of Non-Timber Forest Products etc.

During the group meetings and discussions, participants were introduced about the project features, potential impact on the environment, various mitigation and enhancement measures likely to be adopted during construction and operation phase of the project. The issues raised during meetings were discussed and recorded.

### 3.2.2.2 Data Analysis

**Forest Sampling**

Sampling of the forest was done considering the representation of all kinds of trees in the project site. 5 different sampling plots of 20mx20m quadrates along the alignment were taken for sampling. In each plot tree species having more than 4 inch DBH were identified, countered and measured for diameter at breast height (DBH) for calculation of wood volume. Regeneration (sampling) was determined by plotting of quadrate of 5mx5m with in the same quadrates. Trees having less than 4 inch DBH were considered as sampling for regeneration count. Canopy cover of each tree species was determined through visual observation. The data from forest sampling were quantitatively analyzed for frequency, density, basal area, crown coverage, relative dominance, importance value index (IVI) and estimated wood volume. The aforementioned parameters were calculated by using the following formula:

$$\text{Frequency (F) \%} = \frac{\text{Total number of plots in which the species occurred}}{\text{Total number of plots sampled}} \times 100$$

$$\text{Density (D)/Hectare} = \frac{\text{No. of individuals of a species}}{\text{Size of the plot X Total no. of plots sampled}} \times 10{,}000$$

The basal area is the trunk cross sectional area. The basal area of each of the forest component was calculated on the basis of diameter at breast height.

Basal Area (BA) = ¶ $r^2$=3.14$(dbh/2)^2$

$$\text{Relative Frequency (RF)} = \frac{\text{Frequency of individual species}}{\text{Frequency of all species}} \times 100$$

$$\text{Relative Density (RD)} = \frac{\text{Density of individual species}}{\text{Density of all species}} \times 100$$

$$\text{Relative Dominance (R dom)} = \frac{\text{Total basal area of particular species}}{\text{Total basal area of all species}} \times 100$$

The important value of index (IVI) of the sample plots is calculated by using the following formula:

IVI = RF + RD + Rdom

Standing wood volume of standing tree was calculated by using the following formula:

$$\text{Wood volume} = 1/2 \times \text{Basal area} \times \text{Height}$$

$$\text{or, } \frac{(\text{Girth})^2 \text{x Height}}{16}$$

The green weight biomass has been calculated by referring the "Green Weight Biomass and Volume Table ".

The total biomass was taken obtained by adding the green weight of stem, foliage and branch for each tree of individual species corresponding to their diameter at

breast height. The valuation of standing biomass has been calculated as per the Forest Act, 2049. Moreover, the loss of forest species, its type, volume and number of trees to be cut, etc has been identified and calculated as per the format given by the Ministry of Energy.

### 3.2.3 Socio-economic and Cultural Environment

#### 3.2.3.1 Data requirement and collection method

The following types of data are acquired for IEE study:

- Socio-economic survey of project affected households whose land and house will be permanently acquired. Information on livelihood and property has also conducted;
- Demographic characteristics: Population distribution, migration pattern, age group distribution, etc;
- Ethnicity and religion;
- Education and skill level: literacy rates, skills and skilled, manpower, etc.;
- Health and sanitation: information on sub-health post/health post, hospitals, main disease, incidence of water born disease and infectious disease such as HIV/AIDS;
- Gender, children, the elderly, poor and ethnic minorities;
- Land holding size and ownership
- Community infrastructures and service: drinking water, supply, irrigation, foot trails, transportation, electricity, telecommunication, etc;
- Local institution and activities: government and non-government agencies, cooperatives, community based organizations;
- Other development activities;
- Cropping pattern, practices and production;
- Livestock raising;
- Estimation of loss of standing crops due to project construction, by crop type area and value.
- Local price information: land, agriculture and forest products, etc;
- Economy: occupation, employment, agriculture and livestock production, non-timber forest products, trade and commerce, etc.;
- Land ownership: list of landowners likely to be affected by land acquisition and resettlement;
- Income and expenditure of the Project Affected Families (PAFs);
- Measurement and valuation of houses, cowsheds and other structures to be acquired by the project;

- Compensation rates for land, agriculture products, forest, houses and other private infrastructures; and
- Places of cultural importance; historic, religious or cultural sites in the project affected area and the special occasions of celebrations/gathering, including the relative importance of these sites (local, regional or national);
- Aesthetic value of the affected landscape;
- Attitude of the local people to the development and to this project;
- Cultural practices of the project area; and
- Religion wise population of the project area.

The socio-economic and cultural environmental survey of the people residing in the project affected area as defined in this section was carried out by using the methodology described in the following chronological order. Secondary data published by District Development Committee of the concerned districts and Central Bureau of Statistics, Kathmandu was intensively used to draw the baseline information of moderate and low impact zones. However, the baseline information of high impact zone was collected from the field survey by using the appropriate techniques as mentioned in the subsequent sections.

**Literature Review**

Based on previous experiences and the review of relevant literature associated with IEE studies of various transmission line projects, demographic tables were developed. To fill these tables, a desk study was conducted in the office. All the relevant information associated with socio-economic and cultural environment was reviewed. On the basis of the reviewed information, data gaps were identified and the following techniques were used to generate the remaining data.

**Identification of PAFs and SPAFs**

The land owners of the Angle Towers/substation and the land owners/structure owners of the high impact zone have been identified. These identified families were considered as Project Affected Families (PAFs). In addition, the families losing their residence irrespective of their land holding size and other off farm income and the families losing more than 50% of land were identified as Seriously Project Affected Families (SPAFs).

**Data Collection Tools**

After identification of PAFs, their baseline information was collected by using the following techniques: Households' Survey, Key Informant Survey, Focus Group Discussion, Observation, and Photographs.

**a) Households' Survey**

Pre-tested questionnaires were designed and applied by a trained team of enumerators to solicit information from project affected families. Households' survey was conducted only for project affected families belonging to angle towers and structures falling in right of way. Altogether, 30 questionnaires were filled. The land owners belonging to tower points and substation area were identified through walkover survey and survey report and hence socio-economic status of them has been studied using questionnaires. Households' survey of landowners belonging to Right of Way was not conducted in this stage. It will be finalized during detail design and check survey of the transmission line route.

The questionnaire has been designed especially to cover the sectors like demographic characteristics, basic health conditions, income and expenditure, availability of infrastructure facilities, water and energy related issues, information about project, attitude towards resettlement and expectations from the project. A copy of householder's questionnaire is attached in annex.

**b) Key informant survey**

Key informant survey was employed during the field visit to gather information on socio-economic and cultural activities. Two sets of checklists were used for key informant survey. The VDC level checklist was designed to collect information on basic demographic and migration patterns, food sufficiency and cropping patterns, existence of user's group/committees, public facilities and infrastructure, labour force availability, existence of archaeological and religious sites and the existence of disadvantaged groups and ethnic minorities. Similarly, checklist belonging to agriculture sector was designed to collect the price rate of various agricultural commodity and construction materials rate in the project affected VDCs.

**c) Focus Group Discussion**

Group discussions were organized in some of the project affected VDCs/community forest users' groups to give special attention to issues concerning specific target groups such as women, children and farmers. Local people, political leaders, teachers

and other intellectuals were also included in the discussion. Indigenous and tribal communities, dalit, women and other ethnic minorities were included in the discussion, which give opportunity for the people in the project area to voice their questions and concerns regarding the project and to provide in-depth information associated with their religion, culture, festivals, and etc.

**d) Observation**

Observation of the project site was made to obtain information on different socio-economic and cultural activities of the impact area. Religious and archaeological sites of the impact area were identified to assess the impact on these sites within the high, moderate and low impact zones. At the end of each day notes were written about the observations and a field diary was maintained. Project photographs were also taken during field investigation.

**e) Public Participation**

Public participation and interaction programmes were done in different VDC offices and public places to collect the concerns /issues regarding the proposed 132/220 kV Chilime Sub-station Hub and Chilime Trishuli 220 kV Transmission line project.

The participants were requested to express their opinions as well as they were informed regarding the project and its activities. Information such as project purpose, project type, impact area, likely impacts and potential opportunities due to project implementation were provided to the people during the consultation.

The key issues and concerns raised by the local people are related to compensation, employment, implementation of mitigation and enhancement measures and community participation in the project activities. The key issues/concern raised by the local people during community consultations are summarized in Annex-

#### 3.2.3.2 Data analysis

The field data from each project affected VDCs were compiled edited and analyzed in Kathmandu using windows software like WORD and EXCEL. The analyzed data were then interpreted and discussed in appropriate sections of the IEE report.

### 3.3 Impact Identification, Evaluation and Prediction

A logical, simple and systematic approach has been adopted for impact identification, evaluation and prediction. The impact has been identified for physical,

biological, socio-economic, and cultural environment of the project area. The following tools have been used for impact identification:

- VDC Checklist'
- Households Questionnaire
- Table format for loss of land, crop production and property of the project affected families
- Expert's judgment

Topographic map of the route alignment has been used in predicting the impacts of the proposed T/L by analyzing the effect of project activities on the resources like existing infrastructures, rivers/rivulets, settlements, private land, forest, etc present in the location. The expert's judgment using past experiences of similar type of projects have been used to predict impacts. Wherever possible, impact predictions have been done quantitatively.

Field inventories before project implementation provide the baseline condition of resources. The assessment of impacts is based on the baseline environmental conditions of the affected area with the project activities in relation to spatial and temporal aspects in terms of magnitude, extent and duration using various environmental prediction methods. The impact has been predicted over a specified period and within defined area. Consequences of environmental impacts were interpreted in terms of local, regional and national contexts. The significant positive and adverse environmental impacts associated with the project components have been identified considering the impact zone. The magnitude, extent and duration of the impacts which were categorized according to the National EIA Guidelines, 1993 are given below:

**Magnitude of impacts**

- Low Impact (L): If the value of the resources could be used with no or minimum inconvenience to the public
- Medium/Moderate Impact (M): If the value of the resources could be used with inconvenience to the public
- High Impact(H): If the value of the resources reduced far below publicly acceptable level

**Extent Impacts**

- Site Specific (S): The impact is limited within RoW then it is site specific one.

- Local (L): If the impact of the work extends to the adjoining wards and or within 100m up 300m from the transmission line or angle tower then it is termed as local.
- Regional (R): If the impact of the work extends to the entire district or further then it is termed regional.

**Duration of the Impacts**

- Short Term (ST): If the impacts last for 3 years after project initiation it is classified as short term. Construction phase impacts are mostly categorized under this category.
- 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 for few years of operation falls under this category.
- 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 Involvement

#### 3.4.1 Public Consultation

Public consultation process was carried out by conducting group discussion, interaction meetings, and household survey among the local people/stakeholders, concerned VDCs and related officials/agenesis of the project areas.

#### 3.4.2 Recommendation Letters

As per EPR 1997, a 15 days public notice in Gorkhapatra national daily was published on BS 2071/07/….. The notice consists of a statement regarding brief project information and request to provide comments and suggestions within 15 days to the project office or ESSD. A copy of the public notice is attached in Appendix-IV.

A team was mobilized in the field with copy of public notice along with cover letters to the concerned VDCs, CFUGs, district level line agencies and other local stakeholders. Copy of the notice was displayed in the project sites and proof of deed (*Muchulkas*) was collected. Recommendation (consent) letters was collected from the affected VDCs. In addition, recommendations and suggestions were collected from the affected VDCs, CFUGs and concerned stakeholders (government bodies). Summary of the draft report was distributed to the concerned VDCs and DDCs for

public viewing and comments. The *Muchulkas* and recommendations letters are attached in Appendix-V.

### 3.5 The Study Team

The following personnel were involved during the IEE study of the proposed transmission line:

**Table 3.1: List of persons involved in IEE study**

| SN | Name | Designation | Address | Phone No. |
|---|---|---|---|---|
| 01 | Rajan Rishi Kadel | Deputy Director, (Sociologist) Team Leader | NEA-ESSD | 9841345423 |
| 02 | Navin Rimal | Deputy Manager (Civil Engineer) | NEA-ESSD | |
| 03 | Birendra Bikra Malla | Assistant Manager (Environmentalist) | NEA-ESSD | |
| 04 | Poonam Pokharel | Economist | NEA-ESSD | 9849337788 |
| 05 | Bhoj Raj Bhattarai | Economist | NEA-ESSD | |
| 06 | Krishna Prasad Joshi | Data Base Expert (Statistician) | NEA-ESSD | |
| 07 | Prakash Gaudel | GIS Expert | NEA-ESSD | |

Beside the aforementioned study team, the experts from the project were also involved in providing the project's technical data/facts & figures and suggestions for the preparation of this IEE Report. Forester, Biodiversity and wildlife experts were hired on studies phase. As well as Enumerators and field helpers were hired at the local level to assist the study team in collecting baseline on each environmental domain and other necessary field data.

# CHAPTER-IV
# REVIEW OF PLANS/POLICIES, LEGISLATIONS, GUIDELINES, STANDARDS, AND CONVENTIONS

This chapter summarizes existing policies, plans, laws, guidelines and institutions in order to inform the decision-makers and stakeholders about their implications on the project functioning. These references have been used in preparing the IEE report.

## 4.1 The Interim Constitution of Nepal, 2063 (B.S.)

Article 35(5) of the Interim constitution requires the state to give priority to the protection of the environment and also the prevention to its further damage due to physical development activities by increasing the awareness of the general public environment cleanliness. The state shall also make arrangements for the special protection of the environment and rare wildlife. Provision shall be made for the protection of the forest, vegetation and biodiversity, its sustainable use and equitable distribution of the benefit derived from it. Similarly, the article 16 of Part 3 states about the Right to Environment and Health: According to this article all citizens shall have the right to live in clean environment.

## 4.2 Plan

### 4.2.1 Tenth Five-Year Plan, 2060-2064(B.S.)

The Tenth Five Year Plan (2003-2007) has identified IEE/EIA as a priority area, and it emphasises on environmental monitoring of the project that have undergone IEE/EIA process. The plan focuses on the need for setting-up national environmental standards with the strategy of internalising environmental management into the development programmes. The plan has also realised the need for carrying out Strategic Environmental Assessment to promote environmental administration and governance. The plan emphasizes on the participation of the local people for environment conservation, according to the Local Self Governance Act, 2055, through the local bodies, by making them responsible and capable to manage natural resources at the local level. It stresses to mitigate environmental degradation in the lower regions by development activities in the upper regions (hydropower, irrigation etc.), and to initiate the rehabilitation programmes for the affected parties (NPC, 2002).

The Tenth Five Year Plan encourages the private sector to invest in the hydroelectricity sector from generation to distribution. The strategic thrust is on the

implementing small, medium, large and the reservoir type hydroelectricity projects by ensuring environmental conservation. In this plan, hydroelectricity has been envisaged as the clean alternative to biomass and thermal energy and its development will contribute to environmental conservation by reducing pressure on natural resources specially the forest. This plan has also pointed out the realization of the saving in foreign currency through the development of hydroelectricity sector.

The Government of Nepal has also made commitment to provide electricity services to about 66 percent of the total population through national electricity system. For this, hydroelectricity projects will be implemented to generate a total of 842 MW during the Tenth Five Year Plan. The strategic thrust is on implementing small, medium and large hydroelectric projects taking into account environmental conservation, and involvement of private sector. It also envisages that electricity development will contribute to environmental conservation by reducing pressure on natural resources, particularly the forests which are used for meeting the firewood demand of majority of the local people (NPC, 2002). The sustainable development agenda for Nepal also has a policy of creating economic incentives to use clean energy after conducting IEE/EIA and analysis of alternatives for all projects (NPC/Ministry of Environment, 2003). The major source of the clean energy is, no doubt, the hydropower.

### 4.2.2 National Water Plan, 2002-2007

In the spirit of the Water Resources Strategy, 2002, the Water and Energy Commission Secretariat has prepared the National Water Plan, which has identified action programmes to develop cost-effective small and medium hydropower projects (WECS, 2003). The Strategic Environmental Assessment of the draft plan has also emphasised to conduct IEE/EIA at the project level.

## 4.3 Policy

### 4.3.1 Hydropower Development Policy, 2058 BS

The hydropower Development Policy, 2001 has mentioned that efforts shall be made to maximize the use of country's hydropower potential in order to meet the domestic demand of electricity. It has also specified that small and medium hydropower projects shall be developed and promoted for domestic use in order to strengthen the situation of domestic power supply. The following are the provisions made in Hydropower Development Policy, 2001:

- Appropriate incentive provisions shall be provided and transparent process shall be pursued to attract national and foreign investment in hydropower development;
- Contribution shall be made to protect environment by developing hydropower as an alternative to biomass and thermal energy;
- Emphasis shall be given on mobilization of internal capital market for investment in power sector. Electrification of remote rural areas shall be encouraged by operating small and mini hydropower projects at the local level;
- Rural electrification shall be extended in order to make electric service available to as many people as possible. In addition to mobilization of public participation, a Rural Electrification Fund shall also be established for the purpose;
- The existing institutions in the public sector shall be re-structured to create competitive environment by encouraging the involvement of community cooperated institutions, local bodies and private sector in generation, transmission and distribution of hydropower in order to extent reliable and qualitative electricity service through out the Kingdom at a reasonable price;
- Attention shall be paid to safeguard the consumers' interest by providing reliable and qualitative electricity service to the consumers at a reasonable price;
- Process of electricity tariff fixation shall be made rational and transparent so that electric energy shall be supplied at a reasonable price. Priority shall be given to utilize labors and skills of Nepal in the implementation of hydropower projects;
- An institution shall be developed to impart training within the country to produce skilled manpower for the development of hydropower and enhance the capability of the persons involved in this sector. The institution may also carry out studies and research works related to hydropower development; and
- Consumers shall be encouraged for demand side management to enhance energy conservation.

#### 4.3.1.1 Policy Related to Environmental Provision

It has made a strict provision for the adverse affects on the environment mentioning that the adverse effects on the environment shall be minimized due to the

development and operation of hydropower projects and proper management shall be made to resettle and displaced families. Besides, followings are some provisions made in relation to environment:

- Provision to implement the programmes identified under the environmental impacts assessment study report shall be made in the projects sites where implementation of infrastructures such as powerhouse, embankment site, tunnel or canals and reservoirs, transmission lines, distribution lines of the hydropower generation project have direct impact. The prevailing laws shall govern the environment-related matter during the construction of hydropower projects. Provision shall be made to release such quantum of water, which is higher of either at least ten percent of the minimum monthly average discharge of the riverine/stream or the minimum required quantum as identified in the environmental impact assessment study report.
- The private sector obtaining the license shall be encouraged to acquire the house and land required to construct a hydropower project on its own. Provided, however, that if the necessary houses and land could not be obtained, the Nepal Government may make available such houses and land to private sector, in the same manner as it acquires the land to any institution under the prevailing laws.
- The licensee has to rehabilitate and resettle the families to be displaced while generating, transmitting and distributing electricity in accordance with the standard specified by Nepal Government. The private sector shall be provided necessary assistance by the government level in this respect. Provided, however, that the investors themselves have to bear the necessary resources required therein by including it in the project cost of the project in operation.

### 4.3.2 Nepal Environmental Policy and Action Plan, 1993

The Environmental Policy and Action Plan is a government policy document of environment management with main focus on incorporating environmental concerns into the biological and social components of environment.

## 4.4 Acts

### 4.4.1 Water Resources Act, (2049 BS)

The objectives of the Water Resources Act, 1992 is to make legal arrangements for determining beneficial use of water resources, preventing environmental and other hazardous effects thereof and also for keeping water resources free from pollution. The Act strives to minimize the environmental damage to water bodies, especially

lakes and river through environmental impact assessment. The following are the major provision made regarding the hydropower development activities:

- Enacted to arrange for the rational utilization, conservation, management and development of water resources in Nepal. Provides for integration of EIA during hydropower development of water resources in Nepal. Provides for integration of EIA during hydropower project development.
- In section 8, sub–section I,"A person of corporate body who desires to conduct survey or to utilize water resources, shall be required to submit an application to the prescribed officer or authority along with the economic, technical, and environmental study report and with other prescribed particulars ".
- Section 9 deals with the utilization and acquisition of land and houses;
- Section 18, 19 and 20 deals with water quality standards, water pollution and adverse effect on the environment; and
- The Act stipulates that soil erosion, flooding, landslides or any significant impact on the environment should be avoided in all uses of water resources.

### 4.4.2 Environment Protection Act, 2053 BS

The EPA, 1997 says that no development activity shall take without conducting Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) study as per schedule mentioned in the EPR, 1997. The project proponent must publish a public notice in the national daily newspaper about the project, seeking suggestions regarding impacts due to project;

The proponent will conduct IEE study and make IEE report as per EPR, 1997. Public access to information and transparency of activities has also been looked at in EPR, 1997. However, IEE of hydropower project can be approved by Ministry of Energy. Finally, Ministry of Energy has the prerogative to verify the final report and approve the IEE report.

### 4.4.3 Land Acquisition Act, 2034 BS

It is the main legislation to guide the acquisition of land in the country. This Act covers all aspects of land acquisition, compensation and other assets. It authorizes the government to acquire land for public purpose by providing compensation to the private land owners. 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 powers given under these sections are very broad as Government is empowered to acquire any land in the name of a public work by paying compensation to the owner of the land.

Once the government decides to acquire land for the project, the Project Chief initiate preliminary action to decide where, which and what amount of land is necessary to acquire for the project. S/he is required to affix one copy of this decision to each of the following places so the concerned person can be informed:

- Near the concerned land, especially at a thoroughfare;
- At the office of concerned VDC or Municipality; and
- At the house or compound wall which is to be acquired.

After three days of such notice, the PC is empowered to enter into the proposed land, house or compound with other staff for preliminary investigation. If the owner of the land is not satisfied with the amount of compensation decided by the Project Chief, s/he may file a complaint to the Chief District Officer within 15 days from the date of receiving information of assessment of such compensation. And in such case CDO is the final authority to decide on such issues

### 4.4.4 Electricity Act, 2050 BS

The Electricity Act, 1992 has been endorsed to develop electric power by regulating the survey, generation, transmission and distribution of electricity and to standardize and safeguards the electricity service. Electricity includes electric power generated from water, mineral oil, coal, gas, solar energy, wind energy or from any other means. According to the Section-4, sub-section (a) 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 the economic, technical and environmental report. It has made a strict provision for the terms of license for 50 years in maximum for the generation, transmission or distribution of electricity. Section 33 deals with the utilization and acquisition of land houses.

### 4.4.5 Forest Act, 2049 BS

The Forest Act, 2049 recognizes the importance of forests in maintaining a healthy environment. The Act requires decision-makers to take account of all forest values, including environment services and bio-diversity, not just the production to timber and other commodities. The basis of the Act's approach to forest and forest products is "resources orient rather than use orient".

Section 23 of the Act empowers the government to delineate any part of a national forest, which has "special environmental, scientific or cultural importance", as a protected forest. Section 49 of the Act prohibits reclaiming lands, setting fires, grazing, removing or damaging forest products, felling trees or plants, wildlife hunting and extracting boulders, sand and soil from the national forest without the prior approval.

The Act empowers government to permit use of any part of government-managed forest, leasehold forest or community forest, if there is no alternative for the implementation of a plan or project of national priority without significantly affecting the environment.

### 4.4.6 Soil and Watershed Conservation Act, 2039 BS

The Soil and Watershed Conservation Act, 2039 provides the following legislative measures concerning soil of watershed conservation: To control natural catastrophes such as floods, landslides, and soil erosion; and to maintain the economic viability and welfare of the public. This Act is devoted only to the protection of watersheds. Under Section 10 of SWCA, power is extended to Water Conservation Officer to grant permission to construct dams, drainage ditch and camels, cut private owned trees, excavated sand, boulders and soil, discharge solid wastes and establish industry or residential areas within any protected watersheds. The Act outlines the essential parameters necessary for proper watershed management.

### 4.4.7 Explosive Act, 2018 BS

Implementation of the project will require explosives in the excavation works of road, tunnels, underground powerhouse, aggregate quarry, etc. As per the provisions of Explosive Act, 2018, Article 4, the project needs a license for the procurement, storage, use, and transportation of explosives for its purpose.

### 4.4.8 Local Self -Governance Act, 2055 BS

The Local Self Governance Act, 1998 envisaged local bodies as the main vehicle for the development. This Act provides more autonomy to District Development Committees, Municipalities and Village Development Committees. Section 25 of the Act provides the functions, rights and duties of the Ward Committee. Section 25(e) of the Act requires the ward to help for protection of environment through plantation over the bare land, cliff and mountains. Section 28 has mentioned the functions,

rights, and duties of VDC. Section 55 empowers VDC to levy taxes on utilization of natural resources.

### 4.4.9 Public Road Act, 2031 BS

The Public Road Act, 2031 has been reviewed. Annex-2 (3 Ka) has specified the restriction of any construction work within the space of road without the explicit permission of the Department of Road. The Department has the authority to demolish the construction work as per article 3Ka (2-1) of the Act 2031.

### 4.4.10 Labor Act, 2048 BS

The Labor Act, 2048 (1991) defines "child as a person who has not attained the age of 14 years", and section 2.5.1 explicitly states that no child shall be engaged in work in any enterprises".

## 4.5 Rules/Regulations

### 4.5.1 Electricity Regulations, 1993

Rules have been formulated for the implementation of the provisions made in the Electricity Act, 1992. Rule 12(f) and 13(g) are related to environmental studies, which emphasize that the environmental study report should include measures to be taken to minimize the adverse affects of the project on physical, biological, socio-economic and cultural environment and should also elaborate utilization of local labor, source of materials, benefits to the local people after the completion of the project, training to local people in relation to construction, maintenance and operation, facilities required for construction site, and safety arrangements.

### 4.5.2 Forest Regulations, 1995

The Forest Regulation, 1995 provides guidelines for the preparation of a “Forest Management Plan” of Government managed forest. Emphasis has been given to monitoring and evaluating the implementation of the Plan of the Government managed forests. 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 proponent of the project itself shall bear the amount of compensation to be paid. Similarly, the entire expenses required for the cutting and transporting the forest products in a forest area to be used by the approved project should be borne by the proponents of the project.

### 4.5.3 Local Self Governance Rules, 2056 BS

The Local self-Governance Rules, 2000 states that the Village Development Committee should follow a participatory approach while formulating any plan. The Rule 67 emphasis on maintaining a consistency with the concerned governmental, non-governmental organizations as well as the donor organizations to ensure no repetition while implementing any project/programme with in the VDC area. Similarly, the Rule 68 envisaged that the project owner or the company should submit a clearance report to the concerned VDC after the operation of the project. Article-7 (68) empowers the VDCs for monitoring and supervision of development work implemented in the VDC. Besides, the following provisions were made: VDC is authorized to impose land tax; market/ shop tax, vehicle tax, entertainment tax, rent tax and business industry tax up to NRs. 1,000; Municipality is authorized to impose house/plot tax and land tax, rent tax, business/industry and service tax; Regarding hydropower, municipalities are authorized to impose vehicle tax, integrated property tax, parking fees, and property valuations fees; and DDC is authorized to impose road tax for the maintenance of highway and sub-highways.

The Article-4 of DDC has provision of three members: Agriculture, Forest, and Environment committee to look after the concerned issues. Article-7(210) focuses on environmental studies like sand quarry, stone quarry and coal mine etc while implementing the project.

## 4.6 Guidelines

### 4.6.1 Forestry Sector EIA Guidelines, 1995

The forestry sector EIA guidelines aim at facilitating the sustainable use of forest resources for the socio-economic development and to meet the basic needs of the communities from forest products. The beneficial and adverse impacts of any development project in the forest area are to be identified and plan must be developed to minimize environmental damage, conserving genetic resources and bio-diversity.

### 4.6.2 National Environmental Impact Assessment Guidelines, 1993

The National Environmental Impact Assessment Guidelines, 1993 developed by the National planning commission in conduction with IUCN, set out the process for the environmental review and management of infrastructure of projects in all sectors, and the respective roles of certain government agencies and project proponents. The guideline provides criteria for project screening and IEE. This includes preparation of

Terms of Reference for IEE, methods of IEE report, impact identification and prediction, impact mitigation measures, impact monitoring, evaluation of impact studies, community participation and schedules and annexes. The IEE report must be concise; pay attention to significant environmental issues and impact; analyze extent and depth of impact commensurate with the nature of potential impact; and due consideration must be paid to the responsibilities of target users such as project proponent, designers and decision-makers.

The guidelines require the proponent to consider alternatives to the proposed project. The proponent must consider the alternatives of scale, technology, location, fuel, raw materials, design, time schedule and economic aspects.

### 4.6.3 Forest Product Collection and Sale/Distribution Guidelines, 1998

The guidelines clauses 3 to 10 have specified various procedures and formats for getting approval for vegetation clearance, delineation of land for vegetation clearance, evaluation of the wood volume etc. and government offices and officials responsible for the approval. The Guidelines 3 of section 9 has emphasis that local people should be given priority in tree felling activities. These provisions have a direct relevance to the development of the project and need compliance to these provisions.

## 4.7 International Conventions and Agreements

Nepal is signatory to a number of international conventions such as concerning the protection, conservations and promotion of habitats, biodiversity and cultural heritage. These aspects must be taken into account during the EIA/IEE process of projects, which directly or indirectly affect the protected zones, or other properties covered by such international agreements and conventions.

### 4.7.1 Conventions on Biological Diversity, 2049 BS

Nepal ratified Convention of Biological Diversity, 2049 on 23 November, 1993. This convention obligates Nepal to: Introduce appropriate procedures for EIA; introduce appropriate arrangement to conduct EIA; notify immediate potentially affected neighbouring nations about biodiversity impacts; arrange for protection and conservation of biodiversity and, examine and enforce restoration and compensation of damage to biodiversity.

### 4.7.2 Convention on International Trade of Endangered Species, 1972

In CITES, the contracting States recognizes that wild fauna and flora in their many beautiful and varied forms are an irreplaceable part of the natural systems of the earth, which must be protected for this and the generation to come; Appendix II includes all species, which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival. Similarly, Annex-IX includes all species, which a party identified as being subject to regulation within jurisdiction for the purpose of preventing or restriction exploitation, and as needing the co-operation of other parties in the control of trade. Nepal is signatory to this agreement, which classified species according to criteria where access or control is important (e.g. I-species threatened with extinction; II-species which could become endangered; III-species that are protected).

### 4.7.3 Ramsar Convention

The convention on wetlands of International importance especially as waterfowl habit, adopted in 1971, entered into force in 1975 and currently has 136 parties. The convention provides a framework for international cooperation for the conservation and wise use of wetlands of international importance, to formulate and implement their planning so as to promote the conservation of wetlands includes in the list and the wise use of wetlands in their territory. As of February 2003, 1236 wetlands of international importance have been designated. For a comprehensive approach to the national implementation of the conventions, Nepal has developed national Wetlands Policies.

At present, an integration of EIA/IEE in developed project has become legally binding through the enforcement of the Environment Protection Act, 1997and Environment Protection Rules, 1997. The present IEE study is prepared on the basis of framework developed by the Environment Protection Act, 1997 and Environment Protection Rules, 1997. The project proponent is primarily responsible for abiding by all Acts, Rules, and Regulations, and other relevant Directives of Government of Nepal while implementing the project that is after the approval of the IEE report.

### 4.7.4 Convention on Biodiversity, 1992

The convention on biodiversity was signed by 153 nations on 14th June, 1992 at the Rio conference (Brazil) which was ratified and became effective on 29 December, 1993 after it was signed by a minimum of 30 countries.

The convention aimed to establish a global partnership for the protection of natural resources with the recognition of the sovereign rights of states over their resources. Article 8 (c) of the convention requires that signatory nations regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use. Thus, the convention is legally binding to protect and conserve natural resources of the world as a whole. The convention has become the principal framework within which the development and implementing of rules and regulations on biodiversity conservation occur.

### 4.7.5 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. This 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 provides 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 people concerned to the natural resources pertaining to their lands shall be specifically safeguarded. These rights include the rights of these people to participate in the use, management and conservation of these resources. The use of the term lands include the concept of territories, which covers the total environment of the areas which the peoples concerned occupy or 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 there 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) mentions that wherever 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.

## 4.8 Strategy

### 4.8.1 Nepal Biodiversity Strategy, 2002

The Nepal Biodiversity Strategy adopted by Nepal Government in August, 2002, specifies the construction of EA in accordance with the provision of EPA, 1997 and EPR, 1997 to assess significant impacts of development activities on Biodiversity. The National Biodiversity Strategy describes the protection and wise use of the biologically diverse resources of the country, the protection of ecological process and systems, and the equitable sharing of all ensuring benefits on a sustainable basis, for the benefit of the people and to honour obligations under the conservation on biological diversity.

Biological diversity in Nepal is closely linked to the livelihoods and economic development of most of the people and relates to agricultural productivity and sustainability, human health and nutrition, indigenous knowledge, gender equality, building materials, water resources and aesthetic and cultural well being of the society.

# CHAPTER-V
# EXISTING ENVIRONMENTAL CONDITION

## 5.0 General

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 Topography and Land use

The proposed shorter route with better access facility and minimum settlement traverses an undulated rugged landscape that is dominated by terraced cultivated land and forest of the Lesser Himalayan Region. Spot surveying shows alignment crossing roads at 7 different locations. The landuse pattern of this alternative route is ford, forest and grassland shrub land. The valley floors are characterized by gravel deposits and alluvial plains generating important economic benefits. The altitude of the alignment varies from approximately 750m to 2630m (figure 5.1).

For the transmission line of 220 kV capacity, the right of way (RoW) is defined as 15m on either side from the central line. This means that a total of 78.588 ha of land will be acquired by the project as RoW. Since the tower pads are also constructed, land to be acquired for tower pads is 0.878 ha which is not included under the area of RoW (15 m on each side from the central line).

Table 5.1: Land requirement for project RoW

| S. No. | Landuse | Area (ha) | Percentage |
|---|---|---|---|
| 1. | Cultivation | 34.047 | 43.32 |
| 2. | Forest with Bush/shrub land | 40.608 | 51.67 |
| 3. | Barren & Cliff | 2.703 | 3.44 |
| 4. | River & Rivulet | 1.23 | 1.57 |
| | **Total** | **78.588** | **100** |

*Source: Field Survey 2014*

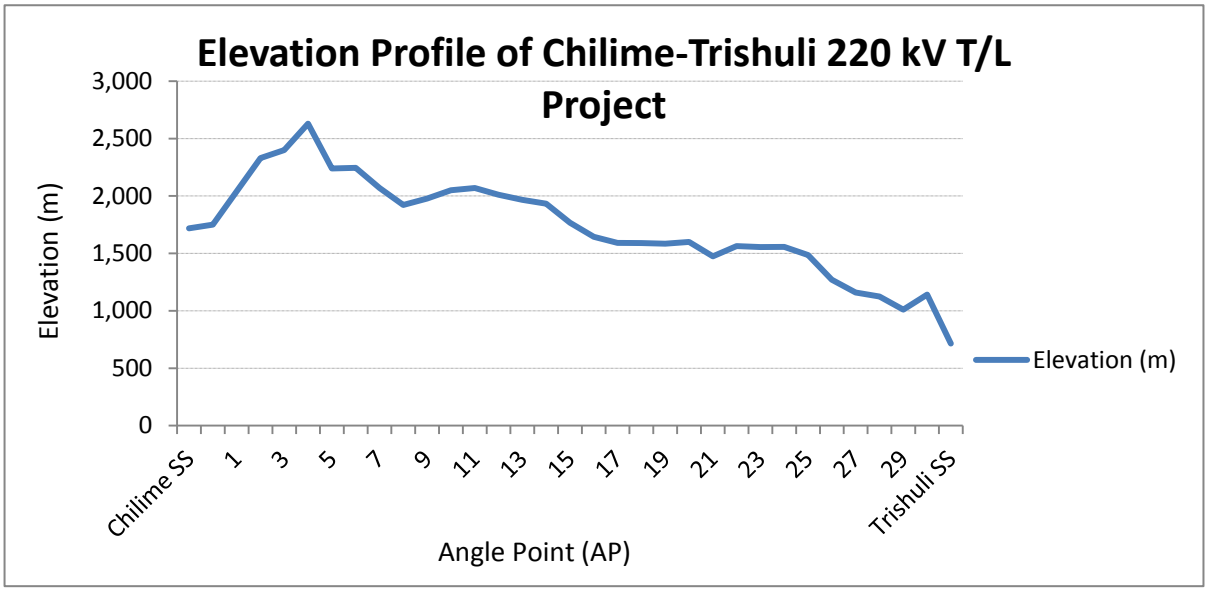



**Figure 5.1:** Elevation Profile of the Transmission Line Alignment

### 5.1.2 Geology and Soil

Physiographically, the whole stretch of the proposed project lies in the Lesser Himalayan Region of meta-sediments. Geologically, the alignment runs adapting through schist and gneiss rock types with terraces and steep gorges. The soil types encountered along the alignment are alluvium deposits, loose soil with gravel mixed and soft rocks. The area lies in the lesser Himalayan zone comprising low to medium grade metamormhic rocks such as phyllite, exotic slices of quartzite, limestone and phyllite and intercalation with shale and slate as observed.

The highland rocks dip steeply northwards and the more resistant crystallines, quartzites and dolomites stand out sharply while the phyllitic exposures are most liable to landslides. The numerous spurs that bifurcate from the highlands are sharp and separated by narrow valleys.

The ridges have a sharp north face and gentle south slope. The north faces are too steep for cultivation and are left forested. The south facing slopes are preferred both for settlement and cultivation. The flights of terraces become more numerous downstream.

### 5.1.3 Erosion and Land Stability

The site observation of the corridor revealed that the line traverses through undulated topography without serious degradation and are short lived. No major unstable areas such as sheet, rill or gully erosion were observed along the alignment. All Angle Points have been located on geologically stable ground and accessible. The information of land

use, soil erosion and landslides are in gentle to inclined topography. Terraced agricultural lands with patches of trees were observed in the field in alluvium deposits. It was a relatively barren land with patches of shrub and grasses. The drainage system of catchment in the traverse of RoW was observed to be stable.

The degree of slope puts an obvious limit to the amount of productive land and in spite of the adverse slopes most suitable lands are already utilized. In the lekh zone, nature is more dominant. On the other hand man-land relationship in the pahar zone is one of mans adaptation to nature and prone to land degradation via deforestation.

### 5.1.4 Climate

The transmission line corridor lies in the humid and Sub-tropical Climatic Zone. Table 5.1 shows the maximum and minimum temperature and rainfall recorded for the year 2005 for the project affected Rasuwa and Nuwakot district.

Table 5.2 Maximum and Minimum Temperature

| S. No | District | Maximum Temperature ($^oC$) | Minimum Temperature ($^oC$) | Rainfall (mm) (Average) |
|---|---|---|---|---|
| 1 | Rasuwa | 24.0 | 4.0 | 691.7 |
| 2 | Nuwakot | 31.6 | 8.2 | 427 |

*Source: District profile of Rasuwa and Nuwakot district*

The region is exposed both to the summer monsoon and winterly jet streams and these two air masses give a distinct seasonal character. Snowfall associated with the westerly disturbances during winter occurs only on the highlands above 6000 ft.

Local convection hailstorms in autumn and strong winds during the dry spring are the limiting factors to certain crops. The seasonal cycle is cool-warm-hot-warm. The agricultural activity conforms to the seasonal rhythm and the vagaries of monsoon affect the farmers poverty or prosperity.

### 5.1.5 Watershed and Drainage

The geomorphology and watershed of the project area is drained mainly by the snow-fed river Chilime khola and trishulinadi at the initial stretch and rain-fed rivers like Nisim Khola, Haku khola and Andhari khola later. There are also other tributaries which contribute to the drainage system and crosses the T/L corridor. The monsoon influences the hydrology of the rivers and streams of the area. The monsoon rain that activates the

intermittent streams starts from June to September. Nearly 80% of the rainfall in the area occurs during monsoon. Sound ecological processes and coherent entities were observed in the drainage system of the line.

Immaturity remains the chief characteristics of the soils found in the region. Indications of laterisation are observable. In descriptive terms montane brown forest soil, montane red earth, recent alluvia in the bensi and gravelly loam of the valleys are observed.

### 5.1.6 Air and Water Quality and Noise levels

The proposed transmission line traverses through rural settings establishing better strategies. The determinant factor as the area passes through rural settings is that the status of air quality is satisfactory and healthy. In the urban setting of Rasuwa and Nuwakot sections where the line traverses gravel roads and foot trail, dust particles were observed due to the movement of public vehicles but of low margin and less environmentally damaging.

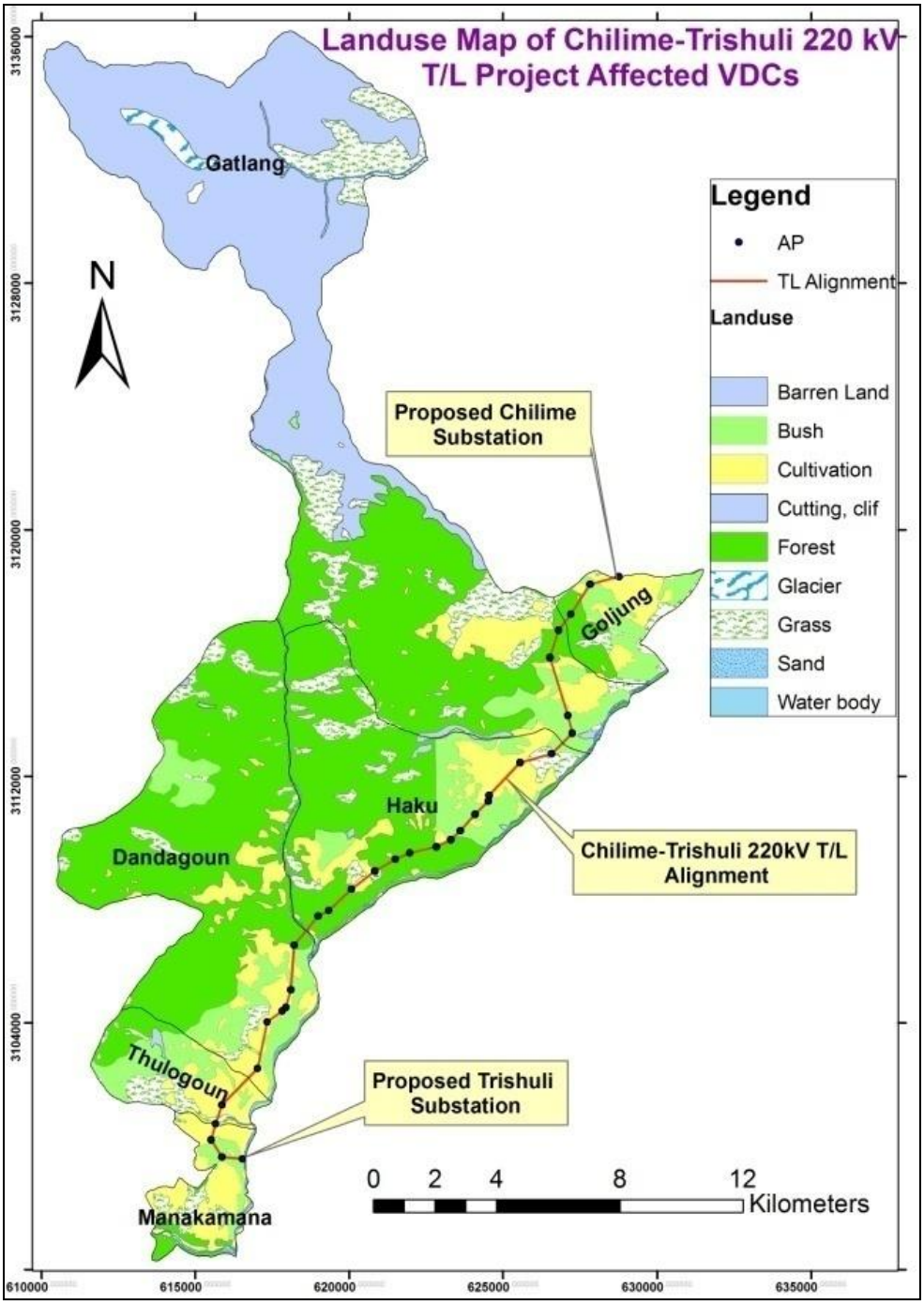



Figure 5.2: Landuse Map of the Project affected VDCs

Apparently, the water qualities of rivers like the Trishuli, Chilime and Mailung and other tributaries like the Nisim Khola, Haku khola and Andhari khola were observed. There are also other tributaries which crosses the T/L corridor. The monsoon influences the hydrology of the rivers and streams of the area. The corridor has been aligned so as to avoid human settlements except at some stretches. The noise levels can be considered to be within the acceptable limits except at stretches of the project area. These areas are

near to human settlements where various human activities related to trading activities have elevated the noise levels.

**5.2. Biological Environment**

Nepal's rich biodiversity is a reflection of this unique geographical position as well as its altitudinal and climatic variation. It incorporates Palaearctic and indo-Malayan biographical regions and major floristic provinces of Asia, creating a unique and rich biodiversity of life. Although comprising only 0.09% of global land area. Nepal possesses a disproportionately large diversity of flora and fauna at genetic, species and ecosystem levels.

### 5.2.1 Forest and Vegetation

Forests in Nepal have high ecological and economic value in terms of maintain ecological balance protecting watersheds and water resources, maintaining natural habitat and biodiversity for wildlife, supporting subsistence farming system and transhumance ruminant livestock system particularly in hills and mountains, providing forage for livestock and fuel wood for majority of the households, and building national economy through sale of medicinal and aromatic plants, timber and other forest products and ecotourism etc. Forest types are diverse ranging from tropical hardwood to temperate conifer and to alpine shrub land.

Administratively, the forest of Nepal is divided in to six types: Government Managed National Forest, Protected Forest, Community Forest, leasehold Forest, Religious Forest and Private Forest.

#### 5.2.1.1 Vegetation/Forest Cover in Project District

Almost all of the project impact area belongs to the subtropical ecological zone in Rasuwa district and tropical in Nuwakot district. Mostly project components are on the right bank of the river. In the left bank site of the Trishuli River lies the buffer zone of the Langtang National park. According to the District Forest Office Reports, 2011; forest covers 35991(32.11 %) hectares of land in Nuwakot district and forest covers 47494 (31.43 % ) hectares of land in Rasuwa district. Major forest types are hill Sal forest, Pine forest, Schima-Castanopsis forest, Rhododendron forest, Alder forest, lower temperate mixed broad leaf forest and others.

### 5.2.1.2 1 Vegetation/Forest Cover in Project Area

The proposed 132/220 kV Chilime Sub-station Hub and Chilime Trishuli 220 kV TL alignment extends 26.50 km from Thambuchet Village, Goljung VDC of Rasuwa district to Champani village, Manakamana VDC of Nuwakot Districts in the Central Development Region of Nepal (Bagmati Zone).The district wise total land area and forest area no of community forest to be affected and along the TL alignment are given in the table 5.1.2 and total number of community forest along the alignment in Rasuwa district is 17 and in Nuwakot district is 1. No part of the proposed alignment fall in National Park, Wildlife Sanctuary Area, Buffer Zone and Conservation Area.

Table 5.3 District wise forest area and no of community forest along the TL alignment

| S. No. | District | Total Land Area, ha | Forest Area,ha | Forest Area % | Total no of CF in the District | No of CF along the alignment |
|---|---|---|---|---|---|---|
| 1 | Rasuwa | 151087 | 47494 | 31.43 | | 17 |
| 2 | Nuwakot | 112100 | 35991 | 32.11 | 277 | 1 |
| | Total no of community forest along the TL alignment | | | | | 18 |

### 5.2.1.3 Transmission Line Alignment

This section should include description of transmission line stretch covering forest type (sal, pine, mixed broadleaf), forest category (community, government, leasehold, private) and major species.

The Transmission line alignment passes through middle hill range.The existing forest condition in nuwakot district is dominant in Sal ( Shorea robusta) followed by Salla( Pinus roxburghii) and Chilaune ( Schima Wallichii). In Rasuwa district Salla ( Pinus Roxburghii) and Chilaune ( Schima Wallichii) are dominant. Sal, Salla and Chilaune are source of timber for construction and furniture and fuel wood for domestic purpose.Leaves of Sal are also used as fodder for domestic animals and preparing leaf plates at villages. The crown cover ranges from 20 - 70 % at various patches of the alignment.

The density of trees is found to be 345 per ha.The land area which is associated with rocky, ridges, hills and barren lands along the transmission line alignment is estimated to be 8% in Nuwakot district and 12 % in Rasuwa district. This is because of the topography

of the ridges and hills in the middle hill ranges.A total of 15491 trees mostly of the pole sizes are expected to be felled and fewer trees sized.
Along the corridor the recorded shrub species are Banmara ( Eupatorium odoratum), Ainselu ( Rubus elipticus) , Dhusugre ( Gaultheria Sp), Chutro ( Barberis aristata) Dhanyero ( Lagerstromia parviflora), Angeri ( Osbekia Sp), etc.The list of the plant species available in and around the project area are given in Annex.

### 5.2.1.4 Tropical and sub tropical broadleaved Mixed Forest

A continuous stretch from AP 19 to AP 27 possesses through the tropical and sub tropical deciduous broad leaved mixed forest. The forest areas are fragmented into small patches. This forest is predominantly composed of Sal (*shorea robusta*), Salla (*Pinus roxborghii*),,Khirro ( *Cucumis Sp*), Mauwa (*Engelhardtia spicata*) Simal (*Bombax ceiba*), etc. Along corridor shrub species recorded are Sano Dhayero (*Woodfordia fruticos*), Ainselu ( *Rubus elipticus*) Bhimsenpati (*Budlegia sp*), etc.

### 5.2.1.5. Hill Sal and Pine Mixed Forest

Hill Sal forest is predominant species under the Transmission line of the project area. Due to the altitudinal and climatic condition, hill Sal forest under the project area are young, mostly pole and sapling size with natural good regeneration. In the project area, Hill Sal forest is found between AP 28 to AP 39 encompassed under the community forest. Pine forest is predominant AP 2 to AP 27 associated with Rohododendron ,Simal and others.
*The main associates species* with the hill *Sal forest are :* Chilaune (*schima wallichii),Khote Salla ( Pinus roxburghii), Simal (Bombax ceiba), Bot Dhayero ( Lagestromia parviflora), Tanki/Koiralo ( Bhalayo Spp) etc.*

Although, Sal (*Shorea robusta*) trees in the Sal forest in the Nepal is in the stage of depletion due to over exploitation. It is banned for felling, transportation and export. However, with approved management plan, in the community forests and government managed forests, it can be felled and used within country, but not exported.

### 5.2.1.6 Forest Composition and Analysis

In the most part of along the proposed 220 kV TL, the forest area has been well conserved due to the effective peoples participation. Species richness and tree density is high in the forest. In the most part along the proposed 220 kV TL the forest canopy cover observed between 40 to 70%. In case of Hill Sal forest, it is almost present 60-70% forest canopy cover throughout the forest area. .Average regeneration rate of the trees species found 944 saplings per ha and seedling per ha is 868 in community forest respectively of the

project affected areas. The Sal and Amala forest undergrowth and regeneration is very high and dense.

**Table-5.4: Species wise vegetation composition with volume, density, and area**

| Mixed Forest | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SN | Species | Botanical Name | no of individual spp | Density/Ha | no of plot spp occurred | F% | BA (m2/Ha) | RF | RD | Total BA | Rdom | IVI |
| 1 | Salla | *Pinus Walichiana* | 23 | 115 | 3 | 60 | 6.52 | 13.04 | 33.33 | 1.30 | 51.30 | 97.68 |
| 2 | Laligurans | *Rhodendron Sp* | 3 | 15 | 1 | 20 | 0.16 | 4.35 | 4.35 | 0.03 | 1.26 | 9.96 |
| 3 | Chilaune | *Schima wallichii* | 7 | 35 | 1 | 20 | 1.37 | 4.35 | 10.14 | 0.27 | 10.79 | 25.28 |
| 4 | Katus | *Castanopsis indica* | 3 | 15 | 1 | 20 | 0.72 | 4.35 | 4.35 | 0.14 | 5.63 | 14.33 |
| 5 | Botdhayero | *Lagerstroemia spp* | 7 | 35 | 2 | 40 | 0.09 | 8.70 | 10.14 | 0.02 | 0.71 | 19.55 |
| 6 | Bhalayo | *Rhus Javonica* | 1 | 5 | 1 | 20 | 0.14 | 4.35 | 1.45 | 0.03 | 1.10 | 6.90 |
| 7 | Sindure | *Bixa Orlena* | 3 | 15 | 2 | 40 | 0.08 | 8.70 | 4.35 | 0.02 | 0.59 | 13.63 |
| 8 | Guenli | *Callicarpa Sp* | 1 | 5 | 1 | 20 | 0.74 | 4.35 | 1.45 | 0.15 | 5.83 | 11.62 |
| 9 | Khari | *Celtis australis* | 2 | 10 | 1 | 20 | 0.74 | 4.35 | 2.90 | 0.15 | 5.83 | 13.07 |
| 10 | Sal | *Shorea robusta* | 6 | 30 | 2 | 40 | 0.48 | 8.70 | 8.70 | 0.10 | 3.74 | 21.13 |
| 11 | Mauwa | *Engelhardtia spicata* | 3 | 15 | 1 | 20 | 0.43 | 4.35 | 4.35 | 0.09 | 3.39 | 12.08 |
| 12 | Simal | *Bombax ceiba* | 2 | 10 | 2 | 40 | 0.27 | 8.70 | 2.90 | 0.05 | 2.09 | 13.68 |
| 13 | Khiro | *Cucumis Sp* | 1 | 5 | 1 | 20 | 0.21 | 4.35 | 1.45 | 0.04 | 1.65 | 7.45 |
| 14 | Areli | *Acacia spp* | 1 | 5 | 1 | 20 | 0.04 | 4.35 | 1.45 | 0.01 | 0.31 | 6.11 |
| 15 | Bakaino | *Melia Sp* | 1 | 5 | 1 | 20 | 0.10 | 4.35 | 1.45 | 0.02 | 0.79 | 6.58 |
| 16 | Belauti | *Psidium guljava* | 1 | 5 | 1 | 20 | 0.09 | 4.35 | 1.45 | 0.02 | 0.71 | 6.51 |
| 17 | Gogan | *Saurauia Sp* | 4 | 20 | 1 | 20 | 0.54 | 4.35 | 5.80 | 0.11 | 4.25 | 14.40 |
| | Total | | 69 | 345 | 23 | 460 | 12.70 | 100.00 | 122.34043 | 2.54 | 99.96 | 299.96 |

Tropical and sub tropical broadleaved Mixed Forest , 17 different species of trees were recorded in the 5 sample plots, equivalent to 20000 m2 area along the proposed 220 kV transmission line alignment. Estimated tree density is 345 trees per ha. Among the recorded and measured species the important value index (IVI) of Salla is the higher value having of 97.68 followed by Chilaune (25.28), Sal (21.13) respectively. Table -5.7 (a) shows the tree density per ha, frequency, basal are in m2/ha, relative density, relative frequency, relative dominance and important value index (IVI) if the sample species of the tropical and subtropical broadleaves mixed forest in the project area.

Ground flora consists of common herbs like Banmara (*eupatorium adenophorum*), Titepati (*Artemisia indica),* Areli also observed in the forest site.

### 5.2.1.7 Forest Management Practice

**i) Community Forest**

Community Forest is a National Forest handed over to the Forest user groups pursuant to section 25 of Forest Act 1993 for its management, development, conservation and utilization for the collection interest. The formulation of the National Forestry Plan (1976) provided a policy base initiating forestry development works in Nepal and was a paradigm shift in policy towards participatory forestry. Community Forests have been formed in the project areas by the local people to meet their daily fuel fodder, timber and other requirement.

Normally, Forest User Group prepares *operationa*l forest management plan for 5 years. The concerned DFO officer approves the operational forest management plan. As per the peoples need and demand and conceptualize new ideas, the users group revised the 5 year operation plan and again approved by the DFO office. The proposed transmission line alignment passes through 18 Community forests (1 in Nuwakot,17 in Rasuwa districts) having 1132.85 ha of land and having more than 1612 households directly benefitted.

About 51.07% of total length of TL alignment passes through forest land among 40 angle points, 11 APs (1,2,3,6,19,20,24,25,27,38,and 39) are located within the forest area. And 5 AP (4,5,7,8,and 15) in the barren land. Most of the following community forest have been handed over the forest users groups. The main tree species found in these Community Forests are Sal (*Shorea robusta*), Chilaune (Schemia wallichii), Khote salla (*Pinus ruxburghii*),Khirro (),Simal (*Bombax ceiba, laligurans*, Koiralo (*Bahunia varigata*), , Dhanyero*,* , Baikano (*Melia azadirach*) , etc. The details of Community Forest found in the proposed transmission line corridor are given in table **5.5**.

Table 5.5: List of Affected Community Forest passing through the Transmission line corridor in Nuwakot and Rasuwa Districts

Rasuwa

| SN | Name of CF | Ward No | Angle Points | Total Forest Area | Benefitted HH | Affected FA |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | Naonggang Pakha | Goljung,9 | AP 0 to AP 1 | 88.5 | 171 | 1.755 |
| 2 | Golgung Pigore | Goljung,1 -9 | AP 2 to AP 3 | 67 | 132 | 2.316 |
| 3 | Gilgung /Pachgode | Goljung,1 -9 | AP 3 to AP 4 | 78 | 147 | 1.938 |
| 4 | Chhangang | Gatlang 7,8 | AP 4 to AP 5 | 34 | 106 | 3.189 |
| 5 | Bomjomane | Gatalang,1 - 6 | AP 5 to AP 6 | 87 | 173 | 3.516 |
| 6 | Jomokharka Nehasing | Haku 1 | AP 6 to AP 7 | 47 | 41 | 1.494 |
| 7 | Nehasingpakha | Haku,2 | AP 7 to Ap 8 | 7.5 | 53 | 2.154 |
| 8 | Rilunehasing Danda | Haku 2,7 | AP9 to AP 10 | 14.5 | 86 | 2.487 |
| 9 | Thulo haku kaloban | Haku,4,6 | AP12 to AP 19 | 85 | 140 | 5.634 |
| 10 | Dachhinkali | Haku,8,9 | AP 19 to AP24 | 182.25 | 83 | 7.626 |
| 11 | Gogane Mahila | Haku,9, c/o Dachhinkali | AP 24 to AP 25 | _ | __ | 1.047 |
| 12 | Guptipakha | Dandagaun,7 | AP 25 to AP 26 | 167.46 | 56 | 1.965 |
| 13 | Dharmapakha | Dandagaun,6 ,7 | AP 26 to AP 28 | 43 | 42 | 1.008 |
| 14 | Chipletipatal | Thulogaun 8,9 | AP 28 | 68.44 | 104 | 2.019 |
| 15 | Kareli Gaunthali | Thulogaun,8 | AP 30 to AP 31 | 5.52 | 34 | 0.15 |
| 16 | Dhuskore | Thulogaun,8 | AP 31 to Ap 32 | 5.32 | 115 | 0.15 |
| 17 | Chhangetuppo | thulogaun,7 | AP 33 to Ap 34 | 1.37 | 29 | 0.15 |
| | Total | | | 981.86 | 1512 | 38.598 |

Nuwakot

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | Jamlebhirpakha | Manakamana, 5 | AP 37 to AP 39 | 150.99 | 100 | 2.01 |
| | Total | | | 1132.85 | 1612 | 2.01 |
| 18 | Grand Total | | | | | 40.608 |
| | River and Rivulets | | | | | 1.23 |
| | Barren and Cliffs | | | | | 2.703 |
| | Tower Pads Along ROW Forest | | | | | 0.36 |
| | Total Affected Forest Area | | | | | 44.901 |

*Source: Field survey, July 2014*

**ii) Leasehold Forest**

Government of Nepal may grant any part of a national forest as a Leasehold Forest through leasehold forest users group to produce raw material for the forest based industries, agro forestry, to plant trees to increase forest products for sale or distribution or for use. The leasehold forestry program has been focusing in reinforcing the highly degraded condition of the forest and land resources by groups of people living below

poverty line. The objective of the Leasehold Forest were to raise the income of families below poverty line and to improve the ecological conditions through various activities such as leasing degraded forest lands to the group of poor households, establishing forest nurseries, forming cooperatives, providing training and raising awareness and income.

In the project area, there are no Leasehold Forests in the proposed transmission line corridor. Rasuwa District Forest Office is planning to handover some leasehold forest to users group as soon as possible. The users groups have already prepared their constitutions and but not managed to register it .The User's Group of these Leasehold Forests consists will be deprived community, Poorest of the poor (POPs), indigenous & tribal people and marginalized people.

#### 5.2.1.8 Ethno botany

Various uses of plants have been observed in the project area. Traditional uses of plants are common in project area and are integral part of livelihood. Some of common medicinal plants found in the project area are Chutro (*Berberis aristata*), Timur (*Zanthoxylum armatum*), Amala (*Phyllanthus emblica*), Asuro (*adhatoda vasica*), Titepati (Artemesia *capillaries*), Ghodtapre (*Centelia asiatca*), Kurelo (*Aspasgus officinalis*), chiraito, etc.

### 5.2.2 Wildlife

The local residents informed that, the movements of wildlife in the project are is very low, because of frequently movement of vehicles on the highway and stream like Mailung khola. Forest is disturbed due to the forest fire, cattle grazing and construction of the village road caused disturbance to the wildlife and its habitat. Some of the wildlife reported in the project is migratory and not confined in the only to the project area. The proposed project area is not a specific habitat for any wildlife.

#### 5.2.2.1 Mammals

A number of mammalian species are reported from the project area. Some of them are common wild animals such as: Leopard (*Panthera pardus*), Barking deer (*Muntiacus munjak*), Jackal (*Canis aureus*), Porcupine (*Hystrix Indica*), Rhesus Monkey (*Macaca mulata*), Common Langoor (*Presbytis entellus*), Malsapro (Martes flavigula), squirrel (*Fuinambulas palmaurum*), Jungle Cat (*Felis chaus),* Fox (*Vulpes vulpes*) etc.

#### 5.2.2.2 Birds

Forest, agricultural field, wetlands, villages, rivers, streams, gorges, and cliffs provide variety of habitat for different species of birds. Common bird species found in the project area are Common Myna (*Acridotheres tristis*), House Swift (*Apus affinis*), House Crow (*Corvus splendens*), Spotted Dove (*Streptopelia chinensis*) and House Sparrow (*Passer domesticus*).

Titra (*Francolinus sp*), Kalij Phesant (*Lophura leucomelana*), Redumped swallow (*Hirundo daurica*), Koilee (*Eudyanamus sp*), Parrot (*Psitta vernalis*), Red Jungle Fowl (*Gallus gallus*), etc are reported bird species in the project area.

#### 5.2.2.3 Reptiles and Amphibians

Common Cobra (Naja naja), Common Krait ( *Bungarus caeruleus*Viper (*Trimeresurus albolabris*), Barred Moniter (*Varanus bengalensis*), House Gecko (*Hemidactylus frentus*), Common frog ( *Rana tigrina*), Golden toad ( *Bufo bufo*) are some of the common species of reptiles and amphibians reported in the project area.

#### 5.2.2.4 Rare, Endangered, Threatened and Protected Species of Flora and Fauna

Due to the forest destruction, degradation and fragmentation and harvesting of wild animals have become rare and endangered in Nepal. The bird species found in project area are common and widely distributed in the middle mountain of Nepal. Even though, the project area is not important habitat for fauna. Some of the plant and wild animals reported from the project area belong to different categories of Rare, Endangered, Threatened and Protected species of flora and fauna, Listed plant species in the project area are Sal (*Shorea robusta*),and Simal (*Bombax ceiba*) . Similarly, Rhesus monkey (Macca mullatta), common langur (Maccac *assamensis*) and leopard *(Panthera parades*) are the listed wild animals found in the area.

## 5.3 Socio-economic and Cultural Environment

### 5.3.1 General Introduction of the Project affected districts

The proposed 132/220 kV Chilime Sub-station Hub and Chilime Trishuli 220 kV Transmission line project is located in two districts (Nuwakot and Rasuwa) of Bagmati Zone, Central Development Region of Nepal. The total area of 2 districts is 2,665 Sq. km. According to National Population census 2011, the total population of the project affected districts is 3, 20,771 with 1,54,262 male and 1,66,509 female. The percentage of the male and female population is 48.09 and 51.91 respectively. The project affected district population covers 1.21% of the total population of the country. The average population

density of the project districts is 138 persons/sq.km. There are 68993 households and the average household size is 4.56. Similarly, the average literacy rate (Population of five years and above) of the two project districts is 56.7%, which is lower than the national literacy rate 65.94%. The average male and female sex ratio is 95.09. General demographic introduction of the project districts is presented in the Table- 5.6.

**Table -5.6: Demographic Characteristics of the Project districts**

| District | Rasuwa | Nuwakot | Total/Average |
|---|---|---|---|
| Total Population | 43300 | 277,471 | 320771 |
| Male | 21475 | 132787 | 154262 |
| Female | 21825 | 144684 | 166509 |
| Total Nubmers of Households | 9778 | 59215 | 68993 |
| Average Households size | 4.43 | 4.69 | 4.56 |
| Population Density (persons/ Sq.km) | 28 | 248 | 138 |
| Sex Ratio (Males per 100 Females) | 98.4 | 91.8 | 95.09 |
| Urban Population (%) | | 10.07 | |
| Population below 5 years(%) | 8.67 | 7.85 | 8.26 |
| Elderly Population 75+Years(%) | 2.63 | 2.87 | 2.75 |
| Economically Active Population (15-60 yrs)(%) | 55.67 | 57.17 | 56.42 |
| Percent of Literacy Rate (6 years & above) | 53.6 | 59.8 | 56.7 |
| Total Area of the Districts (Sq. km) | 1544 | 1121 | 2665 |
| Percent of District Population Compared with Country's | 0.16 | 1.05 | 1.21 |

Sourece: CBS 2011

### 5.3.2 Socio-economic features of the Project VDCs/Municipalities

The proposed alignment traverses through the 6 VDCs of two districts of Central Development Region of Nepal. The map showing the project affected VDCs is presented in figure-2.2. The 26.5 km long transmission line is started from Thambuchet village, Goljung VDC of Rasuwa district to Trishuli 3B hub substation at Champani village, Manakamana VDC of Nuwakot district. As per Electricity Regulations, 2050 (1993), the right of way of the transmission line is taken as 15 meters on either side of the transmission line.

#### 5.3.2.1 Demography

According to the National Population Census 2011, the total population of the project VDCs is 11809 with 5614 males and 6195 females. The male and female percent of the project affected VDCs are 47.54 and 52.46 respectively. The female population is higher as

compared with the male population. The population of the project VDCs covers only 3.68% of the total population of the project affected districts (320771). The total number of households is 2697 with average household size 4.38. The household size in Haku VDC is highest (4.90) and least at Manakamana VDC (4.21). The average population density of the project VDCs is 58.35 persons sq.km which is lower than the average population density 138 persons/sq.km of the project affected districts. However, the project area covers five VDCs of Rasuwa district along which population density is only 28 persons/sq.km. The population density in Gatlan VDC is least (13.1 persons/sq.km) and highest in Thulogaun VDC (113 persons/sq.km) among the project affected VDCs. Detail demographic characteristics of the project affected VDCs is presented in the Table-5.7.

**Table-5.7: Demographic Characteristics of the project affected VDCs/Municipality**

| District | VDCs | Population | | | Total Households | Pop. Density (persons/sq.km) | Sex Ratio (Males per 100 Females) |
|---|---|---|---|---|---|---|---|
| | | Total Population | Male | Female | | | |
| Nuwakot | Manakamana | 3321 | 1537 | 1784 | 789 | 41.29 | 86.2 |
| Rasuwa | Dandagaun | 2186 | 1033 | 1153 | 479 | 31 | 89.6 |
| | Thulogaun | 1356 | 636 | 720 | 317 | 113 | 88.3 |
| | Gatlang | 1805 | 888 | 917 | 400 | 13.1 | 96.8 |
| | Goljung | 972 | 471 | 501 | 269 | 102.1 | 94.0 |
| | Haku | 2169 | 1049 | 1120 | 443 | 49.6 | 93.7 |
| | Total | 11809 | 5614 | 6195 | 2697 | | |
| | % | 100 | 47.54 | 52.46 | | | |

Source: CBS 2011

### 5.3.2.2 Settlements

Dense forest, barren land and scattered settlements are found in the project area. The main settlements of the VDCs through which the transmission line passes are Thambuchet, Chyamdon, Gre, Nasin village, Hechambra, Sanu Haku, Thulo Haku, Gursumba, Gogane,Chandane, Mailung Dovan, Siruchet, Deurali dada, Salim bhitta village, Khadku, Chipleti, Diyale, Dadagau, Pairegau, Archale and Champani. The table-5.8 shows the name of settlements and their locations by districts.

**Table-5.8: List of settlements through which transmission line passes**

| SN | Settlement | VDC/Municipality/Ward No. | District |
|---|---|---|---|
| 1 | Thambuchet | Goljung-1 | Rasuwa |
| 2 | Chyamdol | Goljung-2 | Rasuwa |
| 3 | Gre | Gatlan-7 | Rasuwa |
| 4 | Nasin village | Gatlan-7 | Rasuwa |
| 5 | Hechambra dada | Haku-1 | Rasuwa |
| 6 | Sanu Haku | Haku-2 & 4 | Rasuwa |

| | | | |
|---|---|---|---|
| 7 | Relu odhar | Haku-7 | Rasuwa |
| 8 | Gursumba dada | Haku-7 | Rasuwa |
| 9 | Lumba dada | Haku-7 | Rasuwa |
| 10 | Gogane, | Haku-8 | Rasuwa |
| 11 | Deurali dada | Haku-8 | Rasuwa |
| 11 | Kaptan Kharka | Dadagau-6 | Rasuwa |
| 13 | Siruchet | Dadagau-7 | Rasuwa |
| 14 | Khadku | Dadagau | Rasuwa |
| 15 | Chipleti | Dadagau | Rasuwa |
| 16 | Diyale | Dadagau | Rasuwa |
| 17 | Dadagau | Dadagau | Rasuwa |
| 18 | Achhi Bisauni | Thulogau-8 | Rasuwa |
| 19 | Salim bhitta village | Thulogau-7 | Rasuwa |
| 20 | Pairegau | Thulogau | Rasuwa |
| 21 | Archale Siran | Manakamana-8 | Nuwakot |
| 22 | Champani | Manakamana | Nuwakot |

Source: Field survey, 2014

#### 5.3.2.3 Caste and Ethnicity

The project area is a multi-ethnic composition of different origins, cultures, language and religion. Altogether 9 castes/ethnic groups are found in the project area. The dominant caste groups that residing in the project area are indigenous community (Tamang-70.01% and Gurung-12.08%). Government of Nepal has categorized 59 castes/ethnic groups as indigenous and tribal groups. Under this provision, there is 82.62% population in the project affected VDCs that fall under the category of Indigenous and Tribal groups and they occupy 3.04% of the total population of the project affected districts. The other Major caste/ethnic groups of the project area are Brahmin Hill (9.88%), Ghale (2.26%).and Chhetri (1.18%). The Dalits community (Kami, Damai and Sarki) covers 3.35% of total population of the project area. The population distribution by caste/ethnic groups is presented in the Table-5.9.

**Table-5.9: Population distribution by Caste/Ethnicity**

| Caste/Ethnic groups of the Project Area | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| District | VDCs | Total | Tamang | Chhetri | Brahmin Hill | Newar | Gurung | Damai Dholi | Kami | Ghale | Sarki | Others |
| Nuwakot | Manakamana | 3321 | 1726 | 84 | 664 | 28 | 418 | 23 | 195 | 166 | 15 | 2 |
| Rasuwa | Dandagaun | 2186 | 1570 | 18 | 360 | | 223 | | | | | 15 |
| | Thulogaun | 1356 | 313 | 37 | 122 | | 785 | 29 | 60 | | | 10 |
| | Haku | 2169 | 2085 | | | 21 | | | 28 | 12 | | 23 |
| | Gatlang | 1805 | 1751 | | | | | | 33 | | | 21 |
| | Goljung | 972 | 823 | | 21 | 14 | | | 13 | 89 | | 12 |
| | Total | 11809 | 8268 | 139 | 1167 | 63 | 1426 | 52 | 329 | 267 | 15 | 83 |
| | Percentage | 100 | 70.01 | 1.18 | 9.88 | 0.53 | 12.08 | 0.44 | 2.79 | 2.26 | 0.13 | 0.70 |

Source: CBS 2011

#### 5.3.2.4 Mother Tongue and Religion

Tamang (70.76%) is the main language widely spoken in the project area. Besides Tamang, the second most spoken language in the project area is Nepali (25.69%) followed by Gurung (2.76%), Newari (0.40%), Ghale (0.10%), and others (0.64%). Population distribution of the project area by mother tongue is presented in the Table-5.16. Hindu and Bouddha are the major religion of the people of project area. Besides, Islam, Kirat, Christian and Prakriti are other religions found in the project area.

**Table-5.10: Population Distribution by Mother Tongue**

| District | VDCs | Total | Tamang | Nepali | Gurung | Newar | Ghale | Others |
|---|---|---|---|---|---|---|---|---|
| Nuwakot | Manakamana | 3321 | 1716 | 1466 | 108 | 26 | | 5 |
| Rasuwa | Dandagaun | 2181 | 1564 | 393 | 218 | | | 11 |
| | Thulogaun | 1356 | 301 | 1046 | | | | 9 |
| | Haku | 2169 | 2078 | 36 | | 21 | 12 | 22 |
| | Gatlang | 1805 | 1784 | 43 | | | | 14 |
| | Goljung | 972 | 910 | 48 | | | | 14 |
| | Total | 11804 | 8353 | 3032 | 326 | 47 | 12 | 75 |
| | Percentage | 100 | 70.76 | 25.69 | 2.76 | 0.40 | 0.10 | 0.64 |

Source :CBS 2011

### 5.3.2.5 Festivals, Cultural and Religious Practices

Most of the people of the project area are Tamang and Gurung Community. So the major festivals of the project area are Lhosar, Baisakh Purnima Jatra and Falgun Purnima Jatra. Similarly the festivals adopted by the Hindu population in the project area are Vijaya Dashami, Tihar, Maghe Sankranti, Holi (colour festival), Ram Nawami, and Teej.

Popular cultural activities in the area are Dhami and Jhankri Naach (dance performed during various religious activities and festivals), Teej mela (fair), Bhailo and Deushi (singing and dancing activities) in Tihar, Holi, (Bhajan/Kirtan in Ram Nawami and Kirshnajanmastami (praying by singing) and cultural programs in Shripanchami.

### 5.3.2.6 Education and Literacy

According to National population census 2011, the total population (6 years and above) of the project area is 10748 with male 47.30% and female 52.70%. Of the total population (population of age 6 and above years), the average literacy rate of the project area is 54.12% consisting 60.11% male and 48.69% female literacy rate (Table-5.5). The average literacy rate (54.12%) of the project affected VDCs is slightly lower as compared with the average literacy rate (56.70%) of the project affected districts. This indicate the educational status of the project affected VDCs is satisfactory.

Table 5.11: Literacy Status of Project affected area

| VDCs | Total Population 6 years & above | | | Can Read&Write | | | Literacy Rate | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Male | Female | Total | Male | Female | Total | male | Female |
| Manakamana | 3083 | 1405 | 1678 | 1849 | 952 | 897 | 59.97 | 67.76 | 53.46 |
| Dandagaun | 1996 | 940 | 1056 | 1230 | 656 | 574 | 61.62 | 69.79 | 54.36 |
| Thulogaun | 1242 | 582 | 660 | 764 | 388 | 376 | 61.51 | 66.67 | 56.97 |
| Haku | 1942 | 933 | 1009 | 831 | 422 | 409 | 42.79 | 45.23 | 40.54 |
| Gatlang | 1591 | 791 | 800 | 830 | 474 | 356 | 52.17 | 59.92 | 44.50 |
| Goljung | 894 | 433 | 461 | 417 | 222 | 195 | 46.64 | 51.27 | 42.30 |
| Total | 10748 | 5084 | 5664 | 5921 | 3114 | 2807 | | | |
| Percentage | **100** | **47.30** | **52.70** | **41.33** | **35.15** | **46.88** | **54.12** | **60.11** | **48.69** |

Source: CBS 2011

According to district source of Rasuwa, there are 69 primary schools, 20 lower secondary schools, 12 secondary schools, 10 higher secondary schools in the project affected Rasuwa district. And there are 10 primary, 5 lower secondary, 3 secondary and 2 higher secondary schools in project affected VDCs of Rasuwa district. The list of schools of project affected VDC Rasuwa is given below.

Table- 5.12 Name of the Schools of Project affected VDCs

| Name of the School | VDC, Ward No | Primary | Lower Secondary | Secondary | Higher Secondary |
|---|---|---|---|---|---|
| Shree Parbati kunda HSS | Goljung | | | | * |
| Shree Nepal Rashtriya Sec. School | Gatlan | | | * | |
| Shree Gre LSS, Gre gau | Gatlan | | * | | |
| Shree Haku Sec. School, Thulo Haku | Haku | | | * | |
| Shree Kalika Primary School, Gogane | Haku | * | | | |
| Shree Tiru Primary School, Tiru | Haku | * | | | |
| Shree Hakubesi LSS, Hakubesi | Haku | | * | | |
| Shree Baluday Primary School, Mailungbesi | Haku | * | | | |
| Shree Gosaikunda Primary School, Sano Haku | Haku | * | | | |
| Shree Parbatikunda Primary School, Haku | Haku | * | | | |
| Shree Bhumedevi Sec. School, Thulogau | Thulogau | | | * | |
| Shree Saraswoti LSS, Paire | Thulogau | | * | | |
| Shree Simle Primary School Simle | Thulogau | * | | | |
| Shree Dadagau HSS, Dadagau | Dadagau | | | | * |
| Shree Panchalinge LSS, Khadku | Dadagau | | * | | |
| Shree Karumran LSS, Karumran | Dadagau | | * | | |
| Shree Chipleti Primary School, | Dadagau | * | | | |

| | | | | | |
|---|---|---|---|---|---|
| Chipleti | | | | | |
| Shree Ganesh Primary School, Siruchet | Dadagau | * | | | |
| Shree Dipendra Primary School, Katunje | Dadagau | * | | | |
| Shree Bhumedevi Primary School, Karumran | Dadagau | * | | | |
| **Total** | | **10** | **5** | **3** | **2** |

**Source: District Profile, Rasuwa 2071**

#### 5.3.2.7 Migration

Due to presence of infrastructures, better facilities, and fertile cultivated land, the in-migration pattern from hilly area to terai region is common practice in the project area. The out-migration, specially the young generation migrates to abroad seeking for employment is also common. Malaysia, Qatar and Dubai are the main destinations in abroad to most of the migrant. Hence, remittance is the prominent source of income for most landless, poor, and marginalized households of the project area.

The in-migration to the center Kathmandu for various purposes like business, employment, study and medical services is also common in the project area.
Unemployment, lower educational level, low agricultural production and desire of improving quality of life as well as social trend are the main reasons of migration in the project area. Migration has helped to improve socio-economic status of the local people of the project area and positive impact on local economy.

#### 5.3.2.8 Gender Status

About 52.46% of total population is women in the project area however; the literacy rate of women in the project area is low (48.69%) as compared with the male literacy rate (60.11%). There are fundamental challenges of gender equality in the project area. Domestic and social burden fall on the women as they are expected to undertake all the domestic chores like fetching water, cooking, washing, food processing, household maintenance, hygiene and sanitation activities and looking after the children in addition to feeding their families. The result is that rather than being able to concentrate on activities that earn income, many women spend majority of their time undertaking domestic activities. In regards to land and property ownership women are known to have a say on them.

The decision making process on economic activities is mostly exercised by the both male and female. However, women have lack of access to land and property holding and restrictions on family inheritance. The result is that rather than being able to concentrate

on activities that earn income, many women must spend the majority of their time undertaking domestic activities.

### 5.3.2.9 Economically Active Population and Economic Activities

According to CBS 2011, the total population of age 15 to 59 years of the project affected VDCs is calculated to be 6351 which is 53.78% of the total population of the project affected VDCs. Hence, there is 53.78% population categorized as economically active. Similarly, there is 46.22% dependent population of which 34.68% are below 15 years and 11.54% are senior citizen (sixty years and above age). The dependency ratio in the town is 1:1.16; this is very high, as every 100 people who are working have to support 116 dependants Unemployment.

Agricultural is the main source of income for the majority of people in the project area. Food crops such as rice, wheat, maize and millet are grown for food. Cash crops such as potato, beans and seasonal vegetables are grown by some subsistence farmers for their daily consumption purpose. Livestock is farmed for meat and milk.

### 5.3.2.10 Occupation and Employment

The major occupation of the people of the project area is subsistence farming. After farming, the people are engaged in trade/business, service, labor, manufacturing, transportation and foreign employment. Since there are many new projects running in the project area, the majority of unskilled people are engaged in daily wage activities in the projects operating there. Tourism (trekking guide) is another attractive occupation for the youth of project area**.**

### 5.3.2.11 Public Health, Drinking Water and Sanitation

Health posts and sub-health posts are available almost the entire project affected VDCs. The district level health facility is available in district headquarters Dhunche, Rasuwa and Bidur Nuwakot. Similarly, a rural hospital, which is located at Betrawati bazaar of Laharepauwa VDC (Rasuwa district), is also providing health service to the project affected VDCs (Manakamana, Dadagaun and Thulogaun). Falls/injuries/fractures, gastric, diarrhea, skin diseases, mouth complaints/toothaches, Respiratory Tract Infections, Headache, Intestinal Worms, Pyrexia of Unknown Origin, abdominal pains, bronchitis and ear complaints, Vitamin and nutritional disease are the most common diseases reported from the project area. (Source: District Profile of Rasuwa, 2071). There are many NGOs

and INGOs working in the field of health sector in district level. KFK the non government organization working in health sector is found in Goljung VDC of project area.

On the average 1266 households (46.94% of total households) in the project area are equipped with toilet facilities. This indicates that the level of awareness particularly towards the use of toilet is satisfactory in the project area. However, still a large portion of population of the project area use open defecation along the river or in the open fields. Tap/piped water; spout water, uncovered well and river are the major sources of drinking water in the project area. Among the total households of the project area, 80.05% use tap/piped water, 14.02% use spout water, 3.08% use uncovered well and 1.37% use river for drinking purpose. (source: CBS 2011)

### 5.3.2.12 Infrastructure

#### i) Transportation

Pasang Lahmu Highway from Kathmandu to Dhunche is the main road access to the project area. Galchi-Trishuli road is also used to entre project area. The transmission line alignment is close to the link road. Daily bus services from Kathmandu to Trishuli and Trushuli to Dhunche available throughout the year. Similarly, the nearest airport to the site is Kathmandu Tribhuwan airport.

Most of the section of the transmission line corridor has no road access though the transportation facility to project district has highly developed. The project affected VDCs Gatlang and Thulogau have Kachchi road, however it haven't facilitated to daily bus services. Dadagau VDC has Kachchi road and it has daily bus service. The local bus from Dhunche goes to this VDC once a day. Though Haku VDC is large in size, it is far from infrastructural development. There is no road facility in this VDC. There is only feeder road to connect this VDC to the district headquarter. However, the proposed substations has accessed through daily bus services from Kathmandu.

#### ii) Communication

Communication services such as mobile, CDMA and landline phone facilities are available in most of the VDCs. Modern communication facilities like cable-network, e-mail, internet and fax are available in the market areas. Accesses of some local and national level newspapers are also available in the district head quarters, settlement close to the main high way and market areas.

### iii) Energy

Electricity is one of the major sources of energy for lighting in the project area. Almost all project affected VDCs are fully electrified through the national grid system or through solar power. Similarly, fuel wood is the main source of energy for cooking in the project area. Kerosene and LP gas are also used particularly in market centers.

### iv) Market centers and other service facility

Betrawati, Shanti bazaar, Dhunche, Syaprubeshi, Goljung are the major markets and trade centers of the project area. The average distance of these market centers from the proposed transmission line corridor is ranged from 500m to 25 km.

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

### v) Development Activities

There are a number of development activities found in the project area. There are some hydro electric projects that are constructed and some are in the process to construct in the project area. In the same way, there are cheese industries, mineral water industry in the project area. Some important development activities in the project area are shown Table-5.19.

**Table- 5.13: List of Development activities in the project area (districts)**

| SN | Name of structures | Location | Remarks |
|---|---|---|---|
| 1 | Chilime HEP (22 MW) | Syaphrubesi,Rasuwa | In Operation |
| 2 | Rasuwagadhi HEP (111 MW) | Timure, Thuman, Rasuwa | Under Construction |
| 3 | Upper Trishuli 3A HEP (60MW) | Betrawati, Rasuwa | Under Construction |
| 4 | Sanjen HEP (14.8 MW) | Chilime, Rasuwa | Under Construction |
| 5 | Mailung Khola HEP (6 MW) | Dadagau, Rasuwa | Under Construction |
| 6 | Gosaikunda Cheese Product Center | Syaphrubese-6, Chandanbari | In Operation |
| 7 | Lamtang Cheese Product Center | Lamtang-7, Kyanjin | In Operation |
| 8 | Nara I. Himalayan Spring Water Company | Dhunche-8, Dhunche | In Operation |

Source: District Profile, Rasuwa; 2071

### 5.3.2.13 Law and Order

Law and order situation in project area is comparatively improved after the changes in national politics. The zonal headquarters district police office and illaka police station is maintaining the law and order situation in the project area.

### 5.3.2.14 Religious and cultural places

Most of the people follow Bouddha religion in these areas so that most religious sites are Bouddha Gumbas. Besides these Baba Gosai Kunda, Uttar Gaya, Kalika Temple, Bhairavi, Jalapa Devi, Ugratara, Ram Temple etc are the major religious sites of the project area.

Nuwakot Darbar, Sagar Kunda, Devighat, Uttar Gaya, Bohadehi Tal, Panchakanya Surung, Himalayas, Cayangin valley, Surya Kunda, Parvati Kunda, Tatopani, Godatabela, Chandanbari Dhunche, Sapru etc are the main touristic and historical sites. During the field visit, the archeological, historical and cultural sites of significant importance along the ROW were not reported.

The major festivals of the project area are Buddha Jayanti, Baisakh Purne, Falgun Purne, Vijaya Dashami, Tihar, Teej, Maghe Sankranti, Fagu Holi, Ram Nawami, Uvali-Udhali and Lhosar. Lhosar festival is celebrated by the Sherpa, Tamang and Gurung, and Id for Muslim communities.

### 5.3.2.15 INGOs and NGOs Activities

Some Non-governmental Organizations (NGOs), Clubs and International Non-governmental Organizations (INGOs) are working in the field of energy & water supply, health & sanitation, sports, women awareness, infrastructure development and income generating activities in the project area. The major NGOs and INGOs which are working in the different fields of the project area are Decentralized Local Government Support Program supported by UNDP, Rural Community Infrastructure Works Program (DFID), Decentralized Action for Children and Women (UNICEF), Rural Access Improvement and Decentralization project (IDA), Agricultural Perspective Plan Program (DFID), Micro Enterprise Development Program (UNDP), National Development Volunteer Service (National Planning Commission) etc. These NGOs and INGOs are supporting local people to improve their socio-economic status.

### 5.3.2.16 Tourism Activities

The project affected Rasuwa district is rich in natural, cultural and historical touristic attractions. The Sanjen Himal, Ganesh Himal, Canjin Valley, Lantang Himal, Gosai Kunda, Dudh Kunda, Bhairab Kunda, Saraswoti Kunda, Parbati Kunda, Surya Kunda, Uttar Gaya Betrabati, are the major tourist attraction centers in Rasuwa district. Similarly, Gumbas, Mane Jatra, Syabru Naach, Home stay, Kalika temple, Dhaibung, Ghatu Naach are the cultural attractions of the project area.

### 5.3.3 Profile of the project affected households

#### 5.3.3.1 Population and Households

Households survey of 30 households from project affected VDCs have been conducted. The survey reveals that the total population of the project affected sample household is 208 of which 105 (50.48%) are male and 103 (49.52%) are female. Similarly, the average households size and sex ratio of the project affected households are 6.9 and 1.02 respectively. As per the broad age group classification, the majority of population falls in the age group of 15-59 year, which comprised of 61.08% population. Similarly, the total dependent population (population of the age group 0-14 years and senior citizen-age group of 60 year and above) is 81 (38.94%).

Type of family

Joint type of family is dominant in the project affected households. Of the total 30 households, 19 (63.33%) households are categorized as joint type and the rest 11 (36.67%) are nuclear type.

Marital status

Of the total 208 population, 110 (52.88%) are married and 91 (43.75%) and unmarried. Similarly, the population of widow/widower is 7 (3.37%).

#### 5.3.3.2 Religion

Hinduism and Buddhism are the two main religions followed by project affected households. The majority of the project affected households 80% are Buddhist followed by Hindu 20%. The dominant population of Buddhists is inhabited in Goljung, Gatlang, Haku and Dadagau VDCs. Similarly, Majority of Hindus is inhabited in Thulogau and Manakamana VDCs.

#### 5.3.3.3 Mother Tongue

Nepali and Tamang are the main mother tongues spoken by the surveyed households. About 73.33% of the surveyed households speak Tamang and the remaining 26.67% households speak Nepali language.

#### 5.3.3.4 Occupation

Agriculture is the main occupation of the surveyed households. About 29.55% of the surveyed households have adopted agriculture as a main occupation. The percentage of households occupied other than agriculture is Labour wage 28.79 % (18.94%, inside the country and 9.85%, outside the country); service (5.30%), students (19.70%) and

households work (14.39%). The table-5.14 depicts the detail of the occupational distribution of the surveyed households.

**Table-5.14: Occupational Composition of Surveyed Population (14 to 59 years) by sex**

| Major Occupations | Gender | | | | | |
|---|---|---|---|---|---|---|
| | Male | | Female | | Total | |
| | No. | % | No. | % | No. | % |
| Agriculture | 17 | 25.00 | 22 | 34.38 | 39 | 29.55 |
| Business and Small Industry | 3 | 4.41 | 0 | 0.00 | 3 | 2.27 |
| Labor wage(In country) | 15 | 22.06 | 10 | 15.63 | 25 | 18.94 |
| Labor wage(Outside country) | 13 | 19.12 | 0 | 0.00 | 13 | 9.85 |
| Service(Inside country) | 6 | 8.82 | 1 | 1.56 | 7 | 5.30 |
| Student | 14 | 20.59 | 12 | 18.75 | 26 | 19.70 |
| Household Work | 0 | 0.00 | 19 | 29.69 | 19 | 14.39 |
| Total | 68 | 100.00 | 64 | 100.00 | 132 | 100.00 |

source: Field Survey 2014

### 5.3.3.5 Literacy

From the household survey, it is revealed that 73.33% of the surveyed populations are literate with male literacy rate 80.0% and female literacy rate 66.32%.

**Table-5.15: Literacy Status (6 years and above) of Project affected population**

| Literacy Status | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Illiterate | 20 | 20.00 | 32 | 33.68 | 52 | 26.67 |
| Literate | 80 | 80.00 | 63 | 66.32 | 143 | 73.33 |
| Total | 100 | 100.00 | 95 | 100.00 | 195 | 100.00 |
| **Percentage** | **51.28** | | **48.72** | | **100.00** | |

Source: Field survey, 2014

Of the literate population, percentage of having Primary Level, Lower Secondary Level, Secondary Level, SLC, Intermediate Level and Bachelors Level education are 33.57, 22.38, 11.89, 2.80, 4.20 and 4.90 respectively. Population having literate only is 20.28%. The table-5.24 describes the educational attainment among the literate population of the sample households.

**Table-5.16: Educational Attainment among the Literate Population of the Project Area**

| Educational Attainment | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Literate only | 16 | 20.00 | 13 | 20.63 | 29 | 20.28 |
| Primary Level | 26 | 32.50 | 22 | 34.92 | 48 | 33.57 |
| Lower Secondary | 14 | 17.50 | 18 | 28.57 | 32 | 22.38 |
| Secondary | 11 | 13.75 | 6 | 9.52 | 17 | 11.89 |
| SLC | 3 | 3.75 | 1 | 1.59 | 4 | 2.80 |
| Intermediate | 5 | 6.25 | 1 | 1.59 | 6 | 4.20 |
| Bachelors and above | 5 | 6.25 | 2 | 3.17 | 7 | 4.90 |
| **Total (Literate)** | 80 | 100.00 | 63 | 100.00 | 143 | 100.00 |

Source: Field survey, 2014

### 5.3.3.6 Land ownership status and holding size

Households survey shows that hundred percent of the sampled households have their own land for cultivation. The average land holding size of the surveyed households is estimated to be 1.139ha. The higher landholding size is in Haku VDC (1.668) and the lower landholding size is in Dadagau VDC (0.424). The table-5.25 represents the average holdings size of the households of the surveyed population.

**Table-5.17: Land Holding of the Surveyed Households**

| Ward | HHs | Irrigated Khet(ha) | Bari(ha) | Pakho-Bari(ha) | Total(ha) | Ha/hh |
|---|---|---|---|---|---|---|
| Goljung | 4 | 1.071 | 3.374 | 0.714 | 5.159 | 1.290 |
| Haku | 13 | 3.571 | 14.337 | 3.775 | 21.683 | 1.668 |
| Dadagaon | 8 | 0.867 | 2.525 | | 3.392 | 0.424 |
| Thulogaon | 2 | 1.786 | 0.714 | | 2.5 | 1.250 |
| Mankamana | 3 | 0.561 | 0.867 | | 1.428 | 0.476 |
| Total | 30 | 7.856 | 21.817 | 4.489 | 34.162 | 1.139 |
| **Average** | **-** | **0.262** | **0.727** | **0.150** | **1.139** | |

Source: Field survey, 2014

## Land holding size

Surveyed households have been classified on the basis of different landholding categories such as marginal, small, medium, and large. Majority of the households i.e. 55.42% are categorized as small type families having own land ranges from 0.5 ha to 2.0 ha whereas 39.13% are medium type having land 2.0 ha to 4.0 ha and the rest 5.45% are marginal farmers having land less than 0.5 ha. The distribution of the land holding size on the basis of holding category is shown in Table-5.18.

**Table- 5.18: Distribution of Households by Landholding Size**

| Landholding Categories* | | Households | | Total Landholdings | |
|---|---|---|---|---|---|
| **Category** | **Size of holding (ha)** | **No.** | **%** | **Area(ha)** | **%** |
| Marginal | Up to 0.5 | 7 | 23.33 | 1.862 | 5.45 |
| Small | 0.5 - 1.0 | 9 | 30.00 | 6.734 | 19.71 |
| | 1.0 - 1.5 | 5 | 16.67 | 5.414 | 15.85 |
| | 1.5 - 2.0 | 4 | 13.33 | 6.785 | 19.86 |
| **Medium** | 2.0- 4.0 | **5** | 16.67 | 13.367 | 39.13 |
| **Total** | - | 30 | 100.00 | 34.162 | 100.00 |

Source: Household Survey 2014

*Landholding Categories based on Rural Credit Review Study 1991/92, Nepal Rastra Bank (Central Bank of Nepal), 1999

**Land holding size by type of land**

Low land irrigated paddy field (khet), up land (bari) and sloppy land ( pakho bari) are the main land types owned by surveyed households. On the basis of type of land, the holding size of bari is highest i.e. 0.727 ha followed by irrigated paddy field (0.262ha) and pakho bari (0.150ha).

**Land transaction**

From the field study, it is revealed that there was no any land transaction occurred during last year.

### 5.3.3..7 Agriculture

The main cereal crops grown by the surveyed households are paddy, wheat, maize, and millet. Similarly, cash crop like potatoes and oilseeds are also grown by some sampled households of upper side but very minimal amount. From the households' survey, the total production of paddy, wheat, maize, millet and are 17.64 MT, 6.02 MT, 21.56 MT and 11.41 MT respectively. Similarly, the average yield of paddy, wheat, maize and millet are 2.64 MT/ha, 1.91 MT/ha, 1.88 MT/ha and 1.14 MT/ha respectively. The detail of the major crops, production and yield are presented in Table-5.19.

**Table-5.19: Major Crop Area Coverage, Production and Yield in the Project Area.**

| Description | Major Crops | | | |
|---|---|---|---|---|
| | Paddy | Wheat | Maize | Millet |
| Total Cropped Area | 6.68 | 3.15 | 11.47 | 10.01 |
| Total Production (MT) | 17.64 | 6.02 | 21.56 | 11.41 |
| **Yield(MT/ha)** | **2.64** | **1.91** | **1.88** | **1.14** |

Source: Field survey, 2014

### 5.3.3.8 Income pattern

Households survey shows that the total average annual income of the surveyed households is Rs. 2,92,240. Of the total income share of remittance is highest i.e. 74,800 (25.60%) followed by bonus (19.71%), agriculture and animal husbandry (17.81%), service (12.70%), daily wages/porter (12.42%) and business (11.36). The Table-5.30 depicts the detail of the income sources of the surveyed households from different sectors.

**Table- 5.20: Annual Households Income by Type of Income in the Project Area**.

| Income Source | Average Income | % |
|---|---|---|
| Agriculture and animal husbandry Income | 52040 | 17.81 |
| Service | 37100 | 12.70 |
| Business | 33200 | 11.36 |
| Daily Wages/Porter | 36300 | 12.42 |
| Pension/Briddha Bhatta | 1200 | 0.41 |
| Remittance | 74800 | 25.60 |
| Bonus | 57600 | 19.71 |
| **Total Average Income** | 292240 | 100.00 |

Source: Field survey, 2014

### 5.3.3.9 Expenditure pattern

The average expenditure of the surveyed households is Rs. 1,90,423. The share of expenditure on non-food item is higher i.e. 53.48% as compared to food item (46.52%). Among the non-food items, the larger

portion of expenditure is for education i.e. 14.49%. After education, people spend more income to celebrate festivals (13.31%). The share of clothing is highest 12.05% followed by medicine (4.76%), fuel (3.38%), transportation (3.02%) and communication and electricity (2.47%). The distribution of expenditure pattern among the surveyed households is different in different VDCs.

The income and expenditure pattern of the surveyed households shows that the total average annual saving is Rs. 1,01,817.

#### 5.3.3.10 Drinking water

Pipe water supply is the major source of drinking water of the surveyed population. Households survey shows that 83.33% of the surveyed households of VDCs use pipe water supply in their homes where 13.33% of surveyed households use public tap for drinking purpose. The households survey shows that the available supply of drinking water is sufficient throughout the year.

#### 5.3.3.11 Source of energy

**Cooking fuel**

Fuel wood, LP gas and Bio-gas are the main sources of energy for cooking purpose of the surveyed households. About 80.00% of the surveyed households use fuel wood for cooking purpose while 13.33% use LP gas and 6.67% use Bio gas. Households of Haku VDC use fuel wood only for cooking purpose.

Fuel wood is collected mostly from community forest and private forest. About 79.17% of the households collect fuel wood from community forest while 20.83% collect from own (private) forest.

**Lighting fuel**

Household survey shows that most of the surveyed households (83.33%) use electricity for lighting purpose, where 13.33% use solar and remaining 3.33% of the surveyed households use kerosene lamp for lighting purpose.

#### 5.3.3.12 Health and sanitation

On the average, 63.33% of the surveyed households have their own toilet for defection. Similarly, nearby forest area and open field are used by 26.67% households respectively.

Management of solid waste disposal is poor in the surveyed households. Three methods such as dump at safe place, burn and buried have been adopted by the surveyed households for the management of solid waste disposal. About 46.67% of the households have dumped the solid waste at safe place, while 23.33% buried in near by house and 20.00% burnt the solid waste.

#### 5.3.3.13 Knowledge and Attitude Regarding the Project

Knowledge

Of the total 30 project affected households, 26 (86.67%) households have knowledge about the proposed project and its activities. According to the surveyed households, the main sources of information about the project activity are through the NEA employers, neighbors and others. About 80.77% of the households got information from NEA employers, 11.54% got information through neighbors and 7.69% have knowledge through other sources.

Attitude

About 56.67% of the households have shown their positive attitude towards the proposed project while 16.67% of the households are against the project activities and 20.00% are neutral.

#### 5.3.3.14 Expectation from the project

The expectations of the project affected families are mainly for good compensation for the land and property, employment, electricity facility and local development. However, majority (66.67%) of the households have shown their interest for good compensation. Similarly, 26.67% of the households have shown their expectation for employment and 6.67% for local development.

#### 5.3.3.15 Willingness for compensation by property type

Three options such as cash, land for land and house for house have been preferred by the surveyed households for compensation by property type. Percentage of households preferred for cash compensation is highest i.e. 80.00% followed by land for land (20.00%).

**Use of cash compensation**

The surveyed households have expressed their interest for using cash compensation on purchase of land, construction of new house and to run business. About 70.83% households wanted to use cash compensation for the purchase of land in the project area or its vicinity. Similarly, 12.50% of the households are willingness to start new business and 12.50% for pay loan.

#### 5.3.3.16 Description of the house of the project affected families

- **House**

*By wall type*

Hundred percent of the surveyed households have their own house for residence. The wall of houses is usually constructed mud and stone/brick, wood, bamboo and galvanized zinc sheet. About 73.33% of the houses of the surveyed households are made up of mud and stone/brick wall followed by wooden wall (23.33%) and bamboo wall (3.33). The mud and stone/brick wall houses are common through the project affected VDCs.

By roof type

Wooden, zinc plates and stone type roof are prevalent in the surveyed households. Majority of the households (90.00%) have their house with galvanized zinc sheet followed by stone (6.67%), and wooden (3.33%).

By no. of storey

Two storey houses are common among the surveyed households. About 90.00% of the households have their house with 2 storey where only 10.00% households have one story houses.

**CHAPTER-VI**
**IMPACT ASSESSMENT**

## 6.0 Introduction

This chapter addresses the likely adverse impacts in the construction and operation of the proposed 132 /220 kV Chilime Sub-station Hub and Chilime Trishuli 220 kV Transmission line project. The construction and operation of the project will result in changes to the existing baseline condition. The general discussions are organized in three categories, namely the physical, biological and socio-economic and cultural environment, and split into the construction and operation phases.

## 6.1 Physical Impacts

The main physical impacts on the environment are those associated with land take for stringing of the transmission line, for construction of tower pads and maintenance of RoW. The major impacts anticipated during the construction phase are discussed in the sections below.

### 6.1.1 Watershed and Natural Drainage

**A. Construction Phase**

Since most of the tower pads are located at the top of the subdued hillocks, mid-hills or the ridges the interference with drainage patterns due to the construction of the tower pads will be minimal and environmental regulations are maintained. The impact due to site clearing, clearance of trees, stringing activities, excavation for tower construction and material transportation may disturb watershed condition of the area to some extent and better strategies to be adapted.

Approximately 225 m² of land will be disturbed for each tower pad construction. However, the area for tower pad may vary as per the gradient, location and weight of towers. The earthwork associated with tower construction will be confined to tower base area. Therefore no significant impact is expected. The cultivated area around the tower pads may be affected due to compaction during the construction and transportation of materials. Disruption of natural drainage lines and soil erosion while stringing the line across the river can be anticipated during the construction phase. However, since the Angle Points are not located near the river or streams except for a few locations like AP 10, AP27, AP 28 and AP 35, AP37 the probability of the disruption of natural drainage will be insignificant and extent is determinant.

Some APs are located in the slide prone area and the construction of these towers may contribute to soil erosion. However, since the requirement of land for the construction of tower foundation is limited the impact on drainage and soil erosion is envisioned to be low and are configured. Therefore, the impact is expected to be site specific, low in magnitude and for a short duration.

**B. Operation Phase**

No significant impact on the watershed and natural drainage is expected during the operation and maintenance period.

### 6.1.2 Geomorphology and Geology

**A. Construction Phase**

Failure of the structure may be triggered if the towers are located at instable grounds. This may give rise to accident and impact on health and lives of the labours and local people. Another impact will be possibility of loss of assets. The impact is expected to be site specific, high in magnitude and for long duration.

**B. Operation Phase**

The failure of structure during the operation phase may induce to major impact on human health of the passerby. The impact is expected to be site specific, high in magnitude and for long duration.

### 6.1.3 Topography

**A. Construction Phase**

The land interference during construction of the transmission line is related to the tower foundation, substations and lack of restraint of the RoW. This may result in the change in landscape. No major changes in topography are envisaged during this phase and are configured to mitigate vulnerability. The visualised impact on topographic changes is considered to be low in magnitude,, site specific and for long term

**B. Operation Phase**

No impact on topography is expected during the operation phase except for the impact on natural scenery. The Impact is high in magnitude, local and for long term.

### 6.1.4 Land Take and Land Use

**A. Construction Phase**

The land use changes involved in the implementation of the project will be basically due to the permanent and temporary land acquisition under the Right-of-Way, Substation, Mobile camp and for the construction of tower pads.The project will require 84.556 ha total land for the placement of tower pads, RoW of the transmission line and substations. Out of this 84.556 ha, permanently required 5.518 ha for Tower foundation and Substation and 79.038ha will be temporarily acquired for mobile camps and Right-of-Way of alignment components.

The total number of angle towers will be 39 and an angle tower will typically require an area of 15m x 15m. Considering this area, a total of 0.878 ha will be acquired permanently for construction of 39 tower pads. The substation will acquire 4.64 ha area.

The summary of the land-take and land-use are given in the tables below.

**Table-6.1: Total land-take for the project**

| SN | Description | No. of towers | Area of 1 tower (sq. m.) | Total area (sq.m) | Total area, ha. |
|---|---|---|---|---|---|
| 1 | Permanent land-take for the towers | 39 | 225 | 8785 | 0.878 |
| 2 | Permanent land-take for the substations (1) | | | 46400 | 4.64 |
| 3 | Temporary land ( land under RoW) excluding tower area | 26.5 km | | 785880 | 78.588 |
| 4 | Temporary Land-take (Camp) | | | 4500 | 0.45 |
| | **TOTAL** | | | **845565** | **84.556** |

**Table-6.2: Land-use of the Land-take**

| SN | Type of land take | Cultivated Area, ha. | Forest & Others, ha. | Sanjen & Chilime HEP |
|---|---|---|---|---|
| 1 | Permanent | 3.288 | 0.361 | 1.87 |
| 2 | Temporary | 34.497 | 44.541 | |

**B. Operation Phase**

The impact on the land use changes of the permanent land-take for the towers and substations is expected and it will remain forever. The land under the RoW will be restricted for the erection of any type of structure beside the towers for the project and plantation of trees of tall species. However, cultivation will be allowed. All temporary land acquired will be converted to its original use or agreed new uses

towards the end of the construction period and handed over to their owners. The impact can be classified as high in magnitude, local in terms of extent and of long-term in terms of duration.

### 6.1.5 Air and Noise Quality

**A. Construction Phase**

The construction activities involved in the transmission line project consists of site clearance, excavation for the tower; concreting and erection fugitive dust emissions will be expected. Apart from this movement of transporting vehicles carrying the construction materials along the gravel roads might generate fugitive as well as combustion emissions and will cause minor impact on air quality. Since the construction activities are limited to small area and short termed at a location of tower foundation and vehicular movement and frequency is low; the envisaged impacts on the ambient air quality low in magnitude, site specific in terms of extent and of short duration.

The emission of noise and vibrations are inevitable during construction though only insignificant interruption in noise quality has been expected. The location of the Angle Points are relatively far from the settlements so only the settlements close to the tower pad and road side will feel the noise disturbances due to vehicular movement and construction activities. Noise pollution will be temporary and will not be different from the prevailing conditions due to low traffic movement along the roadside.
The impact is expected to be low in magnitude, site specific and for a short duration.

**B. Operation Phase**

No major impact on air quality is envisaged during the operation phase. However, a kind of humming sound may be created at the substation area. The transmission overhead lines do create some noise in certain circumstances; minor surface damage, dirt or some weather conditions can cause the lines to crackle or hum slightly. This is due to a phenomenon called Corona effect. The effect of corona is conspicuous during rain. However, noise due to the corona effect of transmission line with voltage level of 220 kV will not be significant since the alignment does not pass very close to the settlements. The impact is expected to be low in magnitude, long termed and site specific.

### 6.1.6 Water Quality

**A. Construction Phase**

During the construction period, water will be used from nearby river and streams. Therefore, there is possibility of water pollution especially in sectors where the line crosses the rivers and streams and where the tower pads are situated close to them. Soil

disturbances associated with construction activities of tower pads, the improper disposal of solid wastes and chemicals such as cement slurry, construction materials, and human wastes into the river or streams may deteriorate the river water quality and other existing water bodies around the construction area. This may lead to water borne diseases and other problems especially in the adjacent villages where people use the flow from these streams for household chores. The impact is expected to be moderate in magnitude, site specific and for a short duration.

**B. Operation Phase**

The operation and maintenance activities of the transmission will not have impact on the water quality in the project impact area.

### 6.1.7 Waste and Spoil Disposal

**A. Construction Phase**

The improper disposal of solid waste like cement bags, iron bar and other left -over construction materials, kitchen waste and waste generated by the temporary labor camp might cause adverse impact to the environment. The spoil generated due to the excavation of tower pad will also deteriorate nearby land and water quality of the area. More than 90% of the volume of muck volume will be used for back filling and compaction. The magnitude of impact is considered to be low, extent is site specific and duration is short term.

**B. Operation Phase**

No impact on waste and spoil disposal is expected during the operation phase.

### 6.1.8 Storage of Construction Material and Camps

**A. Construction Phase**

Storage of construction materials will result to the land degradation of the particular area. Likewise, the area designated for the camps will also damage the leased or rented area. The impact will be low in magnitude, site specific and for short duration..

**B. Operation Phase**

No impact is expected during the operation and maintenance period.

### 6.1.9 Crossing of Other Utilities and Interferences

The proposed transmission line alignment crosses roads, rivers, transmission line and structures. Crossings of communication utilities and transmission lines will result in interference to the communication system. Radio interference can disrupt television and

AM (amplitude modulated) radio reception close to a line. Interference can some time be noticed at a distance of 150 meter away. By contrast, FM (frequency modulated) system is affected very little by interference. Interference varies according to the position of the transmission line between transmitter and receiver.

In some cases receiving conditions can be improved due to the reflections caused by a transmission line. The magnitude of the impact is considered to be insignificant. The impact will be low in magnitude, site specific and for short duration.

### 6.1.10 Use of Coolant Oil in the Transformer

Coolant oil is used in the transformer to maintain the temperature. Prior to 1995 PCBs were used as coolent oil in the transformer in Nepal. Now, PCBs are legally prohibited in Nepal. However, there are chances of its use or contamination of the transformer oils by PCBs. In such cases, there is potential of health related problems to the operational workers and communities located close to the substation sites.

The other issue related to the oil use in transformer is the leakage of the oils and contamination of the land and receiving surface and sub-surface water bodies. Though the substations are provisioned to limit the oil leakages in the design, observations in the Nepalese sub-stations have revealed such leakage occurring in many areas, which is not properly attended. The envisaged impact is of moderate significance, site specific and long term.

## 6.2 Biological Environment

### 6.2.1 Vegetation/Forest Resources

#### 6.2.1.1 Construction Phase

Altogether, project includes 39 towers. Of the total towers, 16 towers lie in the forest land (Towers in community forest=11, area equivalent to 11 Towers =0.2475. ha & Towers in barren land =5, area equivalent to 5 Towers =0.1125 ha in total 16 area = 0.36 ha). Due to the implementation of the proposed project, approximately 40.608 ha of community forest including forest area of R-O-W and towers, river = 1.23 ha, barren = 2.703 ha) in total 44.901 ha will be affected. During the construction of the project, in total about 15491 trees (more than 10 cm dbh) in the community forest will be directly affected due to the clearance of 30 m ROW of the transmission line which passes thorough 13.536 km (14.976 km belongs to community forest, barren land/cliffs/and rivers) of forest out of

26.50 km length of the proposed alignment. The detail of forest loss in Community forest in terms of both dbh and species is given in table 6.2.3.

The major impacts of transmission line construction on vegetation will include removal of plants from the RoW due to the erection of transmission towers and stringing of line. More than 51.07 % of the proposed T/L is under the vegetation cover mostly predominantly with the Sal forest with other associates chilaune ( *Schima walichii*) and Salla (Pinus Sp) tree species. Only 43.52% of the proposed alignment passes through the cultivated land and about 5.41% is under the barren/ cliffs and water bodies. Most of the trees predominant Sal (*Shores robusta* ), associates with Chilaune (*Schima Walichii*), Khair (*Acacia catechu*), , Simal (*Bombax ceiba*), Sano Dhayero (*Woodfordia fruticos*), , Khote salla (*Pinus Roxburghii*) and some bamboo clumps of small/big sizes need to be cleared at least at 3 different places along the alignment.

Besides that, impact will occur on ground flora especially at the tower pad site due to the excavation and deposition of spoil materials for the construction of transmission tower. None of any plant species affected by the project construction belongs to the category of protected species of plants. The overall magnitude of impact on vegetation is considered to be low.

**Clearance of R-O-W**

The clearance percentage required along the transmission line alignment is estimated to be 8 % associated with rocky, ridges, barren land and hills in Nuwakot district and 12% associated with rocky, barren land ,ridges and hills in Rasuwa district. This is because of the topography of the ridges and hills in the middle hill ranges. A total of 15491 trees mostly of the pole sizes are expected to be felled and fewer trees sized. Since the TL passes through mountain ridges, hills, it will not be necessary to clear the forest at all parts along the TL. So clearance percentage would be expected to be 85 to 90 % required in both the district.

During the construction period almost all the trees having more than 10 cm dbh under the right of way of proposed transmission line will be cleared for the construction and erection of the transmission tower. A total of 44.901 ha of forest will be directly affected from 30 m wide transmission line. Vegetation clearance will be required from the community forest (40.608 ha) and remaining 4.293 ha will be of barren/cliffs/water bodies. A total of 15491 (more than 10 cm dbh) trees consisting 4383.909 cubic meter of

standing wood volume will be cleared for the proposed alignment. Majority of the trees to be lost are Sal, Simal, Chilaune, Khote salla, etc. A total of 4181855 kg of biomass will be lost from the project area. The total no of Plants Loss in Rasuwa and Nuwakot district is provided in the table 6.3

**Table 6.3 Total No of Plant Loss in Rasuwa and Nuwakot district**

| SN | Species | Botanical Name | Pole | Tree | Total No |
|---|---|---|---|---|---|
| 1 | Salla | *Pinus Walichiana* | 4715 | 449 | 5164 |
| 2 | Laligurans | *Rhodendron Sp* | 674 | | 674 |
| 3 | Chilaune | *Schima wallichii* | 1572 | | 1572 |
| 4 | Katus | *Castanopsis indica* | 674 | | 674 |
| 5 | Botdhayero | *Lagerstroemia spp* | 1572 | | 1572 |
| 6 | Bhalayo | *Rhus Javonica* | 225 | | 225 |
| 7 | Sindure | *Bixa Orlena* | 674 | | 674 |
| 8 | Guenli | *Callicarpa Sp* | 225 | | 225 |
| 9 | Khari | *Celtis australis* | 225 | 224 | 449 |
| 10 | Sal | *Shorea robusta* | 1347 | | 1347 |
| 11 | Mauwa | *Engelhardtia spicata* | 674 | | 674 |
| 12 | Simal | *Bombax ceiba* | 443 | | 443 |
| 13 | Khiro | *Cucumis Sp* | 225 | | 225 |
| 14 | Areli | *Acacia spp* | 225 | | 225 |
| 15 | Bakaino | *Melia Sp* | 225 | | 225 |
| 16 | Belauti | *Psidium guljava* | 225 | | 225 |
| 17 | Gogan | *Saurauia Sp* | 898 | | 898 |
| | **Total** | | **14818** | **673** | **15491** |

As far as tree loss is concerned, 15491 no of trees mostly o f pole sized trees will be clear felled. About 5164 Salla trees are expected to be cleared felled during the construction period followed by Chilaune 1572, Botdhanyero 1572 and Sal 1347 in number respectively.

## Table-6.4 Forest Losses at Different Project Components

| Forest loss at Different Project Components | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Loss of Vegetation | | | | | |
| SN | Project Component | Types of Forest | Forest area (ha.) | Seedling/ha | Sapling/ha | No. of trees > 10 cm dbh | Crown Cover % | Basal Area (m2/Ha.) | Forest type |
| 1 | TL RoW | Community | 40.608 | 785 | 854 | 14010 | 65 | 11.485 | Hill Sal & Mixed Sal |
| 2 | Tower Pad | Community | 0.36 | 7 | 8 | 124 | 45 | 0.100 | |
| 3 | Cf/BL/Rv | Forest | 3.933 | 76 | 82 | 1357 | 30 | 1.110 | |
| | | **Total** | **44.901** | **868** | **944** | **15491** | | **12.700** | |

**Table 6.5 Tree Loss in terms of Plant species (mixed forest)**

| SN | Species | Botanical Name | avg DBH | Se/ha | Sa/ha | Pole | Tree | Vol (cum) | CFT | Chatta | Wet,kg | Dry,kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Salla | *Pinus Walichiana* | 10-32 | 60 | 40 | 4715 | 449.00 | 2720.552 | 96117.09 | 96.11709 | 2595161 | 1749331 |
| 2 | Laligurans | *Rhodendron Sp* | 10-30 | | | 674 | | 23.12402 | 816.9714 | 0.816971 | 22058.23 | 14868.88 |
| 3 | Chilaune | *Schima wallichii* | 10-30 | 100 | 40 | 1572 | | 350.6768 | 12389.41 | 12.38941 | 334514.1 | 225487.3 |
| 4 | Katus | *Castanopsis indica* | 10-30 | | 20 | 674 | | 286.4684 | 10120.93 | 10.12093 | 273265.1 | 184200.9 |
| 5 | Botdhayero | *Lagerstroemia spp* | 10-30 | 56 | 52 | 1572 | | 35.24729 | 1245.287 | 1.245287 | 33622.74 | 22664.22 |
| 6 | Bhalayo | *Rhus Javonica* | 10-30 | 60 | 56 | 225 | | 194.6458 | 6876.837 | 6.876837 | 185674.6 | 125158.4 |
| 7 | Sindure | *Bixa Orlena* | 10-30 | 12 | 20 | 674 | | 3.816585 | 134.8399 | 0.13484 | 3640.679 | 2454.087 |
| 8 | Guenli | *Callicarpa Sp* | 10-30 | | | 225 | | 17.28689 | 610.7456 | 0.610746 | 16490.13 | 11115.57 |
| 9 | Khari | *Celtis australis* | 10-38 | | | 225 | 224.00 | 177.808 | 6281.955 | 6.281955 | 169612.8 | 114331.6 |
| 10 | Sal | *Shorea robusta* | 10-30 | 140 | 148 | 1347 | | 158.0515 | 5583.96 | 5.58396 | 150766.9 | 101628.1 |
| 11 | Mauwa | *Engelhardtia spicata* | 10-30 | | | 674 | | 124.3758 | 4394.196 | 4.394196 | 118643.3 | 79974.37 |
| 12 | Simal | *Bombax ceiba* | 10-30 | | | 443 | | 82.16883 | 2903.025 | 2.903025 | 78381.67 | 52835.05 |
| 13 | Khiro | *Cucumis Sp* | 10-30 | | | 225 | | 60.61635 | 2141.576 | 2.141576 | 57822.54 | 38976.68 |
| 14 | Areli | *Acacia spp* | 10-30 | 32 | 40 | 225 | | 5.38812 | 190.3623 | 0.190362 | 5139.782 | 3464.593 |
| 15 | Bakaino | *Melia Sp* | 10-30 | | | 225 | | 27.16511 | 959.7432 | 0.959743 | 25913.07 | 17467.33 |
| 16 | Belauti | *Psidium guljava* | 10-30 | | | 225 | | 15.93986 | 563.1551 | 0.563155 | 15205.19 | 10249.42 |
| 17 | Gogan | *Saurauia Sp* | 10-30 | 16 | 28 | 898 | | 100.5782 | 3553.429 | 3.553429 | 95942.59 | 64672.41 |
| | Total | | | 868 | 944 | 14818 | 673.00 | 4383.909 | 154883.5 | 154.8835 | 4181855 | 2818880 |

Major land use changes are not expected from the vegetation clearance and the removal of trees will not disturb the existing ecological goods and services. The forest land to be used does not exist in any ecologically sensitive area. The impact on the forest and vegetation cover will be moderate in magnitude, local in extent and long term. The loss of forest and vegetation cover might create indirect impacts resulting in the degradation of the middle hills environment in regional context for a long duration. The details of species wise tree loss in terms of no, wood volume and biomass is given in table 6.3 and also shows the regeneration rate of seedlings/ha and saplings/ha are 868 and 944 respectively. It is likely to be affected during construction phase and the crown cover of the vegetation is found to be varied from 20–70%.

During the operation phase only trees which grow under the RoW after some years might need to be cleared and regular timing of tall trees and growing shrubs will change the cover. In terms of biological environment, the project will yield beneficial impacts from the afforestation program that will be implemented to replenish the loss of forest and vegetation especially in the project affected community forests. The impact is low, site specific and local and long termed.

### Protected species

Sal (*Shorea robusta*), Simal (*Bombax ceiba)* and Khair (*Acacia catechu*) are protected tree species that are going to be lost. However, compared to the existing forest the magnitude of impact is considered to be low, extent is local and duration is short term.

### Harvesting of Non-Timber Forest Products (NTFP)

The proposed project does not directly affect the NTFPs of the project vicinity and low impact is envisaged for NTFP. The project is not rich in the valuable NTFP and the magnitude of impact is considerable to be low and TL RoW corridor has mostly avoided important forest patches. Extent is local and duration is short term. However, even the collection of tiny volumes of NTFPs might result in social conflicts. The occasional intervention of just few people maintaining the TL will result insignificant effect on the forest itself and the NTFP along the TL alignment. Therefore, these impacts are considered as low in magnitude, site specific and of short duration.

**Table:6.6 Loss of NTFP**

| Commercially Important species( other than trees)NTFP | Government Managed (No) | Community Managed (No) | Religious (No) | Leaseh old (No) | Private (No) |
|---|---|---|---|---|---|
| Amala | _ | Frequent | _ | _ | _ |
| Chutro | _ | Rare | _ | _ | _ |
| Chirainto | - | Frequent | _ | _ | _ |
| Kafal | _ | Frequent | _ | _ | _ |
| Dudhe | _ | Rare | _ | _ | _ |
| Kurello | _ | Rare | _ | _ | _ |
| Jatropha | _ | Rare | _ | _ | _ |
| Alloevera | _ | Rare | _ | _ | _ |
| Asuro | _ | Frequent | _ | _ | _ |
| Amriso | _ | Rae | _ | _ | _ |

Source: Field Survey,2014

(Note Estimation of NTFPs in number could not be made due to practical reason. Rather it is estimated as Rare, Frequent, Abundant and Dominant)

### Increase in Demand for Fuel Wood and Timber

Skilled, unskilled and semi skilled labor will be involved in the construction of the project. It is assumed that most of the labor force will be from the local areas. There will be a few people from outside the project area for short period to time. Due to this, the increase in demand of fuel wood and timber during the construction period is expected to be low. Moreover, there will not be any permanent settlements that may lead to encroachment on forest land. The impact will be considered to be low in magnitude, site specific and short termed.

## 6.2.1.2 Operation Phase

### Clearance of ROW

The vegetation of the Right of Way will be maintaining compatible clearance with safe operation. The trees will be trimmed and cuts down in every 3-4 years to maintain the required clearances. ROW clearance will not only change the vegetation cover but also will alter the ecological condition to some extent that may allow invasion of new alien species.

However, the overall operation phase impact on vegetation will be low because once the ROW is cleared, frequent trimming and felling is not required. The extent is site specific and duration is long term.

### Increase Access to Forest

The clearance of 30 m ROW in the forest land may provide easy access to the local people for the intrusion of forest and its products. The magnitude of impact is considered to be low because most of the forest in the project area belongs to community and leasehold forest, which is managed by the community forest user groups. Furthermore, strict rule and regulation and monitoring by the user groups will also control the unnecessary encroachment. This activity will not have a noticeable effect on the forest and vegetation.

## 6.2.2 Disturbance to Wildlife

### 6.2.2.1 Construction Phase

The degree of impact on wild animals depends entirely on the species present, vegetation type and abundance of food. Possible impacts on wildlife population due to the project construction will be minimal. The potential adverse impacts on wildlife and birds are listed below.

#### Loss of Habitat

The construction of transmission line which will require site clearance and other construction related disturbance will cause loss of vegetation and will affect wildlife habitat to some extent. Since, the area to be cleared is quite limited and remaining forest area is large, the magnitude of impact is considered to be low, extent is site specific and duration is long term.

### Avian hazards

The operation of 220 kV TL and sub-station may affect birds through the presence of the conductors (wires).The conductor wires being at the highest height and being thin are difficult to birds to detect and avoid it, may injured or death from collisions. This type of impact is expected to be high in low visibility condition especially bad weather and night time, but it is very difficult to quantify the risks. The magnitude of impact is expected to be low, extent is site specific and duration is long time.

### Hunting and poaching by Labor Force

Hunting and poaching will be one of the likely impacts on wildlife due to the presence of construction workers. The local poachers or hunters among the work force might be attracted to hint birds and other wild animals. The possibility of hunting and trapping by workers during construction period will have some adverse impact on wild fauna. However, such pressure on fauna will be site specific and will decrease once the work is

completed. The overall magnitude of impact is considered to be low, extent is site specific and duration is short period.

**Table-6.7 Summary Table of Biological Impact Matrix**

| Issues | Impacts | Qualifier | | |
|---|---|---|---|---|
| **Construction Phase** | | | | |
| Vegetation/forest resources | Clearance of 44.901 ha of forest land falls under RoW | H | L | LT |
| Loss of tree | Removal of 15491 trees including pole size | H | L | LT |
| Floral diversity | Impact on 17 species of plants due to implementation of the project. | M | L | LT |
| Community forest | Impact on 18 community forest due to removal of trees | L | SS | LT |
| Leasehold forest | | L | SS | LT |
| Rare endangered and protected species | Removal of 3 trees species | H | N | LT |
| Firewood and timber | Increase in pressure on local vegetation due to increase in demand of firewood and timber | L | L | ST |
| NTFP | The implementation of the project will affect NTFP/MAPS | L | L | LT |
| Wildlife Habitat | Reduction in available forest habitat due to removal 44.901 ha of forest area. | M | L | LT |
| Wildlife movement | Impact due to fragmentation of forest habitat | L | L | LT |
| Construction disturbances | Movement and activity of human beings may disturb free movement and feeding of wild animals | L | SS | ST |
| Hunting and poaching | Likely increase in hunting and poaching | L | SS | ST |
| **Operation Phase** | | | | |
| Row clearance | Trees will be trimmed and cut down to make conductor clearance | L | L | LT |
| Plant biodiversity | Likely invasion of new species in cleared RoW | L | SS | LT |
| Access to forest | Increase access to forest | L | SS | LT |
| Electrocution | Electrocution to monkeys and bird | M | SS | LT |
| Changes in habitat | Permanent changes in 44.901 ha forest area into shrub land and open areas | M | L | LT |
| Wildlife movement | Impact due to fragmentation of forest habitat | L | L | LT |

## 6.3 Socio-economic and Cultural Environment

The likely impacts due to project implementation are associated with land take, relocation of households, population displacement, social and cultural problems, health and sanitation, etc. The following are the anticipated impacts regarding the socio-economic and cultural environment of the project area.

### 6.3.1 Acquisition of land and structure

#### A. Construction Phase

- **Households loosing land and structure**

The implementation of the proposed project will affect 32 households. Among them, two households (Phurpu dorze Tamang and Temba darke Tamang-ss) are not found during field survey as they live outside the village. Therefore, only 30 households are surveyed. These Hhs will be affected due to the location of different project components such as tower pad and substation on their land and structures.

- **Households Loosing structure**

Among 32 households, only one household will loose its structures (one house and one kitchen). This household not only loose its structures but also will loose 100% of its land. Therefore, this household should be considered as seriously project affected family (SPAF), and should be treated specifically. The detail of the household who has lost its structures is given below.

**Table-6.8 List of project affected household by type of structures**

| Project Component | VDC/ward no. | Name of HH Head | Sex | Caste | Family Members | Loss of Structure | Affected House | Plinth Area (sq.ft.) | Type | No. of floor | Affected Cowshed | Plinth Area (sq.ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Type | No. | | | | | |
| SS | Goljung-1 | Noerbu wangde Tamang | Male | Tamang | 13 | House | 1 | 720 | Kachchi | 2 | 1 | 180 |
| **Total** | | | | | **13** | | **1** | **720** | | | **1** | **180** |

Source: Field survey, 2014

In the proposed substation area of Goljung VDC, there are also other 12 newly constructed houses which should be relocated anywhere else. These houses are constructed by Sanjen Hydro Power Company to resettle the households who are highly affected by the project.

There is also a newly under constructed building of Himalayan English School (primary level), Thambuchet within the distance of 500m from the proposed substation area.

- ***Households Loosing Land***

Altogether 32 households are likely to be affected due to the location of angle tower on their lands. Of the total 30 surveyed households, 83.33% households will lose their lands less than 10%. Similarly, 10% of households will lose land in the range of 10% to 25%. Moreover, 6.67% of the households will lose more than 50% of land as well (Table-6.11).

According to field survey, it is observed that one household ( Bendo Lemma Tamang) will lose more than 80% of its total land for the project purpose (for substation). Thus, this household should also be considered as seriously project affected family (SPAF) and should be treated specifically.

**Table-6.9 Affected HHs by % Loss of Land**

| Percentage Loss of Land | Households | |
|---|---|---|
| | No. | % |
| < 10 | 25 | 83.33 |
| 10 - 25 | 3 | 10.00 |
| 25 -50 | | 0.00 |
| >50 | 2 | 6.67 |
| Total | 30 | 100.00 |

Source: Field survey, 2014

**Land requirement**

The project will acquired total 84.556 ha of land Out of total, 5.518 ha is permanent land (land required for angle tower 0.878 ha and substation area 4.64 ha), where only 3.288 ha is cultivated land and 79.038 ha is temporary land (land required for ROW excluding angle tower; 78.588 ha and mobile camp 0.45 ha) where 34.497 ha land falls under cultivated land. Out of total angle towers, 23 towers and a substation lie in cultivated land belonging to 32 households. One tower (AP-0) is erected in the substation area and the land covered by it is not calculated separately. Therefore, though the total number of towers is 40 only 39 towers are calculated for the study.

The land under the RoW of transmission line will be restricted permanently for the construction of houses, cow sheds and plantation of timber size big trees, etc. However, there will be no restriction on agricultural farming after the construction work is over. The detail loss of land of project affected families due to construction of towers and substations is shown in Appendix-5.

**Table-6.10 Land use by project components and facilities**

| S.N | Project Components | Quantity | Required(ha) | Cultivated land | % | Remarks |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| | and Facilities | | | | | |
| 1 | Angle towers | 40; only 39 are studied as 1 tower lie in the SS area. | 0.878 | *0.518 | 60.00 | ***23 towers are located at cultivated land** |
| 3 | ROW | 26.5 km | #78.588 | 34.047 | 43.32 | **#taking an area of 26500m x30m and deducting 0.878 ha (79.466-0.878)** |
| 4 | Substation | 1 | 4.64 | @2.77 | 59.70 | @Remaining 1.87 ha land is under Chilime & Sanjen HEP. |
| 5 | Mobile camp | 3 | 0.45 | 0.45 | 100.00 | |
| | **Total land** | | **84.556** | **37.785** | **44.69** | |
| 6 | Total permanent land | | 5.518 | 3.288 | 59.59 | |
| 7 | Total temporary land | | 79.038 | 34.497 | 43.65 | |

source: Field survey 2014

Altogether, 3 camps will be setup for construction activities. One camp will be established in proposed substation area and the other two will be mobile type. Households' survey of land owners related to suspension towers has not been conducted as the number and the place where to erect is not fixed yet. Similarly, land loss of households regarding Trishuli substation has not been considered. Land belonging to this area has already been included in the proposed substation of Trishuli 3B HEP Project. However, baseline study of those households has been incorporated due to location of taping tower within substation area. The magnitude of impact is considered to be high, site specific and long termed. The level of impact may vary with the proportion of land acquired.

### B. Operation Phase

Land acquisition will not be required during operation and no significant impacts are expected during this phase. Due to safety reason, houses and other permanent structures are not allowed to be constructed within the RoW as per the Electricity Regulation, 2050 BS. The land price under the RoW and in the vicinity of the RoW will be reduced significantly. 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. The land that will be used for camp purpose will be return to the respective land owners as in the previous condition. Thus, the overall magnitude of impact is high, extent is site specific and duration is long term.

### 6.3.2 Loss of Crops

**A. Construction Phase**

**Permanent loss of crops**

The total loss of crops of the surveyed households, due to the project implementation, is estimated to be 6.74MT. The loss of cash crop like potato and fresh vegetable are minimal so it is not shown. Loss of cereal crops like paddy, wheat, maize and millet are 1.46MT, 0.87MT, 2.94 and 1.47MT respectively. However, the total production of cereal crops is estimated to be 44.12 MT. This implies that the total loss percentage of cereal crops is only 15.23%. On the basis of the surveyed households, it is estimated that the total permanent loss of the crops of the project affected households is 7.19 MT. The detail individual loss of crops production is shown in Appendix 5.

**Table 6.11 Production Loss of Cereal Crops**

| | | Surveyed households | | | Total Project affected households |
|---|---|---|---|---|---|
| **S.N.** | **Crop types** | **Actual production area loss (ha)** | **Production Loss (MT)** | **Productivity (MT/ha)** | **Production Loss (MT)** |
| 1 | Paddy | 0.553 | 1.46 | 2.64 | 1.56 |
| 2 | Wheat | 0.455 | 0.87 | 1.91 | 0.93 |
| 3 | Maize | 1.564 | 2.94 | 1.88 | 3.14 |
| 4 | Millet | 1.289 | 1.47 | 1.14 | 1.57 |
| **Total** | | | **6.74** | | **7.19** |

Source: Field Survey 2014

(**Note:**Actual production area loss seems to be higher than total cultivated land. This is due to multiple cropping pattern in the same land type; and study period is taken for one year not for one season.)

Preferably the construction of transmission line is to be carried out during lean season so that standing crops will not be damaged or with minimal damage due to construction activities. However, it is not completely ignored that construction activities will not take place during the cropping season. Therefore, the adjoining area of RoW may be disturbed due to movement of contractor's machine, labor force and stringing of the line.

**Temporary Loss of Crops**

**Table 6.12 Estimation of Loss of Land for Different Crops (for Temporary Land)**

| S.N | Crops Types | Cultivated land | Actual production area loss (ha) | **Production Loss (MT)** | **Productivity (MT/ha)** |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| 1 | Paddy | 34.497 | 6.192 | 16.35 | 2.64 |
| 2 | Wheat | 34.497 | 5.095 | 9.73 | 1.91 |
| 3 | Maize | 34.497 | 17.518 | 32.93 | 1.88 |
| 4 | Millet | 34.497 | 14.437 | 16.46 | 1.14 |
| | | | | 75.47 | |

Source: Field Survey 2014

Similarly, about 75.47 MT of cereal crops (paddy-16.35MT, wheat-9.73MT, maize-32.93MT and millet-16.46MT) will be lost due to the construction of transmission line and establishment of mobile camp site. This loss is calculated considering that stringing of the line will be completed in one year and compensation will be paid for one seasonal cropping. The magnitude of this impact is considered to be high, extent is site specific and duration is long termed.

**B. Operation Phase**

The towers constructed in cultivated area, especially those erected in the middle of land parcels will pose hindrance while ploughing the agricultural field. The field may be cultivated by using human labor that will increase the cost of agriculture production. The overall magnitude of impact is considered to be low, extent is site specific and duration is long term.

### 6.3.3 Health, water supply and sanitation

**A. Construction Phase**

**Health and sanitation**

The likely increase of the outsiders' influence during this phase may add further stress on the local health and sanitation situation. Besides, the increase in the noise level due to vehicular movement in the project area is likely to influence the physical and mental health of the local community. Discharge of wastes of various types including metals, paper, kitchen wastes etc. is potential to degrade the sanitary hygienic conditions particularly around the construction sites and campsites. Considering only 300 numbers of manpower and their short termed mobility at one site the impact is considered to be low, site specific and for short termed.

**Maintenance of Transmission Line System**

**Construction and Operation**

The rights-of-way require annual maintenance to remove bush and tree growth beneath power lines so that towers and lines can be maintained. No phytocides will be used for

clearing of vegetation and instead both manual (machetes and slashers) and power saws will be used. The impacts of these operations include physical hazards such as injuries sustained from the tools/equipment, ergonomical problems from poor working posture, dust inhalation among others. The magnitude of impact is low the extent is site specific and the duration is short termed.

**Drinking water**

Similarly, with the increase in population along with the construction activities, a potential decline of the access to the drinking water and existing sanitation condition will occur in the project area. The overall impact on water supply and sanitary situation will be: shortage of drinking water, increase pressure on the existing water supply system, increase distance to the safe drinking water, increase in disease vectors, and reduced water quality due to increased sanitation problems etc. However, the impact on water supply and sanitation will be low, short term and site specific.

**B. Operation Phase**

No impact is anticipated during the operation phase.

### 6.3.4 Occupational Hazards and Safety

**A. Construction Phase**

Work related injuries and vehicle accidents are likely impacts expected during the construction of the project.

**B. Operation Phase**

During the operation phase, the people residing in the vicinity of the transmission line will be vulnerable to electrical hazards such as fire, electrical shocks or even electrocution. Similarly, lack of operation and maintenance skill and unavailability of the essential safety equipments may add further risk with safety regards. The public can be affected principally through their own activities, such as tendency of climbing towers by children; high vehicles attempt to pass beneath the transmission line, surveyors using metal leveling staffs under the conductors, etc. These risks have low probability of occurrences, but a great significance to individuals involved.

The overall magnitude of impacts is considered to be low, extent is local and duration is long termed. The magnitude of impact is moderate, extent is site specific and duration is long termed.

### 6.3.5 Impact on House, Settlements and Social Infrastructures

**A. Construction Phase**

Some tower pads including RoW are proposed to be constructed close to the house, settlements, social infrastructures and other private properties. There are 18 houses (one is damaged); one Mane, one shed, one suspension bridge, some settlements etc are found within the distance of upto 300m from angle points and the transmission line corridor. The list of such structure/property is given in Appendix 6.

The magnitude of impact on above mentioned private and social infrastructures are high, extent is local and duration is long term.

**B. Operation Phase**

The impact on settlements and community structures remain same in this period also. The magnitude of impact is high, extent is site specific/local and duration is long termed.

### 6.3.6 Impact on communal resources (recreation area, places of public congregation

**A. Construction Phase**

The proposed transmission line doesn't passes through communal resources like recreational areas, places of public congregation, etc. Hence, there will be no impact on such resources due to construction of transmission line.

**B. Operation Phase**

Some settlements, markets, schools and cremation sites are located close to the construction site. Impact on these structures/places is considered to be significant. The magnitude of impact is high, extent is local and duration is long termed.

### 6.3.7 Impact on PAF due to alteration of land and property values

The land and property values under the ROW and close proximity to house and settlement will be decreased due to the construction and operation of transmission line. The nature of impact is expected to be high, local and long termed.

### 6.3.8 Disturbances to radio, television, and mobile /cell phone reception

There will be likely impact on radio, television, telephone, and mobile/cell phone due to creation of electromagnetic field interference in the conductor of 220 kV TL. The frequency of such electrical gadgets will be disturbed. However, there are no proven

findings of impact due to high voltage transmission line. Hence, the nature of impact is expected to be high, local and long termed.

### 6.3.9 Health hazard due to current leakage and improper insulation

Current leakage due to improper earthing and insulation will likely to cause health hazard. Current leakage will result great risk for human and other living being inhabited nearby house and settlements. Similarly, impact will also be felt to wildlife movement and habitat.

### 6.3.10 Public safety in line segments, passing through close to the settlements, and places of congregation due to collapsing or toppling of towers

Altogether, 11 angle towers namely AP-2, AP-10, AP-16, AP-17, AP-21, AP-27, AP-29, AP-30, AP-31, AP-33, and AP-35 are located close to the structures/settlements. Similarly, transmission line section like AP-15 to AP-16, AP-22 to AP-23, AP-26 to AP-27, AP-29 to AP-30, AP-32 to AP-33, AP-33 to AP-341, and AP-34 to AP-35 passes close to the settlements/ house. There will be likely impact on those structures and settlements due to the project implementation. The magnitude of impact is high, extent is site specific and duration is long termed.

### 6.3.11 Electric and Magnetic Field Effect

#### A. Construction Phase

No significant impacts are expected during this phase.

#### B. Operation Phase

Electric power transmission lines create electric and magnetic field together known as electromagnetic field or EMF. Electric field is created by the presence of voltage and is expressed in volt per meter (V/m). Magnetic field is produced by the present of current in the line and is expressed in terms of ampere per meter (A/m). Power lines EMFs are strongest beneath the lines and diminish rapidly with distance. Numerous researches have been done abroad to investigate the effect of EMF associated with transmission line but none has proved and quantify about the health risks. Scientific research on the effects of EMFs on public health has not demonstrated clearly the existence of a significant risk, nor has it proven the complete absence of risk. The finding and conclusions are that the field strength on a 132/220 kV line at the distance of exposure (heights of 40-40m is less

than what one would ordinarily be) exposed to in a domestic setup. In this context, prudent avoidance is recommended.

Electric field of high voltage line gives rise to corona effect causing ionization leading to the generation of ozone and oxides of nitrogen, possible radio and television interference and audible noise at high levels. Such noise will increase under rain and smog conditions. Similarly, there will be impact on pacemaker users.

The magnitude of overall impact is considered to be low, extent is local and duration is long termed.

### 6.3.12 Gender and Vulnerable Group

**A. Construction Phase**

During the project construction people will be employed on daily wages for excavation, transportation of construction materials and other construction related works. The contractor, especially the sub-contractors, may discriminate the women and vulnerable group while hiring the worker. Despite, the Government of Nepal ban on child labor, it remains a potential temptation in an economically poor region such as the proposed project area for children to be exploited to pursue mental jobs. It is assumed that most of the labor force required for the construction of the transmission line will be farmers and landless people from the vicinity of the actual work place moving around the alignment as the construction proceeds.

Considering the nature of construction work and manpower employed the magnitude of impact is considered to be low, the extent is local and the duration is short termed.

**B. Operation Phase**

After the completion of the project most of the male population involved directly or indirectly in the project will be left without job, which will compel the female population to look for alternative source of income. This will add extra burden to their normal daily activities. This impact is expected to be high in magnitude, local in extent and long termed in duration.

### 6.3.13 Economic Activities

**A. Construction Phase**

The implementation of the proposed project will have some effects in the local economy. The project workers and staff will stay at particular site for certain days creating demand for local food, vegetables, dairy ad meat products etc. Besides, local contractors will also be used for some petty works, local house and required temporary land will be taken on rent or lease basis. These activities will generate cash income and have positive impacts in the local economy of the project area. However, the experience with other project has revealed that sudden cash flow may cause unproductive spending earned by the workers. The availability of cash may divert some workers towards gambling and other awful habits like alcohol consumption. The magnitude of impact is low, extent is local and duration is short termed.

**B. Operation Phase**

The local people as well the project area will benefit from the project induced economic opportunities. After the completion of the project these opportunities will be closed and the workers will lose their job. Demand for local agricultural production, community and local commodity transactions will be reduced. The withdrawal or decrease in economic activity during operation phase may affect the life of the local people after the habitual of spending more during construction phase. They will face difficulty in managing the lifestyle once the economic activities will be reduced and earning will drastically decline. However, due to the linear nature of the project, the local labors will be hired at the different locations only for the short duration of time.

Thus, the magnitude of the impact is considered to be low because the economic activities are limited and are spread throughout the settlements of the alignment. The extent is local and duration is of long term.

### 6.3.14 Religious, Historical and Archeological Site

**A. Construction Phase**

The project area (Rasuwa district) is famous in historical, archaeological and religious point of view. However, none of the archeological and cultural sites lie within the RoW.

**B. Operation Phase**

No impact is expected during the operation phase.

### 6.3.15 Infrastructure and Service Facility

**A. Construction Phase**

Infrastructures

The major community infrastructures and resources of the project area are educational institutions, health care centers, communication, drinking water facilities and community forests etc. Construction workers from outside may pose some additional pressure on existing facilities, particularly on the existing drinking water and health facilities. Similarly, the work force may use forest resources for cooking their meals and making the huts in the construction camps. The pressure on forest resources by workforce may also be increased. The magnitude of impact considered being low, extent is local and duration is short term.

**B. Operation Phase**

No impact is anticipated during the operation phase.

### 6.3.16 Social and Cultural Practices

**A. Construction Phase**

During the project construction, the influence of the outside workforce on the local way of life and traditional cultural practice may result into cultural erosion, undesired social practices, disputes, conflicts and possible dilution of social bonds among the local people. However, the social and cultural life style of the local people will hardly be affected by the influx of workers due to nature of project. This is because of the linear type of the affected project area, low number of the construction workers from outside and their fast mobility. These impacts are expected to low in magnitude, local and short termed in duration.

**B. Operation Phase**

After completion of the construction work, the impact on culture by the construction work force will subside and will slowly return to its normal social condition.

### 6.3.17 Law and Order

**A. Construction Phase**

During the construction of the transmission line labor from different places with different religion and faiths will be employed by the contractor and there will be possibilities of conflict of interest thus affecting the law and order situation. The past experience reveals that local people have misunderstanding with the employer's and contractor's staff. Since

the project is of linear type and local labor will be employ for construction activities the likely impact on law and order situation due to project is low in magnitude, local and short termed.

**B. Operation Phase**

No significant impacts are expected during this phase.

### 6.3.18 Impacts of Aesthetics

**A. Construction Phase**

No significant impacts are expected during this phase.

**B. Operation Phase**

Impacts to visual resources are examined in terms of changes between the existing landscape character and proposed actions, sensitivity of viewing points available to the general public, their viewing distances and visibility of proposed changes. The existence of tower and transmission line will likely to create aesthetic impact on natural and man-made resources. Hence, the magnitude of impact on aesthetic will be moderate, local and long termed in nature.

### 6.3.19 Rural Economy due to Increased Economic Activities

**A. Construction Phase**

Project activities create some sort of employment opportunity and use of local resources, which will support the rural economy. Such activities that float some money locally, can lead to inflation in the local market. Such impact is however, low with regards to the size of the project and the origin of workforce.

**B. Operation Phase**

First and foremost impact of the operation phase is the withdrawal of economic activities flourished during the construction phase. As most of the construction workforce leave the project area, the facilities developed to meet their demand, will find themselves displaced with low volume of money flow and less economic growth. Since the locals will be preferred as the workforce, the impact due to withdrawal of economic activities is

expected to be minimal. However, the people trained during project construction may have further chance of getting similar employment.

## 6.4 Beneficial Impacts

### A. Construction Phase

### 6.4.1 Local Employment

One of the major beneficial impacts of the project during the construction phase is the creation of employment opportunity (both skilled and unskilled labors). Altogether, 300 people will be deployed during the construction of the project, which includes 200 unskilled, 50 semi-skilled and 50 skilled manpower. Such employment opportunities to some extent may check out migration of the project area and promote in-migration. In this regard, the employment opportunities contribute to poverty alleviation and improve living standard of the people to some extent. The project will open the door for the rural electrification.

The magnitude of impact is considered to be moderate, extent is local and duration is short termed.

### 6.4.2 Local Economy

The employment opportunity, income from shops, house rental, increase demand for fresh vegetables, meat and rental/lease of land, etc are the areas of income during construction period. Furthermore, local contractor and local people will also be engaged for some construction work, which is considered as beneficial impacts for the local economy. As a result of increased trade and business, significant amount of cash will be introduced into local economy. This short term economic boom will contribute to the development of local economy. The increase in business will enhance the economic status of local people. The magnitude of impact is considered to be moderate, extent is local and duration is medium term.

The people of project area will have opportunity to sell their households products (agriculture and livestock) to the construction related workforce and project personnel at cost better than the project market price. This is the significant benefit to the local farmers in terms of cash economy.

With the start of proposed project construction, visible and significant impact will be realized in the local economy of the area as whole and economic activities of market centers like Dhunche, Haku, Dadagau and Betrawati.

### 6.4.3 National/Regional Economy

The proposed 220 kV transmission line project will be able to evacuate the energy from mega projects to be developed in Central Development Region of Nepal. The reliability in power distribution will enhance the production of the industries and boost the economic activity in the Central Development Region.

### 6.4.4 Rural Electrification

The proposed project will open the door for rural electrification of the central development region of Nepal. Though the entire project affected VDCs are electrified, the project will support the other areas of the district which are far from electric facilities through rural electrification programs.

### 6.4.5 Living Standard

The beneficial impacts of such development in the project area are the development of semi urban area with better facilities and amenities, which avail short-term economic benefits to the local community. Given the opportunity of job (150 locals) in the project construction phase, the unemployed people of the area and households depend upon labor will benefit immensely.

Their purchasing power is expected to improve the living standard during the construction phase. People that have been thriving in subsistent agriculture with little cash flow in day-to-day life, when exposed to the direct cash earning economic activities will certainly lead to positive changes in the existing social relationships and socio-economic value.

# CHAPTER VII: ALTERNATIVE ANALYSIS

## 7.0 INTRODUCTION

A key aspect of good environmental practice is the evaluation of potential alternatives. In order to achieve this goal the environmental and social considerations need to be brought into the planning. In case of 132/220kv Chilime substation Hub and Chilime-Trishuli 220kV TL Project, a range of site alternatives was investigated and the lowest and highest impacts on engineering, environmental and land use of these sites was determined to select the best substation site.

The alternative location of the proposed project was selected taking into consideration the following criteria:

- Which have minimal environmental impact
- Improvement of reliability of the power system
- Avoid build up swampy and unstable areas
- Provide easy access for construction and maintenance works
- Avoid settlements as far as possible
- Proximity of road etc.

## 7.1 Alternatives Considered

Some of the major alternatives considered during the feasibility and IEE studies were:

1. Design alternative;
2. Construction alternatives in terms of technology, procedures, schedule and raw materials to be used and
3. No forest Option
4. No project option.

### 7.1.1 Site Alternatives

Comparative studies for the feasibility of the different routes were done on the basis of the following guidelines:

1. Proximity to the all expected hydroelectric plants to be constructed and Shortest distance from the highway as far as possible.
2. Rectangular or square in shape for ease of proper orientation of bus-bars a Feeders.
3. Far away from obstructions, to permit easy and safe approach/termination of high voltage overhead transmission lines.

4. Free from master plans/layouts or future development activities for the present and the future.
5. Easily accessible to the public road to facilitate transport of material.
6. Leveled ground to reduce leveling expenditure.
7. Above highest flood level (HFL) to avoid water logging.
8. Minimum or no forest and vegetation.
9. Avoid the negative impact to the environment.
10. Located on geologically stable ground
11. Avoid settlements areas or densely populated area
12. Minimum no of affected households
13. Avoid close vicinity of radio stations, radar canters and airport
14. Avoid forest, protected area and wildlife sanctuaries

Based on the above guidelines, three possible alternative alignments were selected to evacuate power from the Chilime 132/220 kv sub-station hub to Trishuli 3B substation hub of NEA.

## 7.2 Alternatives Considered

Proposed 132/220 kV Chilime Hub site was selected at Thambuchet village, Goljung VDC of Rasuwa district for the evacuation of energy from different candidate hydropower projects in Chilime river basin. Chilime hub site is located on the right bank of Chilime River at Thambuchet village and is close to existing local road.

Detailed and careful study of the possible routes is plotted in the maps. On the basis of map study, three alternative routes were selected for Chilime –Trishuli section. The summary of three alternative routes was given in the following table:

**Table 7-1: Alternative route selected during desk study**

| S. No. | Route | Approximate Length (km) |
|---|---|---|
| 1 | Thambuchet, Chauhattar, Gre, Nasin, Sano Haku, Thulo Haku, Chandane, Gogane, Mailung Dovan, Chipleti, Diyale, Dadagau, Pairegau, Simle, Puranagau and Champani. | 26.10 |
| 2 | Thambuchet, Chyamdon, Ghaledurbar Dada, Gre, Nasin, Sano Haku, Thulo Haku, Chandane, Gogane, Mailung Dovan, Siruchet, Khadku, Chipleti, Diyale, Dadagau, Pairegau, Puranagau, Champani and Archale. | 25.70 |
| 3 | Thambuchet, Chauhattar, Syo, Bharkhu, Dhunche, Gigan, | 25.20 |

| | | |
|---|---|---|
| | Bokejunga, Thade, Gran, Khasra, Palep, Karmidada, Bhayaldada, Kuwapani and Champani | |

To give a better inside of the identified routes, a comparison table was made within three different alternative routes.

**Table 7-2: Comparison Table**

| S. No. | Item | CHILIME-TRISHULI | | | Remarks |
|---|---|---|---|---|---|
| | | Route-I | Route-II | Route-III | |
| 1 | Total length (Km) | 26.10 | 25.70 | 25.20 | |
| 2 | Number of angle points | 10 | 13 | 10 | |
| 3 | Access facility | Access facility is poor for few sections of the alignment | Access track is close to the alignment at most of the section | Access facility is quite far from the route | |
| 4 | Crossing of existing lines (HT & LT) | 11 kV line | 11 kV line | 11 kV line | |
| 5 | Major River Crossing | 1 | 1 | 3 | |
| 6 | No. of settlement crossing | 4 | 3 | 5 | |
| 7 | No. of road crossing | 1 | 1 | 1 | |
| 8 | Forest area(km) | 18 | 15 | 19.7 | |
| 9 | Marshy and unstable area | Not seen | Not seen | Not seen | Could be in the field |
| 10 | Any other impact | None | None | None | |
| 11 | Any other permanent structure | None | None | None | |
| 12 | Advantages | Most part of the route is | Shorter route, | No. of road and river | |

| | | | | | |
|---|---|---|---|---|---|
| | | close to existing track | access facility is good, minimum settlement area | crossing is minimum | |
| 13 | Disadvantages | The line passes over large forest area & there are lots of settlement area | The line passes over low forest area comparative with others line. | The line passes over settlements and the line passes over large forest area | |
| 14 | Order of Priority | 3 | 1 | 2 | |

### 7.3 Determination and Recommendation

From the desk study on the basis of existing topographical maps available in 1:25000 and 1:50000 scale, certain difficulties were observed along the Route I. Primary among these difficulties are as follows:

i. In the first section (between AP-1 and AP-4), the alignment passes over dense settlement and steep slope.
ii. The access facility is quite far from the proposed route alignment.
iii. This route passes over dense forest of conservation area.
iv. The proposed line also passes over high altitude along the region

Similarly there are also some difficulties in Route III, Primary among these difficulties are as follows:

i. The line is quite short but access facility is poor for most of the sections.
ii. The line passes over major settlement areas and expensive right of way.
iii. The line passes over 19.7km of forest area and about 2 settlement area.

Based on the exercise carried out in this study and comparison made within the identified alternatives, it is fair to recommend that the best route for 132/220 kv Chilime Substation hub and **Chilime–Trishuli** 220 kV T/L is Route - II. The route - II with some modifications, appears to be more suitable as it satisfied most of the selected criteria listed in Section 3.6. As a result a modified version of these routes

was selected and then verified for the reconnaissance survey.

Considering constraint of right of way for transmission system development, it is preferable to cover majority of candidate hydropower projects cover by right of way of the developed transmission line. In the desk study an effort is made to cover majority of candidate hydroelectric project within the vicinity of small river basin too. Although route - III is found to be shortest, this route is not suitable from aspect to access road.

Route-I is slightly better than route III, as majority of line passes within proximity of the access road except for the stretch from Chilime to Trishuli hub site. This route also passes through approximately 1.5 kms west of access road. However, this route does not cover other candidate projects within other river basin.

Despite determination of second smallest among all alternative routes, the route-II passes within proximity of the access road. It is envisaged to constructs a proposed sub-station at Chilime within vicinity of Chilime to Trishuli transmission line, so that majority of the remaining candidate projects within other river basin can be connected. Thus it also determined that route-II has additional benefit to develop transmission system for candidate projects within other river basin in addition to its sole purpose to evacuate power from other HEP.

In addition to evacuate power from other substation, this route has synergetic value to evacuate power from majority of candidate projects within other HEP. Considering the determination made on the desk study, it is thus recommended to develop transmission line in accordance to route-II. It is further recommended to verify by field reconnaissance survey for perusing detail route alignment survey.

Transmission line route selection is an important part of the transmission line route survey. Route selection of the transmission line needs input from technical, environmental, social and economic aspects. The route selection was initially based on the desk study of maps and relevant data of the site, and final route was determined after verification from the field reconnaissance survey.

The main objective of the reconnaissance study is to verify the route alignments at site that was proposed during the desk study and finally to select the best alternative route. At the same time reconnaissance study helped us to make suitable programs for detailed survey.

## 7.4 No Project Options

The power generated by the underconstructed Hydroelectric Projects will be evacuated by the proposed Chilime–Trishuli 220kV Transmission Line. Without this project, the power generated cannot be evacuated and supplied to power deficit areas within the country. Without the construction of this line, the power generated by the Project will be wasted and revenue cannot be generated. Therefore, there is no other option but to construct the 220 kV line up to Trishuli 3B substation hub.

## 7.5 COSTRUCTION SCHEDULE

The construction of the proposed line will be completed in 24 months. The major construction work like clearing tower sites for tower foundation will be done in the dry season to avoid erosion as some of the tower sites are located in fragile areas of soil formation. The tower sites during construction will require drainage and surface revegetation of the sites to avoid erosion and instabilities. Stringing of the line will be scheduled to avoid harvest season.

## 7.6 Construction Method and Material

Standard technology will be used in the construction and operation of this project. All erection works is assumed manual, which limits access impact to clearing of footpaths to the tower sites. The basic building materials like cement has to be transported from nearby markets and aggregates will be sourced locally as well as unskilled labour for civil works and certain parts of the erection.

## 7.7 No Forest Option

No forest option for the proposed project was also analyzed so as to alter the location of project components such that minimum forest would be disturbed.

# CHAPTER VIII: MITIGATION MEASURES

## 8.1. Physical Environment

The main physical impacts associated with the proposed transmission line project will be related to permanent and temporary land take for tower pads and for 30 m Right of Way (RoW) respectively. Minimization of land take, where feasible, will be the primary mitigation measure of the project. The second category of moderate impacts includes alteration in drainage pattern, change in land use practice, localized noise and air pollution.

### 8.1.1 Topography, Land use pattern and Land-take

As discussed in Chapter 6, the total land requirement will be approximately 84.556 ha out of which the permanent land take will be 5.518 ha and the temporary land take will be 79.038 ha. An area of 0.878 ha will be required for the construction of the 39 number of tower pads and 4.64 ha will be needed for the construction of the substations. The temporary land take for the RoW will be 78.588 ha and 0.45 ha for the mobile camp area. The permanent land use changes due to tower pad construction cannot be mitigated. However, the land under the RoW will not be restricted for the cultivation and other uses except for the construction of the structures. The following measures are proposed for the construction and operation phase.

**A. Construction Phase**

- The natural slope disturbances will be minimized during the construction of tower pads.
- Erection of tower foundation in the unstable land and/or near water bodies will be avoided.
- Land fragmentation will also be avoided as far as possible.
- The stringing of the line and other construction activities will be done in off-farm season.
- Wherever possible the proposed line will be aligned along the existing RoW of gravel road and edges of the fields.

**B. Operation Phase**

Restoration and maintenance of the Right-of-Way and the tower pad area will be done.

### 8.1.2 Watershed Condition

The adverse impact on the existing watershed will primarily be reduced by acquiring only the confined area, restoration and re-vegetation of the area. The possibility of sedimentation is envisaged in and around tower construction sites. The clearance of vegetation for tower pads construction is the only physical intervention that may disturb the natural drainage. Following measures are proposed to protect the watershed:

**A. Construction Phase**

Restoration of the area around the tower pad for cultivation and regeneration of vegetation will be done. Streamside areas along the transmission line will be re-vegetated. Vegetation clearing and ground disturbances will be confined within the foundation and required Right-of-Way. Top soil around the tower pad construction area will be stockpiled and reused for site restoration. Site restoration will be done at each tower site. Clearing works will be carried out in dry season to avoid erosion problems. Especial technologies for foundation works like matt foundation will be selected of tower pads which are near to the road, streams and other flood prone areas. Adequate drainage around all the towers pad area will be provided.

**B. Operation Phase**

Proper inspection and maintenance of tower pad areas will be done to reduce the risk of soil erosion. The annual site verifications and costs will be borne by the project proponent and which will be included in the operation & maintenance budget annually.

### 8.1.3 Air Quality

The construction and operation of the transmission line will not have significant impact on the air quality of the project impact area. The project will not lead to a significant deterioration in air quality except in much localized instances and localized areas.

**A. Construction Phase**

Water spraying will be done to control dust pollution. Following measures will be implemented to control air pollution in the project area.

**B. Operation Phase**

No mitigation is proposed for the operation phase.

### 8.1.4 Noise and Vibrations

Due to the construction activities, there may be an impact on the ambient noise level in the vicinity of the construction area. The relative distance of existing settlement from the construction sites will mitigate adverse impacts to some extent. Local villages living adjacent to the study area will be mostly affected by noise emissions during the construction and operation. However, this problem is expected to be insignificant.

**A. Construction Phase**

- Regular maintenance will be done for all equipment as per Manufacturer's Specifications
- Working hours will be limited in more environmentally sensitive areas for e.g. near settlements
- Helmets, Ear mufflers or plugs will be provided to the laborers
- Temporary relocation of particularly vulnerable people (old/sick, etc.) to acceptable locations will be done

**B. Operation Phase**

No mitigation is possible against the low noise caused by the Corona effect during the operation phase.

### 8.1.5 Water Quality

The main impacts on the water quality will be due to the soil disturbances (from foundation work) and waste generated from work camps. The discharge of liquid and solid waste into the streams from labour camps may result in water quality pollution. The contractor will provide onsite sanitation facilities to control and treat wastes within the workforce campsite. Side casting of excavated material from the foundation into the surface water bodies may result in water pollution.

**A. Construction Phase**

- Garbage and solid wastes generated by the workforce will be dumped safely away from water bodies.
- Good construction practices and site management will be adopted to avoid impacting soil and ground water, and pollution of water bodies from accidental spills from fuels and lubricants etc.
- Toilets in all camps will be provided during construction

- All waste oils and chemicals will be collected and stored in suitable storage tanks and disposed through incineration.

**B. Operation Phase**

Since the impact on water quality during the operation period is expected to be minimal, no mitigation measure is proposed.

## 8.2 Biological Environment

### 8.2.1 Forest and Vegetation

**A. Construction Phase**

The adverse impacts foreseen due to the construction of the project on forest and vegetation can be minimizing by adopting various mitigation measures. Selected felling is one of the best approaches to minimize the loss of vegetation at the project construction site. In addition, the following mitigation measured, mitigation cost and mitigation activities etc are briefly mention:

**i. (a) Compensatory Plantation**

Proposed 220 kV transmission line route traverses through forest land, cultivated land and agricultural zone. It is estimated that total 15491 trees will likely to be felled down for the ROW clearance. The compensatory measured for the loss of trees due to the site clearance, plantation in 1:2 ratio will be carried out in the adjacent site of the vegetation clearance zone. Assuming 15491 trees will be cut down. A total of 30982 seedlings of different species of plants will be planted.

In addition, as per the Procedural guideline for the use of Forest Land (2063), 44.901 ha of land occupied equivalent to project infrastructure and facilities , hence total number of seedling to be planted are 71842 ( 1600 seedlings per ha). In total, 102824 numbers of seedlings of the different species plants will be planted. The total estimated cost for seedling plantation, protection and conservation is NRs, 23054400 (Detail is given in Table 8.1)

The plantation site in community forest area will be finalized after discussion with the members of concerned forest users group. Meanwhile the District Forest Offices will be consulted for the technical support and success of plantation activities.

In community and leasehold forest, deep rooted fodder, fuel wood, fruit bearing trees and other NTFP species are proposed to promote the interest of forest users group in conservation and livelihood enhancement. The plantation will be done through effective people's participation. The plantation species will be selected after the discussion with the concerned forestry users groups and technical staffs of DFO office. To produce seedlings, DFO office of concerned district will be given priority or the local nursery will be encouraged to produce necessary seedlings of plant species proposed and prioritize for plantation.

**i (b) Plantation of NTFP and Valuable economic plants**

High priority is given for the plantation of NTFPs/MAPs and plants of economic value particularly along the section of the RoW, that is not passing through the private land. As per the consultation with DFOs, CF users group and other stakeholders on the ecological and economic basis some of the prioritised plants are: Chirainto, Kurello, Jetrofa, Allevera, Asuro, Amriso, etc. For this NRs 2000000 has been allocated.

**Table: 8.1 Estimated Cost for Seedling Plantation and Protection/Conservation**

| SN | Particulars | Estimate(NRs) |
|---|---|---|
| A | Total no. of trees to be cleared : 15491 | |
| 1 | Seedling production cost @ 1:2 (30982 no. of seedlings to be planted) | 1549100 |
| 2 | Seedling plantation cost | 774550 |
| 3 | Seedling Protection/conservation cost | 4647300 |
| | Sub total | 6970950 |
| B | As per the forest work schedule rule (2063)<br>No of seedling to be planted =71842 ( 1600 seedlings per ha) 44.901 ha of land occupied equivalent to project infrastructure and facilities | |
| 1 | Seedlings production cost (71842 seedlings to be planted) | 3574100 |
| 2 | Seedling plantation cost | 1787050 |
| 3 | Seedling Protection/conservation cost | 10722300 |
| | Sub total | 16083450 |
| | Grand Total (30982+71842 =102824 seedlings to be planted ) | 23054400 |

**ii. Compensation for the Trees felling in the Private Land**

Compensation will be paid for the loss of private trees from the farm land. Such compensation will be given as per the standard norms of DFO office depending on the species affected by the project. The wood extraction from such trees will be given to the respective owner and cost for transportation will also be borne by the project.

**III. Nursery Training and Micro-nursery Development**

The project proponent is recommended to establish several satellite nurseries rather than one central nursery. Since the project area consists of one Community Forest in Nuwakot district and 17 in Rasuwa district that is highly affected. So, one nursery in Nuwakot district will be established. Altogether 18 Community Forests has been foreseen affected by project activities in the Nuwakot and Rasuwa district, but the project activities, construction takes place in private land and that of the substation in Nuwakot. Activities are more on private, cultivated and barren land in both the districts and hence, the development of one nursery is recommended one in Nuwakot and one in Rasuwa. This programme will be accomplished in the first year of project construction and continued until project completion. The project will train Community Forest Users Groups for nursery establishment. The project shall also provide improved seeds and the required technical support for nursery operation. The seedlings raised in the micro-nurseries will be purchased and used by the project for its reforestation program. The project will determine the number and species of seedlings to be produced by the micro-nurseries. The elements of this mitigation and enhancement programmes are listed and the estimated in Table 8.2

**Table 8.2 Nursery Establishment and Training**

| Particulars | Quantity | Rate( NRs) | Amount (NRs) |
|---|---|---|---|
| Enhancement Cost | | | |
| Revegetation Expert | 4 man months | 50000 | 2,00,000 |
| Nursery Expert | 4 man months | 25000 | 100,000 |
| Training Material | | Lump sum | 50,000 |
| Total Enhancement Cost | | | 350,000 |
| Mitigation Cost | | | |
| Support for 2 Nursery Development | 3 Years | 50000/year | 3,00,000 |
| Total Mitigation Cost | | | 6,50,000 |
| Total Enhancement and Mitigation Cost (NRs) | | | 6,50,000 |

**iii. Minimizing the Forest Clearance**

Selective felling of trees in Right of Way of the transmission line will be carried out manually to minimize the adverse impacts of the transmission line. Similarly, the trees in the gully and valley will be avoided from the felling as far as possible. In such area, it is proposed what the minimum forest areas that are needed for the laying and stringing of conductor will only be cleared and remaining trees of the ROW will be kept intact. This will not only limit the forest loss but also directly contribute to conserve the biodiversity of the project area. ROW vegetation will be carried out manually and herbicides will not be used at all in any case. Angle tower and suspension towers will be placed ridge to ridge to avoid the forest between the two towers. Similarly, the trees in the gully, ridge, stiff cliff and slope areas will be avoided from felling as for as possible. Minimum of 8 m ground clearance in vertical section of tower and 30 m wide of horizontal clearance in the RoW , where selective felling, pruning other possibilities of clearing trees and poles can be adopted with close coordination from DFO

**iv. Utilization of Forest Products**

Trees that are likely to be removed will be counted, marked and harvested with the proper forest management techniques by involving technical staffs from DFO office of the concerned district. Wood and other forest products extracted as part of the site clearance from the forest will be handed over to the concerned forest user groups/DFO office. For the ROW clearance in community and leasehold forest concerned forestry user groups will be mobilized rather than labour from outside which indirectly helps for the conservation of forest. Special due care will be given to minimize the loss of sapling and undergrowth during construction phase.

**v. Supply of Alternative Fuel**

In order to minimize the need of forest products, the project workers will compulsorily be provided kerosene to meet their fuel requirements. During the construction of temporary camps, use of pole size timber will be encouraged rather than mature timber.

**vi. Non-Timber Forest Products**

Labour force will be prohibited for the collection of non timber forest products. Informative and waning sign at each construction sites located in and around the forest area will be placed.

**vii. Awareness for Forest Conservation**

Local people of the project area and labour will be made aware about importance of forest conservation, plantation and economic importance of forest and its role in rural society. Such program will be implemented in 15 places of the project area. Organization of lectures, distribution of pamphlets, audio visual, posters and mobilizing of local NGOs/CBOs will be utilized for the awareness programme. An amount of NRs 16,00,000 is proposed for this programme.

**Table-8.3 Mitigation Cost for Forest Conservation**

| S.N | Particulars | Quantity | Rate | Amounts (NRs) |
|---|---|---|---|---|
| 1 | Conservation Trainer (2 Nos) | 6 mm x2 | 50,000 | 600000 |
| 2 | Training (20 during before plantation and after plantation) including income generation programme | LS | LS | 500000 |
| 3 | Training material and logistics | LS | LS | 500000 |
| | Total cost | | | 16,00,000 |

**B. Operation Phase**

**i) Management of the Plantation Site**

The plantation site will be managed by the concerned forest user group members under the guidance and supervision of DFO office. Replacement plantation will be based on the survival percentage. The planted trees will be managed for five year and tress maintenance and operation cost for each sited will be borne by the project.

Herbicides will not be used for vegetation clearance. Trees which are considered critical for the operation and maintenance of transmission line will be removed manually. The saplings which will grow more than 4 m height will be trimmed for the safe operation of the line. The saplings below 4m height will be kept intact, since plants below such height will have no impact on operation and maintenance of line.

**ii) Increase Access to Forest**

The ROW will be maintained as per Electricity Regulation, 1992. The environmental awareness for conservation program will be implemented to minimize the likely impact.

### iii) Forest Sector Mitigation Cost

To mitigate the adverse impact on forest resources and to enhance the income generation opportunity of the people associated with the community and private forests, a total forest sector mitigation cost of NRs **74572900** is proposed. Detailed breakdown of the mitigation cost for forest sector is given in Table 8.4

**Table-8.4 Total Forest Sector Mitigation Cost**

| S.N | Description of the programme | Rate (NRs) | Qty. | Cost (NRs) |
|---|---|---|---|---|
| A | Plantation Programme | | | |
| 1 | Seedling cost | 50 | 102824 | 5141200 |
| 2 | Plantation cost | 25 | 102824 | 2570600 |
| 3 | Seedling Protection/conservation cost | 50/3 yrs | 102824 | 15423600 |
| 4 | Operation cost for 5 years (23 forest watcher for 44.901 ha)@Nrs 5000/month one watcher for 2 ha) | | | 6900000 |
| 5 | Tree harvesting cost | 15491*2500 | | 38727500 |
| | **Sub total** | | | **68762900** |
| B | Awareness cost for Forest conservation including IG programme | LS | | 1600000 |
| C | NTFP Seedling, plantation and operation | LS | | 2000000 |
| D | Nursary establishment and training | LS | | 650000 |
| E | Technical Support from DFO office for 2 years | LS | | 1560000 |
| | **Sub total** | | | **5810000** |
| | **Total forest sector mitigation cost** | | | **74572900** |

### 8.2.2 Wildlife

**A. Construction Phase**

**i. Habitat loss**

The compensatory plantation programme in 44.901 ha area. Similarly, awareness for conservation will help minimize the likely impact on habitat loss. The clearing of trees will be done manually without using herbicides.

**ii. Construction Disturbance**

As for as possible, construction work will be labour based. Unnecessary heavy machinery disturbance and lighting will be avoided.

**iii. Hunting and poaching**

Hunting and trapping of wildlife will be fully discouraged by incorporating an appropriate clause in tender document (contract document) for contractors strictly prohibited hunting and poaching practices in the project area. Informative and warning sign at construction sites will be placed and orientation regarding the wildlife law and act will be given to the local labour and project staffs.

**iv. Awareness for Wildlife Conservation**

Awareness for wildlife conservation will be implemented at 3 places to minimize the adverse impact on wildlife. The conservation programme include about the importance of wildlife conservation, wildlife occurrence in the project area, existing rules and regulation with respect to wildlife and benefits associated with the wildlife conservation. Organization of lectures, distribution of pamphlets, audio visual, posters and mobilizing of local NGOs/CBOs will be utilized for the awareness programme. An amount of NRs 15,30000 is proposed for this programme.

Table-8.5 Mitigation Cost for Wildlife Conservation

| S.N | Particulars | Quantity | Rate | Amounts (NRs) |
|---|---|---|---|---|
| 1 | Conservation Trainer | 2 mm | 65,000 | 130,000 |
| 2 | Training (20/5day groups during construction) | LS | LS | 100000 |
| 3 | Training material and logistics | LS | LS | 100000 |
| 4 | Awareness Cost for wildlife conservation | LS | LS | 1200000 |
| | Total cost | | | 15,30000 |

**B. Operation Phase**

The impact due to bird collision is unavoidable. However, danger for bird collision can be minimized by proper design and by maintaining height of trees under the RoW. In addition, silhouettes of birds of prey can be attached to frighten birds, markers can be attached to wires such as coloured balls, to improve the visibility for birds and

installation of screens to prevent monkeys and other arboreal mammals from climbing towers can be adopted to avoid bird collision.

**Table-8.6 Summary of mitigation measures matrix**

| Issues | Impacts | Mitigation/ Enhancement Measures |
|---|---|---|
| **Construction Phase** | | |
| Vegetation/forest resources | Clearance of 44.901 ha of forest land falls under RoW | Plantation of 102824 seedlings |
| Loss of tree | Removal of 15491 trees including pole size | Altogether 102824 seedlings will be planted in 2 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. |
| Floral diversity | Impact on 17 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. |
| Community forest | Impact on 18 community forest due to removal of trees | Implementation of training and assistance program for the CFUGs affected by the project |
| Rare endangered and protected species | Removal of 3 trees species | Due emphasis will be given for the plantation of species having conservation significance. Forest conservation awareness program will be implemented in project area. |
| 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. |
| NTFP | The implementation of the project will affect NTFP/MAPS | Implementation of NTFP training and distribution of NTFP/ MAPs species to CFUGs |
| Wildlife Habitat | Reduction in available forest habitat due to removal of forest from 44.901ha | The plantation in 110.65 ha area will minimize this impact |
| Wildlife movement | Little Impact on movement of Wild life in Mailung khola, and Trishuli River area due to fragmentation of forest habitat | Due emphasis will be given for the plantation of sapling |
| Construction disturbances | Movement and activity of human beings may disturb free movement and feeding of wild animals | Construction work will be labor based and unnecessary disturbances will be avoided |
| Hunting and poaching | Likely increase in hunting and poaching | Awareness program is proposed |
| **Operation Phase** | | |
| Row clearance | Trees will be trimmed and cut down to make conductor clearance | Selective felling will be done and herbicide will not be used |
| Hazardous Trees Felling | Trees will be cut down | Selective Felling will be done |
| Plant biodiversity | Likely invasion of new species in cleared RoW | NTFP species will be planted to use RoW land and the trees below certain height will not be cleared. |
| Access to forest | Increase access to forest | RoW will be strictly managed and awareness program will be implemented |
| 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. |
| Changes in habitat | Permanent changes in 44.901 ha forest area into shrub land and open areas | Mitigation measures applied in construction phase will be applicable |
| Wildlife movement | Impact on movement of wild life, 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. |

## 8.3 Socio-economic and Cultural Environment

In this sub-chapter mitigation measures on socio-economic and cultural environment have been proposed order to address impacts of the proposed project.

### 8.3.1 Acquisition of land and structure

**A. Construction Phase**

**Compensation for Structures**

Compensation will be provided for 2 structures (1house and 1 kitchen). Compensation cost for structures has been calculated classifying into two categories i.e. cost for plinth area of the structures and construction cost of the structures

- **Compensation cost for land occupied by structures (Plinth area)**

Since structures are located in the proposed powerhouse site and area occupied by structure is included in powerhouse components so additional amount for plinth area (i.e.360 sq.ft) will not be required.

- **Compensation of structures based on construction cost**

The total compensation of 2 structures based on the construction cost is estimated to be Rs. 9,00,000.00. Out of which compensation for 1 house and 1Kitchen are Rs. 7,20,000.00 and Rs.1,80,000.00 respectively. The construction cost per sq. ft is estimated to be Rs 1000.

**Table 8.7 Construction cost of the Structures**

| Type of structures | No. | area (Sq. ft.) | Rate (Rs./sq.ft) | Amount (Rs.) |
|---|---|---|---|---|
| House | 1 | 720 | 1000 | 7,20,000.00 |
| Kitchen | 1 | 180 | 1000 | 1,80,000.00 |
| **Total** | **2** | **900** | **1000** | **9,00,000.00** |

*Source: Field Survey 2014*

**Compensation for land**

- **Compensation for permanently acquired land**

The project will acquired 37.785 ha of cultivated land. Out of total, 3.288 ha is permanent land (land required for angle tower and substation area) and 34.497 ha is temporary land (land required for ROW excluding angle tower and mobile camp).

However, compensation cost for 3.080 ha of land of 30 households has been calculated for the study purpose. Hence, mitigation cost for 3.080 ha of land is estimated to be Rs. 30182627.00. (The average price of land of the project area is Rs. 98,00,000/ha respectively). Based on this cost, using prediction method, cost for 3.288 ha of permanently acquired land will be Rs. 3,22,22,400. However, the individual loss of land owned by 30 households and their value is given in Appendix-5.

- **Compensation for temporarily land**

The land used for transmission line and camp sites is considered as temporary land.
The total temporarily (cultivated) land to be used is 34.497 ha. On the basis of the surveyed households, the average price of the compensation cost of 34.497 ha of land is calculated as Rs. 33,80,70,600. As per NEA new practice, project will provide only 20% of the total land value for temporary land. Therefore, the compensation cost for temporary land is Rs. 67614120.00.

- **Total compensation for land**

Hence, the total compensation of land to be acquired permanently and temporarily used is Rs. 9,98,36,520.

**Table 8.8 Compensation for the Land Loss**

| S. No. | Type of Land | Total Land (Ha) | Total Price NRs | Remarks |
|---|---|---|---|---|
| 1 | Permanent Land Loss | 3.288 ha (0.518 ha for 23 APs and 2.77 ha for substation) | 3,22,22,400 | 100% Compensation |
| 2 | Temporary Land Loss | 34.497 ha (34.047ha for RoW and 0.45 ha for camps) | 6,76,14,120 (20% of 338070600) | 20% Compensation |
| | **Total** | | **9,98,36,520** | |

Source: Field survey, 2014

### 8.3.2 Compensation for loss of standing crops

**Production Loss in Permanent Land**

The total compensation of the project affected households for production loss of 7.91MT is estimated to be Rs. 2, 71,755. The value of total loss of crops is estimated based on their yield, production, and local market rate. The crop wise value with area is shown in Table-8.9. Similarly, individual loss of household's compensation for the loss of crops is shown in Appendix-5.

**Table-8.9Value of Total Loss of Agriculture Production due to Land Acquisition**

| | | Surveyed households | | | | Total affected households | |
|---|---|---|---|---|---|---|---|
| **S.N.** | **Crop types** | **Actual production area loss (ha)** | **Production Loss (MT)** | **Productivity (MT/ha)** | **Amount** | **Production Loss (MT)** | **Amount** |
| 1 | Paddy | 0.553 | 1.46 | 2.64 | 58400 | 1.56 | 62325 |
| 2 | Wheat | 0.455 | 0.87 | 1.91 | 33060 | 0.93 | 35248 |
| 3 | Maize | 1.564 | 2.94 | 1.88 | 111720 | 3.14 | 119280 |
| 4 | Millet | 1.289 | 1.47 | 1.14 | 51450 | 1.57 | 54904 |
| **Total** | | | **6.74** | | **254630** | **7.19** | **2,71,755** |

Source: Field Survey 2014

**Production loss in temporary land**

The project requires 34.497 ha cultivated land as temporary land (both R0W & camp site). The total loss of cereal crops produced in this land is estimated as 75.47 MT which value is estimated to be Rs. 28,51,199 for one year. The crop wise area allocation, production and value is shown in Table-8.10

**Table-8.10 Value of Total Loss of Agriculture Production due to land utilization**

| S.N | Crops Types | Cultivated land | Actual production area loss (ha) | **Production Loss (MT)** | **Productivity (MT/ha)** | **Amount** |
|---|---|---|---|---|---|---|
| 1 | Paddy | 34.497 | 6.192 | 16.35 | 2.64 | 653898 |
| 2 | Wheat | 34.497 | 5.095 | 9.73 | 1.91 | 369810 |
| 3 | Maize | 34.497 | 17.518 | 32.93 | 1.88 | 1251456 |
| 4 | Millet | 34.497 | 14.437 | 16.46 | 1.14 | 576036 |
| | | | | **75.47** | | **28,51,199** |

Source: Field Survey 2014

- **Total compensation for Production Loss**

Hence, the total compensation for Production Loss of permanent and temporary Land is Rs. 31,22,954.

**Table 8.11 Compensation for the Production Loss**

| **S. No.** | **Type of Land** | **Production Loss (MT)** | **Total Price NRs** | **Remarks** |
|---|---|---|---|---|
| 1 | Permanent Land | 7.19 | 2,71,755 | |
| 2 | Temporary Land | 75.47 | 28,51,199 | |
| | **Total** | **82.66** | **31,22,954** | |

Source: Field survey, 2014

### 8.3.3 Health, Water and Sanitation

**A. Construction Phase**

The project proponent will keep the project area clean and hygienic to ensure that the project does not cause the spread of communicable diseases. The labor camp will be provided with simple dry pit toilet constructed on hard ground and far from water sources. Toilets will be made for temporary camps at the rate of approximately 6 people in each toilet.

First aid kits will be maintained for preliminary treatment in emergencies. The domestic solid waste generated in the project area will be either buried in designed landfill areas or converted in to compost. An additional health care centre will be established in the project area in order to provide basic health care and handle accidents.

A joint program on health and sanitation will be launched in association with the existing NGOs and other local communities during the construction phase. In addition, health posts located in the affected VDCs will be strengthened in association with the District Health Office to meet the demands of new cases. Prior to this certain medical facilities will be provided by the health centre. For serious injuries, especial arrangement (ambulance provision) will be made to send the injured person to the nearest hospital. Health check-up of workers and documentation of health status will be made periodically. Priority will be given to the local people in project works to minimize the impacts on health and sanitation.

The project must ensure adequate safety gears for workers (Personal Protective Equipment, accommodation, First Aid box etc). It must arrange the training for contractors and workers. It should provide temporary security fencing surrounding the construction site and safety signboard at all sites in Nepali languages should be put.

To minimize the impact on water supply at least one drinking water supply system will be installed at each camp site to cope the demand of the drinking water supply for the labors and technicians. The water supply of the project area will be strengthened by installation of new pipe lines, keeping taps at a regular interval, and by improving the storage of water at the source. The quantity of drinking water will be increased by distributing the water of existing perennial stream. This water supply system will be handed to the local community after the project is over.

**B. Operation Phase**

No mitigation measures are required during this phase.

### 8.3.4 Occupational Hazards and Safety

**A. Construction Phase**

The construction area will be cleared up and all the necessary precaution and warning signs will be placed at construction site. This area will be restricted for the entry of unauthorized people. The project proponent will provide safety helmet, eye glass, safety boot, safety belt, fire fighting accessories, caution signals and other safety equipment as required at particular site and work area.

Safety training will be implemented and any loss of life or injury will also be compensated as per prevailing rules. The safety training for the project workers will be conducted prior to the construction work. Community safety awareness program about the transmission line and potential risks associated with transmission line construction will also be implemented. The project workers involved in construction work will also be trained for health and occupational measures.

**B. Operation Phase**

Safety equipment required for the operation of the transmission line will be provided. During the maintenance, the construction area will be restricted for entry of unauthorized person to avoid disturbances and risk. Safety helmet & glass, safety boot, ear plugs, good electric light system, good earthling devices, fire fighting accessories, caution signals, safety belt and other safety equipments as required at particular site and working area will be provided. The 30m 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.

### 8.3.5 Impact on PAFs due to alteration of land and property value

**A. Construction Phase**

Land fragmentation will be minimized as far as possible. Remaining portion of land that will not significant for agriculture purpose will be acquired for tower foundation. Compensation for permanently acquired and temporarily used lands will be provided.

The temporarily used land will be return to respective land owner as in the previous condition.

### 8.3.6 Impact due to restriction of future land use development close to settlement

**A. Construction Phase**

Coordination with the project affected households, VDCs/DDC authority and concern stakeholders will be done during to construction phase. Land Use Policy-2068 will be followed while designing of the project.

### 8.3.7 Disturbance to radio-television and mobile/ cell phone reception

**A. Operation Phase**

Coordination will be done with the concern authority for the minimization of frequency interference and easy network connection of radio-television and mobile/cell phone reception. If required, the project will support for the establishment of additional mobile/cell phone towers in the critical areas.

### 8.3.8 Public safety in line segment passing through close to settlement, and places of congregation due to collapsing or toppling of towers

**A. Operation Phase**

Following mitigation measures will be followed for public safety:

- Public awareness about the possible collapsing or toppling of towers; and
- Quick information system will be developed through locals/ NEA authority while happening of such incident particularly during earthquake and thunder.

### 8.3.9 Electric and Magnetic Field Effect

**A. Construction Phase**

No mitigation measure is required during the construction phase since the transmission line will not be charged until the completion of the stringing.

**B. Operation Phase**

In order to reduce the impact of the EMF effect, phase split in either of the circuit will be considered during the Detail Design Stage. Market centers are far from the transmission line, will itself reduce the impact of EMF to certain extent. However, for the safeguard of the local people, an awareness program about the concept EMF and the risk of neglecting the maintenance of the R-o-W will be conducted.

### 8.3.10 Gender and Vulnerable Group

**A. Construction Phase**

The project will ensure not to discriminate the local people based on their gender, caste, colour and place of origin. Similarly, priority for jobs will be given to the vulnerable group as per their ability and skills and willingness to work in the project area. Child labor will be prohibited in the project area. The project proponent will consult and assist the local NGO working for the welfare of the women and children to monitor and control Child Labor Act, 2049 will be effectively implemented during construction period.

**B. Operation Phase**

No mitigation measures required during operation phase.

### 8.3.11 Economic Activities

**A. Construction Phase**

To minimize the adverse impacts on local economy and enhance the living standards of the affected households following measures will be implemented:

- Compensation for the hindrance due to use of land for the transmission line has been done through private negotiation route. Replacement value has been added to the average value of the land to bring it closer to or at par with the prevailing market rate. The disturbance allowances will be provided to the affected households;
- To minimize the impacts of loss of agricultural products due to the land acquisition, and any effect on the occupation will be compensated through appropriate agricultural extension program, livelihood skill training programs, etc.;
- Maximum job opportunities will be provided to the local people in prudential order and assistance to local communities into the planning through coordination with district level and local government office of the respective district.
-

**B. Operation Phase**

No mitigation measures required during operation phase.

### 8.3.12 Religious, historical and archeological sites

**A. Operation Phase**

No archaeological, historical or cultural important sites are affected by the construction of the transmission lines. Hence no mitigation measures are required.

### 8.3.13 Infrastructure and Service Facility

**A. Construction Phase**

To minimize the impacts on the existing institutions and service facilities following measures will be implemented:

- Provision of water supply through tube wells,
- Separate communication facilities other than the existing facilities through extension
- Provision of health and support program;
- Provision of additional support police force (if required) through coordination with the District Administration Office, and District Police Office, etc.

**B. Operation Phase**

No mitigation measures are required during this phase.

### 8.3.14 Social and Cultural Practice

**A. Construction Phase**

The impacts on social structures and practices in the project area are related mostly with the influx of construction workforce and their number. Besides, to minimize the impacts on local communities, following code of conduct will be enforced to the outside construction workers:

- The labour force will be instructed about the conducts and manners to be maintained while working along the transmission line. No discrimination in terms of salary or nature of job among local and migrant workers will be allowed.
- Respecting the rights, properties and practices of local people;
- Prohibiting all the outside labours to live outside construction camps;
- Prohibiting the use of alcohol in the project site, camp and nearby villages.
- Management of the short term influx of the labours during construction and stringing phases will include communication about the technical aspect of the construction and operations, and to allay fears about any apprehensions of perceived accidents during the operational phase of the project.

- The project proponent will demonstrate its concerns about the health and safety of the workers as well as the community through awareness programmes and grievance redressed.
- The workers will be briefed about the health risk of communicable diseases due to unhygienic environment as well as sexually transmitted diseases.
- No child labour or the forced labour would be engaged by the project proponent.
-

**B. Operation Phase**

Employment in RoW maintenance will be given to the local people to reduce tension and potential conflicts with local residents.

### 8.3.15 Law and Order

**A. Construction Phase**

During the construction of the transmission line, labor from different places with different religions and faiths with their own norms and values will be employed by the project contractor and there may conflict of interest between locals and the outsiders affecting law and order situation in the project area. Local employment, wage/ labor rate, working hours, use of local resources by the project workers, etc are the major factors that may create conflict in the project area which may pose threat to law and order situation. The proponent will implement a strict code of conduct for the workforces. In case any worker is found as a drunkard or soliciting prostitution and gambling etc. will be penalized and terminated too. The existing facilities of GoN from Rasuwa and Nuwakot districts will be used to maintain the law and order situation as when required basis. The proposed awareness program will also minimize this impact to some extent.

**B. Operation Phase**

No mitigation measures are required during this phase.

### 8.3.16 Impact on Aesthetic

**A. Construction Phase**

The significant impact of transmission line and towers on aesthetic value cannot be mitigated completely. The stringing of the 220 kV transmission line with towers 42 m high will cause visual change to the existing landscape and scenery.

**B. Operation Phase**

No mitigation measures required during operation phase.

### 8.3.17 Withdrawal of Economic Activities

**A. Operation Phase**

Upon the completion of project, most of the skilled labours find some inconveniences and difficulties in losing their jobs due to financial reason. In order to minimize the adverse impacts on the local economy in this critical condition and enhance the living standard of the affected communities, following measures will be adopted by the project:

A training program like welding, plumbing, electrical wiring etc. shall be organized particularly targeting for skilled labour force willing to establish their own entrepreneurship, where they can utilize their skill and earn money. A training package shall be developed to suit majority of the skilled labour force and encourage them to initiate their business.

### 8.3.18 Resettlement and Rehabilitation Plan (RRP)

- **Relocation of House**

One house belonging to 1 household (Norbu Wangde Tamang) of proposed substation area of Goljung has to be relocated. However, this household has denied leaving its house and resettling anywhere else because of the adaption problem to the new society and its attachment to old one. The project proponent should find an appropriate place suitable to resettle him in all aspect and make him convince to leave the place happily.

The under constructed 12 houses of Sanjen HEP should be resettled anywhere else. The Sanjen HEP has resettled these households to this place from their origin. The project proponent, thus, should discuss to the Sanjen HEP for this purpose.

- **Applicable policy and legislation**

Land Acquisition Act 1977 will be the main legislative system for land and other physical asset acquisition. The procedure defined in the Act will be followed for the acquisition; Compensation Fixation Committee (CFC) will determine the compensation rates of each unit at replacement cost. Project proponent is the responsible for the implementation of RRP.

- **Entitlement framework**

The entitlement framework accordingly specifies compensation and /or rehabilitation measures for two units of entitlement individuals including affected individuals and their households, and groups. Loss of private assets will be valued and compensated based on the entitlement policy matrix (Table 8.7).

- **Government Property**

Government infrastructures and facilities affected by the project will be repaired or replaced in consultation with the relevant department authorities. Government forest land will be acquired by getting approval from Ministry of Forest and Soil Conservation.

- **Displacement Allowance**

In addition to the compensation for asset losses, households who are losing houses will qualify for the displacement allowances. Households, which required to be relocated, will receive a housing displacement allowance equal to per capita income (per capita income is taken as $550 which is equivalent to NRs.53,460 (@ 1$= NRs.97.2) of one month based on the calculation for a household. Titleholders, tenants in own accommodation and squatters will be entitled to this allowance, to be paid at the time of compensation payment.

- **Rehabilitation Measures**

Apart from the provision of displacement allowance, the rehabilitation of PAFs will additionally be supported through preferential access transmission line construction employment opportunities to the extent possible. The project will, in addition, provide some support allowances to the vulnerable or marginalized project affected households. In this project, Indigenous, Dalit and Tribal households are categorized into this category.

There is potentially for two types of grievances: grievances related to land acquisition and resettlement requirements, and grievance related to compensation or entitlement. Special project grievance mechanisms such as site provision of complain hearings allows project affected persons to get fair treatment on time.

The project authority will ensure that funds are delivered on time to CFC and the implementing consultants for timely preparation and implementation of the proposed,

as applicable. The compensation issues and rehabilitation measures will be completed before civil work starts. Civil works contracts will not be awarded unless required compensation payment has been completed.

- **Rehabilitation Allowance**

Relocated household will receive a housing rehabilitation allowance. A total of NRs. 40,000 has been allocated for displacement and rehabilitation allowances.

**Table 8.12 Displacement and Rehabilitation Allowance**

| Allowances | No | Amount (Rs.) |
|---|---|---|
| Displacement allowance | 2(1 house &1 kitchen) | 53,460 |
| Housing rehabilitation | 2 | 40000 |
| **Total** | | **93,460** |

**Summary of social mitigation cost**

The total socio-economic mitigation cost is calculated to be Rs. 10,39,52,934. The detailed cost analysis is shown in Table-8.13

**Table-8.13 Summary of mitigation cost**

| **Description** | **Amount (Rs.)** |
|---|---|
| **Mitigation Measures** | |
| **Description** | **Amount (Rs.)** |
| Land acquisition (3.288 ha) | **3,22,22,400** |
| Cost for leased land (34.497 ha) | **6,76,14,120** |
| Compensation for house and structures (2) | **9,00,000** |
| Compensation for loss of crops | **31,22,954** |
| • Permanent loss of crops=7.19MT<br>• Temporary loss of crops=75.47MT | 2,71,755<br>28,51,199 |
| Displacement and Rehabilitation Cost | **93,460** |
| **Total** | **10,39,52,934** |

### 8.3.19 Enhancement Measures

#### 8.3.19.1 Agricultural Intensification Program and Vegetable Farming

The proposed project will itself provide the local communities and the region with numerous opportunities for socio-economic development. As more than 50% of the transmission line traverses through the cultivated land, the environment team has come into conclusion that the project area will benefit from the training programme on improved agricultural farming system. During the field investigation, the social team observed that most of the cultivated land of Haku VDC (Rasuwa district) falls under the area of transmission line corridor. The main vegetables grown here are cauliflower, beans and potatoes. The program will train the local community in farming of local vegetables and using new techniques for better yield. Priority will be given to women wherever possible and practicable. This training program will consist of lectures from experts, demonstration of techniques and dissemination of information. Altogether 60 people from PAFs will be trained for vegetable farming.

The other proposed training programs are: livestock including pig farming, fruits cultivation, medicinal herbs, use of organic fertilizer; irrigation techniques; appropriate cropping patterns; and methods of harvesting, processing and storage. Such training programmes will be conducted in coordination with District Agriculture Development Office, District Livestock Office, District Forest Office and District Development Committee of the corresponding VDCs

The total cost allocated for training programs regarding agriculture and livestock is 20,00,000 (including cost for trainee's allowance, expert hiring, training materials, logistic support, etc).

#### 8.1.19.2 Health, Sanitation and Safety Program

An awareness program will be conducted in the project area to alert local people to the potential dangers related to health, sanitation and safety. This program will be targeted to the people residing in and around the vicinity of the corridor. It is envisaged that the influx of construction crew will increase the pressure on the existing health facilities of the area. The project proponent will be responsible for providing mobile health and sanitation facilities to its work force and this will ease the pressure on the existing facilities. The project proponent will provide technical assistance and materials for building low-cost squatting type toilets. Priority will be given to relocates. In addition,

awareness program on construction related safety issues and electrocution will also be conducted for the labor force and local residents. A joint program on health and sanitation can be launched in association with the existing NGOs of the project area and other local communities during the construction phase. In addition, existing health posts in the affected VDCs should be strengthened in association with the District Public Health Offices. The project will allocate 10,00,000 for sanitation and safety programs program for SPAFs.

### 8.3.19.3 Skill Development Program

Construction related training programs such as electrical wiring, plumbing, and welding will be conducted for the affected population to tackle the adverse impact of the project. This training will enable the inhabitants in getting suitable jobs during and after the construction. The affected people will benefit from these skills in house wiring and other electrical and mechanical works in their own localities. The project affected people (especially focus for those households who lose land more than 25%) will be benefited from skill development program The total estimated cost for such training programs is NRs. 8,00,000 (including cost for trainee's allowance, expert, training materials, logistic support, etc).

### 8.3.19.4 Tourism and handicraft related training program

Rasuwa district is famous for touristic target. The Sanjen Himal, Ganesh Himal, Canjin Valley, Lantang Himal, Gosai Kunda, Dudh Kunda, Bhairab Kunda and Uttar Gaya Betrawati are the major tourist attraction centers in Rasuwa district Many tourists (indoor and outdoor) visited here every year. For this point of view, training program on tourism and handicraft will be provided to the project affected people including locals. Altogether, 50 people will be benefitted with the proposed training. A total of Rs. 5,00,000/- has been allocated for this purpose.

### 8.3.19.5 Skill development training for women

Skill development training like bakery training, beauty parlor, tailoring, handicraft making, computer training and secretarial course will be provided to women selecting one member from PAFs. One month training will be provided on these disciplines in appropriate location of the project affected VDCs. For this purpose, Rs. 7,00,000 has been allocated including cost for expert hiring and other logistic supports.

### 8.3.20 Enhancement Measures Cost

The total social enhancement cost is estimated to be Rs. 50,00,000.

**Table-8.14 Summary table of Enhancement measures**

| SN | Proposed training programs | Amount (Rs.) |
|---|---|---|
| 1 | Training on Agricultural Intensification and Vegetable Farming | 20,00,000 |
| 2 | Health, Sanitation and Safety Program | 10,00,000 |
| 3 | Skill Development Program (focussing for man) | 8,00,000 |
| 4 | Skill development training for women | 7,00,000 |
| 5 | Tourism and handicraft related training program | 5,00,000 |
| | **Total** | **50,00,000** |
| | | |

**Grievance Redress Mechanism**

There is potentially for two types of grievances: grievances related to land acquisition and resettlement requirements, and grievance related to compensation or entitlement. The SPAFs will have access to both locally formed grievance redress committee. Special project grievance mechanisms such as site provision of complain hearings allows project affected persons to get fair treatment on time.

The project authority will ensure that funds are delivered on time to CFC and the implementing consultants for timely preparation and implementation of the proposed, as applicable. The compensation issues and rehabilitation measures will be completed before civil work starts. Civil works contracts will not be awarded unless required compensation payment has been completed.

### 8.3.21 Corporate Social Responsibility (CSR)

As a corporate responsibility the proponent has allocated some money for the betterment of local people. Money on different programs sectors like education, health, infrastructure, service facility and religious sites has been allocated. Following are the sectors covering as CSR:

- **Education Support Program**

Financial support will be provided to 9 schools which are located within the 100m to 300m from the proposed transmission line alignment. Support will be provided for

purchase of computer, library establishment, drinking water facility, ladies toilet construction, extension of school play ground and other educational materials. Each school will get Rs. 2,00,000. Hence, the total amount for this provision is Rs. 18,00,000. Followings are the name of schools to be benefitted.

**Table-8.15 List of schools benefitted by education support program**

| S.N. | Name of School | Address | Remarks |
|---|---|---|---|
| 1 | Shree Himalayan English School (Primary) | Thambuchet-1, Goljung | Substation site |
| 2 | Shree Haku Sec. School | Thulo Haku | Close to angle tower |
| 3 | Kalika Primary School | Gogane, Haku | Close to angle tower |
| 4 | Balodaya Primary School | Haku | Close to angle tower |
| 5 | Shree Panchalinge Lower Sec. School | Khadku-6, Dadagau | Close to transmission line alignment |
| 6 | Shree Chipleti Primary School | Chipleti-7, Dadagau | Close to transmission line alignment |
| 7 | Saraswoti Lower Sec. School | Pairigaun-8, Thulogau | Close to transmission line alignment |
| 8 | Bhumidevi Sec. School | Thulogaun-6 | Close to transmission line alignment (within 300m) |
| 9 | Bhumidevi Primary School | Manakamana-6 | Close to transmission line alignment (within 80m) |

**Source: field survey 2014**

- **Religious, Archaeological sites and social Infrastructures**

The proponent aims to support temples and other religious sites as well as social infrastructures which are located close proximity to the transmission line corridor. Altogether, 1temples, 1 Gumba and 2 health post will be benefitted financially by this scheme. Each temple, Gumba and Health post will receive Rs. 1,00,000. Hence, the total budget for this provision is estimated to be Rs. 4,00,000. Support will be utilized for strengthening and fencing of temples/Gumba/Health post. Following religious/ cremation sites will be supported financially:

**Table-8.16 List of temples/religious site benefitted from financial support**

| SN | Name of temple | Address | Remarks |
|---|---|---|---|
| 1 | Tasi Chholing Gumba | Haku | Close to transmission line alignment |
| 2 | Health Post | Thulo Haku, Haku | Close to transmission line |
| 3 | Devi than | Dadagaun | Close to transmission line |
| 4 | Sub health post | Thulo gaun-6 | Close to angle point 35 ( within 160m) |

**Source:Field Survey 2014**

- **Health and Sanitation Program**

Mobile health cline will be launched by the proponent during project construction. It will be conducted focussing on general health check-up of school children of the project affected VDCs. Besides, eye and teeth check-up of senior citizen (60 and above years) of project affected VDCs will be conducted. For this purpose Rs. 8,00,000 has been allocated including doctor's fee and other logistic supports. Health clinic will be organized for 2 days in each project affected VDCs. Similarly, Rs. 7,00,000 has been allocated in sanitation sectors like toilet construction in public places (market centres, places of public congregation, holy places, etc). Progam will be implemented through VDCs and local NGOs.

- **Infrastructure and service facility**

Project also aims to support to people/stakeholders of each project affected VDCs in the infrastructures and service facility sector. Support will be provided for renovation of existing foot trails in hilly areas, community building centres for study, furniture purchasing for community forest office buildings, management of drinking water sources, strengthening public meeting place in VDCs office, etc. For this Rs. 10,00,000.

- **Additional Support Allowance**

Income generation and skill orient training program are needed to the severely project affected households and vulnerable families. According to baseline report, altogether 82% population of project affected VDCs falls under the category of indigenous and tribal community, whereas 83.33% of surveyed households are of indigenous group. In this case some additional support allowance will be provided for the betterment of their present living conditions. A total of NRs 2,50,000 has been allocated as additional support allowance.

**Table-8.17 Support Allowance to the Indigenous and Tribal households**

| Type of HH | No. | Allowance /HH | Amount (NRs.) |
|---|---|---|---|
| Indigenous and tribal households | 25 | 10,000 | 2,50,000 |
| **Total** | | | **2,50,000** |

**Total CSR Cost**

The total CSR cost is estimated to be 49,50,000. The breakdown cost of each sector is shown in Table-8.18

**Table-8.18 Summary of CSR cost**

| Description | Amount (Rs.) |
|---|---|
| **Corporate Social Responsibility (CSR) Cost** | |
| Education | 18,00,000 |
| Health and sanitation program | 15,00,000 |
| Religious Historical Sites and social infrastructure | 4,00,000 |
| Infrastructure and service facility | 10,00,000 |
| Additional Support Allowance | 2,50,000 |
| **Total** | **49,50,000** |

### 8.3.22 Socio-economic Cost

The mitigation cost, enhancement cost, and CSR cost for implementing the socio-economic and cultural environmental aspect described in this sub-chapter is estimated to be NRs. 10,89,52,934. Listing of the elements and a breakdown of the costs is given in Table-8.19.

**Table-8.19 Total socio-economic cost**

| Description | Amount (Rs.) |
|---|---|
| Mitigation Cost | 10,39,52,934 |
| Enhancement Cost | 50,00,000 |
| Corporate Social Responsibility (CSR) Cost | 49,50,000 |
| Total | 10,89,52,934 |

**Table-8.20 Entitlement Policy Matrix**

| Type of loss | Entitlement unit | Description of entitlements | Implementation Measures |
|---|---|---|---|
| **1. House and other structures** | | | |
| Loss of own house and residential plot | • Titleholders<br>• Tenant<br>• Squatter on public land | Cash compensation for full or partial loss of house at replacement cost, according to house type | • Land valuation undertaken by CDC, house and other structure valuation by project authorities, compensation rate established by CDC<br>• Material may be salvaged with no deduction from compensation<br>• Displaced households will receive a housing displacement allowance<br>• Notice to vacate will be served at least 35 days prior to acquisition date<br>• An appropriate compensation advance and housing displacement allowance to be paid at time of notice to vacate, balance payable prior to possession of property<br>• Compensation for partial losses payable prior to acquisition<br>• To ensure fair compensation, determination of rates will be done not more than one year prior to property |
| | Titleholder | Where displaced, cash compensation (at replacement value) for residential plot, or provision of suitable replacement residential pot in the vicinity, if available. | |
| | Tenant | Assistance with identification of alternative residential land | |

| | | | |
|---|---|---|---|
| | | | acquisition<br>• All transfer costs and taxes will be the responsibility of the project<br>• Formal resettlement planning will be undertaken where more than 10 households from one settlements/ residential area are displaced |
| Loss of commercial establishment | Titleholder | • Cash compensation for full or partial loss at replacement cost, according to building type<br>• Where displaced, cash compensation for plot or provision of suitable replacement plot in the vicinity if available<br>• Assistance with identification of alternative business | • Compensation determination, notice to vacate and compensation payment<br>• Owners of displaced commercial establishments will receive a business displacement allowance |
| Loss of other privately owned structures | Titleholders, Tenant | • Cash compensation for full or partial loss at replacement cost, according to building type<br>• Cash compensation for damages to structures resulting from temporary occupation of land | • Other structures includes: sheds, water tank, etc<br>• Loss of structures other than houses and commercial establishment does not entail payment or a displacement allowances<br>• Compensation determination, notice to vacate |

| **2. Cultivable land** | | | |
|---|---|---|---|
| Loss of private land | Titleholder | • Provide compensation at full replacement cost<br>• Provide full title to land of equal area and productivity acceptable to owner in the vicinity<br>• If land is not available elsewhere then provide cash compensation at full replacement cost based on current market rate or government rate which ever is higher<br>• Resettlement assistance in lieu of compensation for land occupied (land, other assets, employment ) at least restore their livelihoods and standards of living of pre-displacement levels.<br>• In the case of farm land, the SPAPs will be entitled the cultivation disruption allowance equal one year production | • A list of affected and entitled persons and the area of land loss is required<br>• Notice to vacate will be served at least 35 days prior to acquisition date<br>• If any owner having significant impacts receives cash compensation for farm land and purchases replacement farmland within 1 year from the date of receiving compensation, all related land registration frees, taxes and duties will be borne by the project<br>• Case-wise compensation will be either by cash or by cheque, depending on the owner's preferences<br>• To ensure fair compensation, determination of rates will be established not more than one year prior to property acquisition<br>• |

| | | | |
|---|---|---|---|
| Vulnerable social categories | Adults 18 years and older in the vicinity | • Assistance in reestablishment and improvement of livelihood<br>• Training in life skills Preferential employment on project construction and maintenance to the extent possible | • Vulnerable social categories actually affected by the project will be identified<br>• Tribal groups<br>• Dalits<br>• Landless households<br>• Women headed households |
| **3. Government property** | | | |
| Loss of infrastructures and facilities | Relevant agency | • Facilities will be repaired or replaced | • To be undertaken in consultation with the relevant department or ministry |
| Loss of forest areas | Department of Forest | • Mitigation by means of a forestation | • An assessment of maintaining that kind of vegetation<br>• To be undertaken in consultation with Department of Forestry |
| Loss of government land | Relevant agency | • No provision of compensation | • Consultation with relevant government agencies |
| **4. Other privately owned resources** | | | |
| Building and structures | Local community | • Restoration of affected community buildings and structures to at least previous conditions, or replacement in areas identified in consultation with affected | • Community buildings and structures includes: tempos, water tank, irrigation canals trails and bridges |

| | | | |
|---|---|---|---|
| | | communities and relevant authorities | |
| **5. Rehabilitation Assistance** | | | |
| Displacement of households | Titleholders, tenant | • Housing displacement allowance for loss of own residential accommodation | • The housing displacement allowance will be based on tow months per capita poverty level income (PLI), as established by the Nepal Living Standard Survey for a households of 5.4 members. The value of the allowance will be adjusted annually for price escalation<br>• Allowance will be paid at the time of serving the notice to vacate<br>• Displacement allowances (housing, business and cultivation will be paid severely |
| **6. General counselling** | | | |
| All project impacts | Households within ROW or outside the ROW | • General counselling on project impacts, construction schedules and acquisition dates, valuation compensation and grievance resolution mechanisms construction employment procedures and local development initiatives | • This will be achieved through the periodic distribution of information sheets and consultation with local officials<br>• Cooperation with GoN ministries and departments such as department of Agriculture, District Forest Office to support effective resource utilization and community development |

**Table-8.21 Mitigation and Enhancement Matrix**

| Socioeconomic and Cultural | Impacts | Mitigation/ Enhancement Measures |
|---|---|---|
| **Construction Phase** | | |
| Acquisition of Land | The project will acquire 3.288 ha permanently and temporarily 34.497 ha | Compensation will be paid on current market rate. Land required for temporary facilities will be compensated based on production loss. |
| House | Acquisition of 1 house and 1 Kitchen | All the structures will be compensated at replacement cost. |
| Agriculture income | Loss of agriculture production (82.66 MT) due to land acquisition and utilization | Compensation will be paid equivalent to 1 year agriculture loss |
| Community resources and infrastructure | Loss of community forest, | Plantation of income generating species, etc |
| Temple | No Temple under the ROW | |
| Crop | Likely damage to standing crop in 3.288 ha area | Compensation will be paid for cultivated land |
| 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 |
| 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 |
| 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 |
| Life style | Likely changes in life style | Implement awareness program |
| Peoples safety | Likely accidents during line charging process while testing and commissioning | Implement awareness program |

| | | |
|---|---|---|
| Livelihood | Impact on livelihood due to acquisition of land and house | Implement livelihood restoration program |
| 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. |
| Aesthetic value | Mankamana Cable Car | 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. |
| **Operation Phase** | | |
| Agriculture production | Temporary Loss =75.47 MT, permanent loss=7.19 MT | Implementation of livelihood restoration and agriculture assistance program |
| Land | Devaluation of land value falls in RoW especially in semi urban and urban areas | Compensation has been proposed 10% of the land value for the urban, semi urban and rural areas. |
| 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. |
| 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 will be prohibited. |
| Withdrawal of economic activities | Likely impact on local economy due to withdrawal of economic activities | Awareness program is proposed |
| Livelihood | Impact on livelihood due to acquisition of land and house | Continuation of livelihood support program |
| Occupational health and safety | Likely increase in accidents | Proper training to operation staff and all required safety gears will be provided |

| | | |
|---|---|---|
| Firewood and fodder | Impact on 4383.909 cubic meter of standing wood volume and 4181855 kg of biomass of forest loss | Compensatory plantation will minimize this impact. |

**Table 8.22 Total Environmental Cost**

| S.N. | Description | Quantity | Unit rate | Amount | Remarks |
|---|---|---|---|---|---|
| **A.** | **Mitigation measures** | | | | |
| **1** | **Physical Environment** | | | | |
| | Protection and bioengineering works | | LS | 800000.00 | |
| | **Sub-total** | | | **800000.00** | |
| **2** | **Biological Environment** | | | | |
| | **S.N** | **Description of the programme** | **Rate (NRs)** | **Qty.** | **Cost (NRs)** |
| | A | Plantation Programme | | | |
| | 1 | Seedling cost | 50 | 102824 | 5141200 |
| | 2 | Plantation cost | 25 | 102824 | 2570600 |
| | 3 | Seedling Protection/conservation cost | 50/3 yrs | 102824 | 15423600 |
| | 4 | Operation cost for 5 years (23 forest watcher for 44.901 ha)@Nrs 5000/month one watcher for 2 ha) | | | 6900000 |
| | 5 | Tree harvesting cost | 15491*2500 | | 38727500 |
| | | **Sub total** | | | **68762900** |
| | B | Awareness cost for Forest conservation including IG programme | LS | | 1600000 |
| | C | Nursery establishment and training | LS | | 650000 |
| | D | NTFP Seedling, plantation and operation | LS | | 2000000 |
| | E | Technical Support from DFO office for 2 years | LS | | 1560000 |
| | | **Sub total** | | | **5810000** |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| | Total Forest Sector Mitigation cost | | | | **74572900** |
| | **Wild Life** | | | | |
| | 1 | Conservation Trainer | 2 mm | 65000 | 130000 |
| | 2 | Training 20/5 day during construction | LS | LS | 100000 |
| | 3 | Training Material and Logistics | LS | LS | 100000 |
| | 4 | Awareness for Wild life Conservation | LS | LS | 1200000 |
| | Total Cost for Wildlife Conservation | | | | **15,30000** |
| **3** | **Socio-economic and cultural environment** | | | | |
| | Land acquisition and utilization | | | | |
| | Land acquisition, permanently | 3.288 ha | | 3,22,22,400 | |
| | Land utilization (R-O-W), temporarily and temporary campsite | 34.497 ha | | 6,76,14,120 | |
| | 2. Compensation for loss of crop, 82.66 MT (temporary loss=75.47 MT & permanent loss=7.19 MT) | 82.66 MT | | 31,22,954 | |
| | Compensation for house and other structures | 2 | | 900000 | |
| | Displacement and Rehabilitation Allowance | | | 93,460 | |
| | Sub-total | | | **10,39,52,934** | |
| **B.** | **Enhancement Measures Cost** | | | | |
| | Training on agricultural intensification and vegetable farming | 60 | | 20,00,000 | |
| | Health Sanitation and safety program | 1 | | 10,00,000 | |
| | Skill development program for men and women separately | 1 | | 15,00,000 | |

| | | | | | |
|---|---|---|---|---|---|
| | Tourism and handicraft related training program | 50 | LS | 5,00,000 | |
| | **Sub-total** | | | **50,00,000** | |
| **C.** | **Corporate social Responsibility cost (CSR)** | | | | |
| | Education support program | 9 | 200000 | 18,00,000 | |
| | Financial support for religious, archaeological sites and social infrastructures | 4 | 100000 | 400000 | |
| | Support for health and sanitation program | LS | | 1500000 | |
| | Support for infrastructure and service facility | | LS | 10,00,000 | |
| | Additional support allowances | 25 | 10,000 | 2,50,000 | |
| | **Sub-total** | | | **49,50,000** | |
| | **Total environmental cost** | | | **19,08,05,834** | |

### 8.3.23 Total Environmental Cost

The total environment cost including mitigation, enhancement, relocation and CSR costs is estimated to be Rs. 1,05,57,06,652.

**Table-8.23 Total environmental cost**

| **Description** | **Amount (Rs.)** |
|---|---|
| A. Mitigation Cost | 103859474 |
| A.1 Physical | |
| A.2 Biological | |
| A.3 Socio-economic | 1019291873 |
| B. Enhancement Cost | |
| B.1 Physical | - |
| B.2 Biological | 1100000 |
| B.3 Socio-economic | 3700000 |
| C. Corporate Social Responsibility (CSR) Cost | 6300000 |
| D. Relocation Cost | 1864778.79 |
| **Total** | **1,05,57,06,652** |

# CHAPTER IX: ENVIRONMENTAL MONITORING

## 9.0 INTRODUCTION

This section discusses and outlines the environmental monitoring and management programs of Chilime 132/220kV Sub-station Hub and Chilime- Trishuli 220kV Transmission Line project. It also assists to ensure compliance with environmental laws and in ameliorating and eliminating adverse impacts. A detailed monitoring program in the form of an Environmental Management Action Plan (EMAP) will be made prior to implementation.

## 9.1 REQUIREMENTS FOR ENVIRONMENTAL MONITORING IN NEPAL

The National EIA Guidelines (1993) and the EPR, 1997 specify, in general, the requirements for environmental monitoring as needed to assess the actual effects and ensure compliance of the implementation measures during project construction and operation.

An Environmental Monitoring Plan will be required to define the responsibilities for the monitoring, the parameters that will be monitored, where the monitoring will take place and its frequency. Effective monitoring of the whole project cycle, particularly the resettlement related aspects, will assist in the identification of unexpected problems/outcomes, and facilitate the correction of these. Monitoring of socio-economic impact indicators should wherever possible be participatory, involving local groups assessing their own situations as part of the process. This will assist local communities raise their awareness about their situations and the chain of causality bringing about their situations of relative gain or loss.

Social monitoring will also be incorporated in the scope of work for construction management, so that the local labor recruitment norms and requirements, their operating conditions, rights and penalties can be closely observed in order to avoid inequities and conflicts. Social monitoring is the most effective if local community leadership and administration structures are involved in a process that is participatory, and provides recourse to recognized authority structures. Involving community leaders and local authorities often provides the means to resolve social problems identified in a direct, efficient and effective manner.

## 9.2 ENVIRONMENTAL MANAGEMENT AND MONITORING UNIT

The Chilime-Trishuli 220kV Transmission Line Environmental Management and Monitoring Unit (EMMU) will be formed which will be responsible for implementing mitigation measures; monitoring and conduct community related mitigation measures on behalf of the project (which is not specifically related to the activities of the construction contractors. This unit will consist of experts from Consultancy, Ministries, local administrators and other qualified personnel from the local market will also be responsible.

The Unit will work in close co-ordination with the Project Manager/Director and in addition of foreseeing mitigation monitoring and management will also take care of the community problems arising during project construction.

The co-ordination of the compliance monitoring and mitigation program allocated under the contractor will be the responsibility of the Project. As already stated, the Environmental Management Unit will

work for the monitoring of compliance issues of construction contractors. The Unit will have the responsibility for approval of contractors Environmental Protection Plan (EPP) and Environmental Safety Plans. In addition, the Unit in coordination of Project Manager will have the authority to penalize contractors for violation of environmental tender clauses and non-performances. The Unit will work in close co-ordination with VDCs, DDCs, NGOs, INGOs and contractors

### 9.2.1 Reporting Requirements

The Unit will prepare and disseminate a monthly report containing information on the implementation status of the environmental protection measures and monitoring results during the construction period. The unit will be responsible for sending the report to the Project Manager, Ministry of Energy (MoEn) and Ministry of Science, Technology and Environment (MoSTE).

## 9.3 ENVIRONMENTAL MONITORING PLANS

A monitoring program required for the project to evaluate the application and effectiveness of mitigation measures is formulated in three phases. The monitoring plan will consists of:

**i) Baseline Monitoring**

The primary concern during this phase will be to implement field data collection programs needed to enhance the knowledge of baseline conditions. Focus will be on the gathering of scientific and sociological information needed to verify and update the data provided by this IEE process.

**ii) Compliance Monitoring**

In this monitoring, the Government of Nepal licensing entity (MOEn/DoED) oversees and ensures the implementation of the required mitigation measures according to GoN guidelines and approved mitigation plan. The Unit will be delegated the day-to day responsibilities in this respect.

**iii) Impact Monitoring**

Impact monitoring will focus on key indicators to assess whether the impacts have been accurately predicted, and whether the mitigation measures are sufficient and effective. The monitoring of the 132kV T/L Project will include:

**Physical Environment**

- Watershed monitoring /Land use
- Stability of the area around the tower pads

**Biological Environment**

- Forest Clearing
- Re-vegetation and slope stabilization
- Wildlife

**Socio-economic and Cultural Environment**

- Employment monitoring
- The economic status of the affected people and relocated people
- Adaptation of resettlement households to their new homes and communities
- Public safety and security monitoring
- Health and sanitation monitoring
- Compensation etc.

Table 9.1 summarizes the monitoring plan and schedule for all three types of monitoring: baseline, compliance and impact.

**Table 9.1: Monitoring Plan and Schedule**

| SN | Parameter | Indicators | Method | Location | Schedule |
|---|---|---|---|---|---|
| **A** | **Baseline Monitoring** | | | | |
| | | | | | |
| **Physical Environment** | | | | | |
| 1 | Land Use | Changes in land use pattern | Observation | RoW and nearby areas | Once during the construction phase and operation phase each |
| 2 | Slopes | Stability at tower pads | observation | Near tower pads | Before and after rainy season prior to construction |
| **Biological Environment** | | | | | |
| 3 | Forest cover and management | Density of Forest and maintenance of RoW | Discussions with users group, observation, local people and District forest Office | Under the RoW and in the vicinity of the corridor | Once each during preconstruction, construction and operational phase |
| 4 | Wild life | Wild life habitat and clearance | Observation, discussion with local residents | RoW and nearby areas | Once each during preconstruction, construction and operational phase |
| **Socio-economic and Cultural Environment** | | | | | |
| 5 | Settlement/infrastructure | Increae in settlements/infrastructure, migration | Discussion with local people, VDCs, Observation | Project affected VDCs | Once each prior to construction and operation |
| 6 | Socio-economic/cultural baseline | Update socio-economic/cultural baseline | Discussion with local people, observation, review | Project affected areas | Once prior to construction |
| **B** | **Impact Monitoring** | | | | |
| **Physical Environment** | | | | | |
| 1 | Land use/slopes | Degree of slopes, slope stability, changes from the baseline | Observation | Around the tower pad area | Continuous observation during construction, annually during operation |
| 2 | Waste disposal | Unpleasant odor and visual impact | Observation | Temporary camps/construction sites | Weekly during construction |
| 3 | Air Quality/water quality | | Observation | Project area | Weekly during construction |
| **Biological Environment** | | | | | |
| 4 | Vegetation Clearance | No of trees felled, ground cover | Observation of the area, discussion, counting | Under the RoW | During construction |
| 5 | Pressure on forest | Forest cover | observation and survey of the forest area before and after construction, discussions with local people | Along the T/L | Regular during construction and annually during operation |
| 6 | Wildlife | No. of wildlife seen | Observation Keeping record on Wildlife, birds and reptiles killed | In the vicinity of the corridor | Regularly basis during construction and annually during operation |
| **Socio-economic and Cultural Environment** | | | | | |
| 7 | Compensation | Socio-economic parameters like economic status, living conditions etc of the affected | Housing assets, living conditions, income etc. | Affected local people | Regularly for at least three years following land acquisition |

| | | | | | |
|---|---|---|---|---|---|
| | | people. | | | |
| 8 | Land Loss | Acquisition of land, lease of land and temporary disturbances in land | Cross checking the compensation list | Tower pad, RoW and the leased area | Quarterly during construction and once during operation |
| 8 | Health issues | Types of Diseases and record of outbreak of diseases | Record of diseases, inspection of camps of camps | Project area and particularly camps | Continuous during construction period |
| 9 | Safety | No. of casualties | Records of accidents | Project area | Continuous during construction period/operation phase |
| 10 | Employment | No. of local people employ by project | Records kept by management | Project area | Continuous during construction period and annually during operation |
| 11 | Impact on Women/Children | Status of women children | Record of women employment; children education; Inspection on Child Labor | Project area | Continuous during construction period |
| 12 | Indirect economic benefits | Economic activities in the area | Trade and business revenues | Project affected VDCs | Once a year during construction and once during operation |
| **C** | **Compliance Monitoring** | | | | |
| 1 | Incorporation of IEE Recommendations into project documents | Yes/No | Review/cross checking of tender and design documents | Site Office | During and after the project design stage completion of tender documents |
| 2 | Incorporation of Environmental considerations mentioned in the tender documents in the contractors proposed work plans | Yes/No | Review of proposed work plan submitted by the contractor | Site office | During contract negotiations |
| 3 | Integration of mitigation measures in the detail design and contract documents | Yes/No | Review process | Site office | During project approval |
| 4 | Allocation of adequate budget for the implementation of the environmental mitigation measures and monitoring works | | Review, inquiry and consultation | Site office | During detail design and contract agreement |
| 5 | Clean-up and reinstatement of the project area | Muck disposal, drainage around the tower | Site observation, and inspection | A round the Tower area, substation area | At the end of construction period |
| 6 | Compensatory plantation of native species and conservation of planted seedlings for 5 years | Type of planted Species, survival of seedlings | Site observation/sampling | Corridor inspection, tower area, plantation areas | Periodically during construction and operation |

| | | | | | |
|---|---|---|---|---|---|
| 7 | Land/property acquisition procedures | Compliance with national legal requirements | Discussions with local people | Affected VDCs/site office | At the time of acquisition |
| 8 | Trainings and trainees | Number of trainings and trainees | Survey/observation | Project affected area/VDCs | Periodic during construction and operation |

### 9.3.1 Agencies Responsible for Environmental Monitoring

#### *9.3.1.1 Project Stakeholders for Environmental Management*

Key stakeholders including Chilime 132/220kV substation hub and Chilime – Trishuli 220kV TL , to be involved for project environmental management in hierarchy orders are:

- Ministry of Forest and Soil Conservation (MoFSC)
- Ministry of Energy (MoEn)
- Department of Forest
- Construction Management/Supervision Consultant
- Project proponent/Nepal Electricity Authority/NEA-ESSD
- Environment Monitoring Unit
- Environment Management and Grievances Redress Unit
- Local Consultative Forum
- Contractor and
- Local level Government and non-government organizations such as District Development Committee, (DDC), District Forest Office (DFO), Village Development Committee (VDC), Community Forest User Groups, NGOs and Community based Organizations (CBOs).

#### 9.3.2.1 Institutional Arrangement and Responsibility

#### 9.3.2.1.1 Central Level Arrangement

**I) Environment and Social Studies Department**

Environment and Social Studies Department (ESSD) is one of the four departments of Engineering Service Directorate 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 will be responsible for the overall control of social management program of the project. This department will also be responsible for the coordination of work of the project at central level management of NEA and central line agencies. It is proposed that ESSD will implement monitoring program and some of the social mitigation work in coordination with concerned line agencies and local NGOs. The mitigation and social support program will be implemented by mobilizing local NGOs, Consulting firm Contractor and line agencies. The Program Coordinator will be responsible for overall coordination and implementation of the environmental and social mitigation programs. The Program Coordinator will be assisted by environmental and social expert at central and local level.

### *II) Central Level Line Agencies*

The central level line agencies such as Ministry of Energy, Department of Electricity Development have responsibility for the monitoring of project activities with regards to Environmental and Social Management, Mitigation and Monitoring Plan. ESSD will coordinate with central level line agencies regarding the monitoring work.

As the concerned line agency, Department of Forest is responsible for the implementation of a forestation program as per the Procedural Guideline for the Use of Forest Land 2063. Discussion is ongoing between the Project/NEA and Department of Forest regarding the implementation of the compensatory forestation program. NEA will pay the required cost for plantation and five years management to Department and the Forest Department will implement the work through their district level forest offices. ESSD may also implement the aforestation program if requested by the project.

#### III) Joint Monitoring Committee

To ensure the proper implementation of mitigation measures and monitoring work a joint monitoring team will be formed which will monitor the activities of the Chilime-Trishuli Environmental Management Unit (CTEMU) and Contractor on periodic basis. This monitoring team will be coordinated by the Project. Due to coordination with line ministries (MoEn and MoFSC) will be made during such monitoring work. The committee will include the representative of district level line agencies (DDC, DFO, Agriculture Development Officer, District Administration Officer, Education and Health Officer), representative of local club and mother group etc.

#### IV) Panel of Expert

The project proponent will hire independent Panel of Expert (PoE) to make sure the mitigation and monitoring works are implemented according to plan. The PoE shall include environmental and social expert with relevant experience in environment management of the Transmission Line projects. The experts will review the work conducted by CTEMU, LCF and Joint Monitoring team and provide their suggestions to PMO for improvement if required based on the ground condition.

#### *9.3.2.2.1* Project Level Arrangement

#### I) Project Manager Office

The Project Manager Office will be established under the organizational setup of Nepal Electricity Authority. The Project Manager will have overall responsibility regarding the implementation of EMP including others. He will be also responsible for acquiring necessary permits for forest clearance from Ministry of Forest and Soil Conservation, land acquisition and compensation etc. The Project Manager will be responsible to make sure the incorporation of IEE recommendations in tender document and contract agreement and allocation of necessary budget for the implementation of Report.

He will be responsible for establishment of Compensation Determination Committee (CDC), Local Consultative Forum (LCF) and Environment Management and Grievances Redress Unit. The Project Manager will be responsible to make sure the allocation of necessary budget for the implementation of the program. He will be responsible for the overall coordination of the work and make final decision on environmental, social and public concern issues.

Under the Project Manager Office, a Land Acquisition and Rehabilitation Unit (LARU) will be established. The in-charge of unit will be responsible for the acquisition of land and house, asset valuation and verification, implementation of compensation and rehabilitation grant (house rent, transportation and dislocation allowances) and coordination of the work with District and Central level agencies with regard to acquisition of private property. The officer in-charge of the unit will also work as member of secretary of the CDC and member of LCF.

The construction contractor will be responsible for implementation of mitigation measures specified in the part of contractor and compliance with the tender clauses. The contractor will be responsible for the implementation of spoil disposal, waste management, occupational safety, recruitment of local labor, health and sanitation measures, air, noise and water quality protection measures, etc.

### II) Chilime-Trishuli Environment Monitoring Unit (CTEMU)

A site based Environment Monitoring Unit will be formed at the project site for day to day environmental monitoring of the project, implementation of monitoring plan and coordination of work with concerned stakeholders. The unit will function under the direct supervision of the Project Manager.
The following manpower will be deployed in CTEMU

- Environmental Expert/Unit Chief
- Environmental/Civil Engineer
- Ecologist/ Forest Expert
- Wildlife Expert
- Socio-economist
- Field Supervisors/Monitors
- Office Support staff

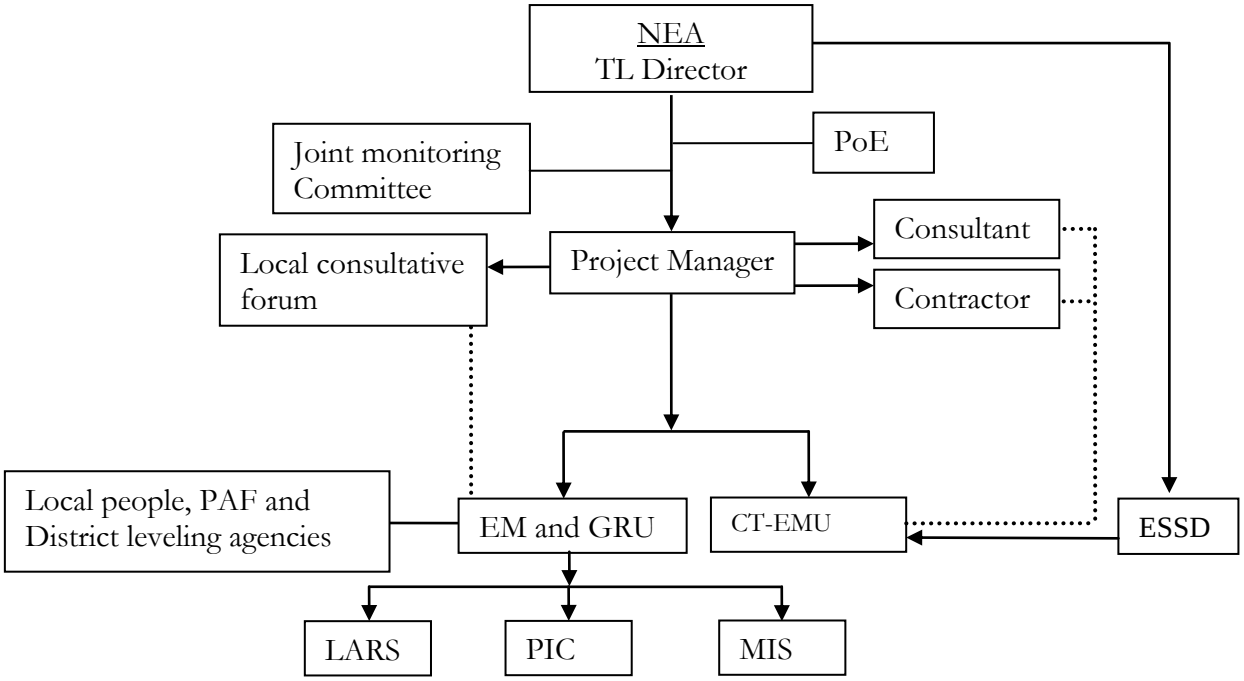
### III) Environment Management and Grievances Redress Unit (EM and GRU)

Environment Management and Grievances Redress Unit will be established under the Project Organizational setup. This office will be under direct supervision of PMO. This Unit will have three sections namely Land Acquisition and Rehabilitation Section (LARS), Project Information Center (PIC) and Mitigation Implementation Section (MIS). All three sections have unique responsibility regarding the implementation of different action. LARS will be responsible for the implementation of land acquisition and rehabilitation program whereas

public disclosure work will be conducted through PIC. The MIS will implement mitigation measures proposed in Chapter-8 especially the program proposed in biological and socio-economic environment. The MIS will coordinate the work district level line agencies such as District Forest Office, District Development Committee, and District Land Revenue etc. The following manpower will be deployed in EM and GRU.

- Unit Chief Environmental/Social Expert
- Program coordinator
- Community Liaison Officer
- Land Acquisition and Resettlement officer
- Office Assistant
- Supervisor
- Support Staff

**Figure 9.1: Organizational setup for Environmental Management and Monitoring**




where,

| | | |
|---|---|---|
| NEA | : | Nepal Electricity Authority |
| TL | : | Transmission Line |
| PoE | : | Panel of Expert |
| EM and GRU | : | Environment Management and Grievances Redress Unit |
| CT-EMU | : | Chilime-Trishuli Environment Monitoring Unit |
| LARS | : | Land Acquisition and Rehabilitation Section |
| PIC | : | Project Information Center |
| MIS | : | Mitigation Implementation Section |
| PAF | : | Project Affected Family |
| ESSD | : | Environment and Social Studies Department |

### 9.4.1 Environmental Monitoring Cost

The estimated monitoring cost is NRs. **11,618,000** for pre-construction, 2 years construction and two years operation phase monitoring. This cost includes cost for manpower, transportation, joint monitoring with line agencies and concerned stakeholder, report preparation and office operation (Table 9.2).

Table 9.2: Environmental Monitoring Cost

| S. No. | Item | Man-month | Rate/ Month (NRs.) | Amount (NRs.) |
|---|---|---|---|---|
| **A.** | **Baseline/Pre-construction** | | | |
| 1 | Manpower | | | |
| 1.1 | Team Leader /Environmental Expert | 2 | 40,000 | 80,000 |
| 1.2 | Ecologist/Forest Expert | 1 | 30,000 | 30,000 |
| 1.3 | Wildlife expert | 1 | 30,000 | 30,000 |
| 1.4 | Socio-economist | 1 | 30,000 | 30,000 |
| | **sub-total** | | | **170,000** |
| 2 | Out of Pocket Expenses | | | |
| 2.1 | Transportation | | LS | 150,000 |
| 2.2 | Field survey( Enumerators, supervisors etc) | | LS | 50,000 |
| 2.3 | Daily allowances | Persons -24 | 2,000 | 48,000 |
| 2.4 | Data Analysis | | LS | 50,000 |
| 2.5 | Report Production | | LS | 50,000 |
| 2.6 | Miscellaneous | | | 10,000 |
| | **sub-total** | | | **358,000** |
| | **Total of A** | | | **528,000** |
| **B** | **Construction Phase (Compliance & Impact for 2 years)** | | | |
| 1 | Manpower | | | |
| 1.1 | Environmental Expert/ Unit Chief | 24 | 60,000 | 1,440,000 |
| 1.2 | Civil / Environmental Eng | 2.5 | 60,000 | 150,000 |
| 1.3 | Ecologist/Forest Expert | 2.5 | 60,000 | 150,000 |
| 1.4 | Public Relation Officer | 2 | 60,000 | 120,000 |
| 1.5 | Socio-economist | 3 | 60,000 | 180,000 |
| 1.6 | Environmental monitor-2 | 48 | 30,000 | 1,440,000 |
| 1.7 | Support Staff-2 | 48 | 20,000 | 960,000 |
| | **sub-total** | | | **4,440,000** |
| 2 | Out of Pocket Expenses | | | |
| 2.1 | Transportation | | LS | 2040,000 |
| 2.2 | Daily allowances | | LS | 350,000 |
| 2.3 | Report Production | | LS | 100,000 |

| | | | | |
|---|---|---|---|---|
| 2.4 | Field test and laboratory analysis | Twice in a year (At least 4 times during construction | 200000 | 800,000 |
| 2.5 | Miscellaneous | | | 50,000 |
| | **sub-total** | | | **3,340,000** |
| 3 | Joint Monitoring Committee | | | |
| 3.1 | Daily allowances for 5 people quarterly 5days input in each quarter month for each member | 5*5*4 (for two Year) | 1,500 | 1,500,000 |
| 3.2 | Transportation and other expenses | LS | | 600,000 |
| | **sub-total** | | | **2,100,000** |
| 4 | Panel of Experts | | | |
| 4.1 | Remuneration | 5 | 50,000 | 250,000 |
| 4.2 | Transportation and other expenses | LS | | 250,000 |
| | **sub-total** | | | **500,000** |
| | **Total of B** | | | **10,380,000** |
| **C** | **Operation and Maintenance Phase (Two Years Compliance and Impact)** | | | |
| 1 | Manpower | | | |
| 1.1 | Team Leader Environmental Expert | 2.0 | 60,000 | 120,000 |
| 1.2 | Civil / Environmental Engineer | 1.0 | 60,000 | 60,000 |
| 1.3 | Ecologist/Forest Expert | 1.5 | 60,000 | 90,000 |
| 1.4 | Socio-economist | 1.5 | 60,000 | 90,000 |
| | **sub-total** | | | **360,000** |
| 2 | Out of Pocket Expenses | | | |
| 2.1 | Transportation | - | LS | 150,000 |
| 2.2 | Daily allowances | No of Persons-50 | 2,000 | 100,000 |
| 2.3 | Report Production | | LS | 50,000 |
| 2.4 | Miscellaneous | | LS | 50,000 |
| | **sub-total** | | | **350,000** |
| | **Total of C** | | | **710,000** |
| | **Grand Total (A+B+C)** | | | **11,618,000** |

# CHAPTER X: CONCLUSION

## 10.0 INTRODUCTION

This chapter sums up the findings and conclusions of the Initial Environmental Examination Study of the 132/220kV Chilime sub-station Hub and Chilime–Trishuli 220kV Transmission Line Project. An overall Examination is provided first, followed by sections giving specific conclusions and recommendations.

## 10.1 SUMMARY

The environmental issues identified during the Initial Environmental Examination Study are fairly unproblematic. The impacts are moderate, within acceptable limits and can generally be mitigated. There are enhancement and risk reduction opportunities to be reaped on behalf of the local communities, which will experience positive rural development activities. Other direct benefits of the project will be from establishment of industries and general improvement of infrastructures and services in the project impact area due to reliable electricity and some employment to the local people.

Wherever possible, efforts have been made by the project planning team to limit adverse impacts on the environment by selecting environmentally benign design options and otherwise suggesting appropriate mitigation measures.

## 10.2 CONCLUSIONS

### 10.2.1 Physical Environment

(i) The project will acquire a total area of 84.556 ha of land for tower pads, camps and for the RoW, out of which 5.518 ha will be permanent and the rest will be temporary. The land under the RoW will be temporarily acquired and the people will be able to use the land for cultivation after the completion of the project.

### 10.2.2 Biological Environment

(ii) The major impacts on vegetation and forest resources include the loss of 15491 trees of various species and sizes and their standing wood volume is estimated as 4383.909 cubic meters.

(iii) Assuming 30m of RoW, the total forest area under the transmission line alignment is about 44.901 ha lies in alignment.

### 10.2.3 Socio-economic and Cultural Environment

iv) In terms of the loss of land and assets, one households will be affected due to the implementation of the project and 32 households are affected by tower pad.

v) One household will have to be relocated.

vi) The land acquisition and disturbance will cause the one time loss of 82.66 metric tonnes and permanent annual loss of 7.19 metric tonnes agricultural production. In addition 34.047 ha agricultural land under RoW will be devalued and will be restricted from construction and free plantation.

(vii) Increase in the accidental risks like electric shocks, fire hazards from the high tension transmission lines will be one of the impacts associated with the transmission line. Public awareness programs on safety issues will be the major mitigation measures to reduce the accidents.

### 10.2.4 Environmental Management Plan

(vii) The total cost for implementing the Environmental Management Plan is estimated to be NRs.....which is about ....% of the total transmission line project cost. This cost includes mitigation and enhancement cost, monitoring cost and auditing cost.

## 10.3 RECOMMENDATIONS

A detailed Environmental Management Action Plan will be made prior to construction which is required for a number of reasons, partly because the project configuration and engineering parameters or techniques may be changed and partly because firmer commitments must be secured from the many actors involved in the implementation of the EMP.

i) The mitigation measures recommended will be incorporated in Contract Documents for the works thus providing the Environment and Social Mitigation/Enhancement requirements for the Contractors/Project Company to consider in his bid and follow during construction.

ii) Further examinations of individual household conditions with emphasis on their ethnic background will be done during the further project development before determining compensation packages for the permanent land take.

iii) Further studies on the baseline conditions are required during the further project development. Such studies will include:

- Detailed survey and documentation of endangered plants and wildlife.

- Detailed survey and documentation of the operation of the existing community managed forests and national forests.
- Detailed survey and documentation of existing agricultural practices.