Initial Environmental Examination

Project No. 43281
Final Report
June 2010

NEP: Tanahu (Upper Seti) Hydropower Project

Prepared by Nepal Electricity Authority (NEA).

Initial Environmental Examination (IEE)
of
Upper Seti(Damauli)-Bharatpur 220 kV Transmission Line Project

Final Report
Vol. I - Main Report

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Prepared and Submitted by:

Environmental & Social Studies Department,
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Jamal, Kathmandu

June, 2010

Acronyms and Abbreviations

ACRP	:	Acquisition, Compensation and Rehabilitation Plan
ACSR	:	Aluminium Conductor Steel Reinforcement
CBS	:	Central Bureau of Statistics
CFUG	:	Community Forest Users Group
CITES	:	Congress of International Trade of Endangered Species
DFO	:	District Forest Officer
DNPWC	:	Department of National Park and Wildlife Conservation
DOED	:	Department of Electricity Development
EIA	:	Environmental Impact Assessment
EL	:	Elevation
EMP	:	Environmental Management Plan
EPA	:	Environmental Protection Act 1997
EPR	:	Environmental Protection Rule 1997
ESSD	:	Environmental and Social Studies Department
FSL	:	Fully Supply Level
FUG	:	Forest User's Group
GIS	:	Geographical Information System
GON	:	Government of Nepal
ha	:	Hectares
Hh	:	Household
IEE	:	Initial Environmental Examination
IUCN	:	World Union for Nature Conservation
km	:	Kilometer
m	:	Meter
MBF	:	Main Boundary Fault
MOEST	:	Ministry of Environment Science and Technology
MOFSC	:	Ministry of Forest and Soil Conservation
MOL	:	Minimum Operating Level
MOWR	:	Ministry of Water Resource
MW	:	Megawatt
NARC	:	National Agricultural Research Center
NEA	:	Nepal Electricity Authority
NGO	:	Non-governmental Organization
NRDB	:	National Red Data Book
PAA	:	Project Affected Area
PAF	:	Project Affected Families
SPAF	:	Seriously Project Affected Families
SRC	:	Soil, Rock and Concrete Laboratory
T/L	:	Transmission Line
TOR	:	Terms of Reference
USBDTLU	:	Upper Seti (Bharatpur) – Damauli Transmission Line Unit
VDC	:	Village Development Committee

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१. आयोजनाको प्रस्तावक र प्रारम्भिक वातावरणीय परिक्षण अध्ययन गर्ने निकाय:

प्रस्तावित माथिल्लो सेती (दमौली)–भरतपुर २२० के.भी. प्रसारण लाइन आयोजनाको प्रस्तावक नेपाल विद्युत प्राधिकरण हो । नेपाल विद्युत प्राधिकरण ऐन २०४२ अन्तर्गत वि.स. २०४२ साल भाद्र १ गते नेपाल विद्युत प्राधिकरणको स्थापना भएको हो । जुन नेपाल सरकारको पूर्ण स्वामित्वमा रहेको एक संगठित संस्था हो । प्रस्तावित प्रसारण लाइन आयोजनाको प्रारम्भिक वातावरणीय अध्ययन कार्य नेपाल विद्युत प्राधिकरण अन्तर्गत स्थापित वातावरण तथा सामाजिक अध्ययन विभागले गरिरहेको छ ।

२. आयोजनाको विवरण

प्रस्तावित माथिल्लो सेती जलाशययुक्त जलविद्युत आयोजनाबाट उत्पादन हुने १२७ मेगावाट विद्युतलाई राष्ट्रिय विद्युत प्रणालीमा आवद्ध गर्न माथिल्लो सेती (दमौली)–भरतपुर २२० के.भी प्रसारण लाइन निर्माणको लागि प्रस्ताव गरिएको छ ।

माथिल्लो सेती (दमौली)–भरतपुर २२० के.भी. प्रसारण लाइन आयोजना पश्चिमाञ्चल विकास क्षेत्रको तनहुं र मध्यमाञ्चल विकास क्षेत्रको चितवन जिल्लामा पर्दछ । प्रस्तावित विद्युत प्रसारण लाइन तनहुं जिल्लाको कार्हुंशिवपुर गाउं विकास समितिमा निर्माण गरिने माथिल्लो सेती जलाशययुक्त जलविद्युत आयोजनाको विद्युत गृहबाट शुरु भई चितवन जिल्लाको भरतपुर नगरपालिकास्थित गणेशस्थानमा निर्माण गरिने २२० केभी सवस्टेशनमा जोडिनेछ । प्रसारण लाइन डवल सर्किट, लम्बाई करिब ३८ कि.मी. र राइट अफ वे (तार मुनी पर्ने जमीनको क्षेत्र) ३० मिटरको हुनेछ ।

मुख्य विशेषताहरु

आयोजनाको नाम	:	माथिल्लो सेती (दमौली)–भरतपुर २२० के.भी. प्रसारण लाईन आयोजना
जिल्ला	:	तनहुं र चितवन ।
गा वि स नगरपालिका	:	कार्हुंशिवपुर, पोखरीभन्ज्याङ, केशवटार, धरमपानी, देवघाट, छिपछिपे, करिवलास र भरतपुर नगरपालिका ।
विद्युतको श्रोत	:	माथिल्लो सेती (दमौली) जलाशययुक्त जलविद्युत आयोजना
भोल्टेज	:	२२० के.भी.
सर्किट	:	डवल सर्किट
लाइनको लम्बाई	:	करिब ३८ कि.मी.
टावरहरु बिचको अनुमानित दुरी	:	३०० मि.
टावरको संख्या	:	लगभग १३०
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टावरको उचाई	:	१६-२२ मी.
टावर जगको लागि आवश्यक पर्ने जमीन	:	५.२ हेक्टर (स्थायी रुपमा उपयोग गरिने)
राइट अफ वे को लागि आवश्यक पर्ने जमीन	:	९३.४हेक्टर (अस्थायी रुपमा उपयोग गरिने)
टावरको क्षेत्रफल	:	१५६.२५ वर्ग मिटर (औपत प्रति टावर)
आयोजनाको कूल लागत	:	करिव रु. ७४,४६,७५,०००।-

३. अध्ययन विधि

प्रस्तावित २२० के.भी. प्रसारण लाइन आयोजनाको वातावरणीय प्रभाव मूल्यांकन अध्ययन वातावरण संरक्षण ऐन २०५३, वातावरण संरक्षण नियमावली, २०६६ (संशोधन सहित) तथा राष्ट्रिय वातावरणीय प्रभाव मूल्यांकन निर्देशिका बमोजिम गरिएको छ ।

४. विद्यमान वातावरणीय ऐन, नियम तथा निर्देशिका

आयोजना निर्माण तथा संचालन अवधिमा वातावरणीय प्रभाव मूल्याकन कार्यसंग आकर्षित हुनसक्ने प्रचलित ऐन, नियम तथा निर्देशिकाको पुनरावलोकन तथा समिक्षा गरी कार्यान्वयनमा ल्याइनेछ ।

५. विद्यमान वातावरणीय अवस्था

५.१ भौतिक वातावरण

भौगोलिक रुपमा प्रस्तावित प्रसारण लाइनले पहाड तथा तराइको भू-भाग छोएको र समुद्र सतहको २०० मिटर देखि १००० मिटर उचाई सम्म फैलिएको छ । प्रस्तावित सवस्टेसन तराइको समथर भूमिमा निर्माण गरिनेछ । प्रसारण लाइन मुख्यतया कृषि भूमि, चरन, जंगल र बाँझो जमीन हुदै जानेछ । प्रसारण लाइनले नदी, खोल्सी, सडक तथा चरनक्षेत्र गरी कूल लम्बाइको १८%, जङ्गल ४३% र कृषि भूमि ३९% ओगटनेछ ।

५.२ जैविक वातावरण

प्रसारण लाइन क्षेत्रमा उष्ण हावापानीमा पाइने वन, वनस्पति तथा जीवजन्तुहरु पाइन्छन् । तनहुँ जिल्लाको पहाडी पाखा/पखेरा हुँदै जाने प्रसारण लाइनमा चिलाउने र कटुसको पातलो जङ्गल पर्दछ भने यसै जिल्लाको धरमपानी र देवघाट गा.वि.स हरुमा पर्ने होचो भू-भागमा सालको जङ्गल समेत पर्दछ । त्यस्तै प्रस्तावित प्रसारण लाइन चितवन जिल्लाको समथर भू-भागमा रहेको सालको जङ्गल हुँदै भरतपुर नगरपालिकामा प्रस्तावित सवस्टेशन सम्म जानेछ । प्रसारण लाइनमा पर्ने अधिकांश वन क्षेत्र सामुदायिक वनको रुपमा हस्तान्तरण भैसकेको र केही हस्तान्तरण हुने प्रक्रियामा रहेको छ । चितवन जिल्ला अन्तर्गत रहेको कविलास गाविसको कबुलियती वन पनि प्रसारण लाइन क्षेत्रमा पर्दछ । यस जिल्लामा पर्ने सालको जङ्गलमा खासगरी बाघ, चितुवा, बंदेल लगायत विभिन्न जन्तु तथा चराचुरुङ्गीहरु पाइन्छन् ।

५.३ सामाजिक, आर्थिक तथा सांस्कृतिक वातावरण

प्रस्तावित आयोजनाबाट तनहुँ जिल्लाको ६ गाविसहरु कार्हुशिवपुर, पोखरीभन्ज्याङ्ग, केशवटार, धरमपानी, देवघाट र छिर्पाछिपे तथा चितवन जिल्लाको कविलास गा.वि.स. र भरतपुर नगरपालिका प्रभावित हुनेछन् ।

यस आयोजनाबाट प्रभावित हुने गा.वि.स/न.पा.को कूल जनसंख्या १,२६,६१३ रहेको छ । जसमध्ये पुरुष ६३,८४९ र महिला ६२,७६४ छन् । आयोजना क्षेत्रमा बाहुन र क्षेत्रीको बाहुल्यता रहेको छ । आयोजनाबाट प्रभावित क्षेत्रमा करिब ४०% बाहुन/क्षेत्री, १५% मगर, १२% गुरुङ्ग, ८% नेवार, ६% दलित, ४% तामाङ्ग र १५% अन्य जातिका मानिस बसोबास गर्दछन् । आयोजना क्षेत्रको करिब ४८% जनसंख्या कृषि कार्यमा संलग्न देखिएता पनि धेरै मानिस कृषि संग-संगै अन्य सेवा तथा व्यवसायमा समेत संलग्न रहेको पाइएको छ । आयोजना प्रभावित क्षेत्रको कूल साक्षर जनसंख्या करिब ६८% छ ।

प्रस्तावित आयोजनाको प्रभावित क्षेत्रमा पर्नसक्ने परिवारहरुमध्येबाट नमुना संकलन गरिएको आधारमा कृषिजन्य उपजहरु धान, मकै, कोदो र तोरीको वार्षिक कूल उत्पादन १४५ मेट्रिक टन देखिएको छ । आयोजना क्षेत्रमा करिब ८५% घरधुरीहरुमा खाद्यान समस्या रहेको पनि अध्ययनबाट देखिएको छ ।

६. प्रभाव मूल्यांकन

६.१ भौतिक वातावरण

आयोजनाले टावरको जग, क्याम्प र प्रसारण लाइन मार्गको लागि करिब १०२ हेक्टर जमिन अधिग्रहण तथा उपयोग गर्नेछ । उक्त जमिन मध्ये करिब ५ हेक्टर स्थायी रुपमा अधिग्रहण गरिनेछ भने बाँकी ९७ हेक्टर जमिन निर्माण अवधिमा मात्र उपयोग हुनेछ । कूल १०२ हेक्टर जमिन मध्ये ४४ हेक्टर कृषि योग्य भूमी, ५७ हेक्टर वनजंगल र बाँकी बाँझो जमिन छ । प्रसारण लाइनको राइट अफ वे मा प्रयोग हुने जमिन अस्थाई रुपमा उपयोग गरिने हुनाले आयोजनाको निर्माण सम्पन्न पश्चात उक्त जमीनलाई सम्बन्धित परिवारले पुनः कृषिको लागि प्रयोगमा ल्याउन सक्नेछन् । यद्यपि उक्त जमिन कृषि बाहेकका अन्य संरचना निर्माण कार्यको लागि उपयोगमा ल्याउन सकिने छैन ।

६.२ जैविक वातावरण

प्रस्तावित २२० के.भी. प्रसारण लाइनको राइट अफ वे मा पर्ने करिब ५७ हेक्टर वन क्षेत्र प्रभावित हुनेछ । जसमध्ये तनहुँ जिल्लामा २५.३५ हेक्टर र चितवन जिल्लामा ३१.३५ हेक्टर पर्दछ । तर डाँडाकाँडा हुँदै प्रसारण लाइन जाने भएकोले तार मुनि पर्ने जम्मा २६.७९ हेक्टर (तनहुँ-४.०६ र चितवन २२.७३ हेक्टर) वन कटान गर्नु पर्ने अनुमान गरिएको छ । जङ्गल भित्र निर्माण कार्य तथा रुख कटानले जीवजन्तुको हिंडडुल तथा वासस्थानमा असर पर्नसक्नेछ ।

६.३ सामाजिक, आर्थिक तथा सांस्कृतिक वातावरण

आयोजना कार्यान्वयनबाट सामाजिक तथा आर्थिक रुपमा २५० घरधुरी प्रभावित हुनेछन् । जसमध्ये १५७ अति प्रभावित परिवार भित्र पर्दछन् । यसैगरि आयोजना कार्यान्वयनबाट प्रसारण लाइनको राइट अफ वे मा पर्ने कूल जमिनमध्ये करिब १३५ घरधुरी प्रत्यक्ष रुपमा प्रभावित हुनसक्नेछन् भने १२ घरपरिवार विस्थापित हुने देखिएको छ । जग्गा अधिग्रहण तथा उपयोगले एक बाली बराबर करिब ३०३ मेट्रिक टन अन्न अस्थायी रुपमा नोक्सान हुनेछ भने स्थायी रुपमा करिब ५ मेट्रिक टन कृषिजन्य उत्पादनको नोक्सानी हुनेछ ।

यस अतिरिक्त प्रसारण लाइनको राइट अफ वे मा पर्ने करिब ४१ हेक्टर कृषि भूमीको स्थायी रुपमा अवमुल्यन हुने र उक्त क्षेत्र भौतिक संरचना निर्माण कार्य वा अरुला जातका रुख बिरुवा रोप्नबाट वञ्चित हुनेछ ।

७. वैकल्पिक विश्लेषण

प्राविधिक रुपमा छनौट गरिएका ३ वटा प्रसारण लाइन मार्गको वैकल्पिक विश्लेषण वातावरणीय दृष्टिले समेत गरिएको छ । सकेसम्म कम परिवार विस्थापित हुने र न्युन मात्रामा जंगल कटान गर्नु पर्ने जस्ता पक्षलाई मध्यनजर गरी वातावरणीय प्रभाव मूल्याङ्कन गर्दा प्रस्तावित प्रसारण लाइन मार्ग वातावरणीय दृष्टिकोणले उपयुक्त विकल्प हुनसक्ने देखिएको छ ।

८. प्रभाव न्युनिकरणका उपायहरु

८.१ भौतिक वातावरण

प्राविधिक रुपले उपयुक्त भएसम्म टावर निर्माणको लागि आवश्यक पर्ने थोरै जमिन प्रयोगमा ल्याइनेछ । टावरको जग वरिपरि जमिनको सन्तुलन कायम गरिनेछ । निर्माण व्यवस्थापन र अन्य सुरक्षाका उपायहरु अपनाइनेछ । पहिरो तथा भू-क्षय हुनसक्ने जमिनमा जैविक प्रविधि अनुरुप कार्य गर्न पानीको निकास दिई टावर वरिपरिको जमिनलाई व्यवस्थापन गरिनेछ ।

८.२ जैविक वातावरण

कर्वुलियती तथा सामुदायिक वनमा पर्ने र कटान हुने रुखको उचित क्षतिपुर्ति र वृक्षारोपण कार्य गरिनेछ । वन नियमावली अनुसार वन पैदावारको प्रयोग सम्बन्धित सामुदायिक वन उपभोक्ता समूह तथा जिल्ला

वन कार्यालयको समन्यवयमा गरिनेछ । वनजंगल संरक्षण कार्यको लागि निर्माण अवधिमा कामदार तथा स्थानीय वासिन्दालाई लक्षित गरी जनचेतनामुलक कार्यक्रमहरु संचालनमा ल्याइनेछ ।

८.३ सामाजिक, आर्थिक तथा सांस्कृतिक वातावरण

आयोजनाबाट प्रभावित निजी जमीनको क्षतिपूर्ति जग्गा प्राप्ति ऐन २०३४ बमोजिम गठन हुने क्षतिपुर्ति निर्धारण समितिबाट तोकिएको आधारमा गरिनेछ । अति प्रभावित परिवारलाई लक्षित गरी उनिहरुको सामाजिक तथा आर्थिक हानीनोक्सानी कम गर्न क्षमता अभिवृद्धि र कृषि उत्पादनमुलक कार्यक्रमहरु संचालन गरिनेछ । प्रसारण लाइनको निर्माणबाट भविष्यमा हुनसक्ने दुर्घटना कम गर्न जनचेतनामुलक कार्यक्रमहरु गरिनेछ । आयोजना कार्यान्यवयनबाट पुनर्स्थापना हुनसक्ने परिवारलाई जग्गाको उचित क्षतिपूर्ति, पुनर्स्थापित क्षेत्रमा आवश्यक पर्ने आधारभुत आवश्यकता तथा अन्य मानवीय न्युनतम सुविधाहरु उपलब्ध गराइनेछ । क्षति न्युनिकरण र अन्य वातावरणीय व्यवस्थापन योजनाको लागि रु. ५१,०५८,३००।- छुट्याइएको छ जुन आयोजनाको कूल लागतको करिब ७% रकम हुन आउंछ ।

९. वातावरणीय अनुगमन

प्रस्तावित आयोजनाबाट सामाजिक, आर्थिक तथा सांस्कृतिक र भौतिक एंव जैविक वातावरणमा पर्न सक्ने प्रभावहरुलाई निराकरण गर्न, न्यूनीकरणका कार्यक्रमहरुलाई प्रभावकारी रुपमा कार्यान्वयन गर्न र अनुगमन गर्न एउटा वातावरणीय व्यवस्थापन तथा अनुगमन इकाई गठन गरिने छ । यस वातावरणीय इकाइमा नेपाल विद्युत प्राधिकरण, वातावरण तथा सामाजिक अध्ययन विभागका विषेशज्ञहरु एंव प्रभावित क्षेत्रका शिक्षित व्यक्ति एंव विज्ञहरुलाई समावेश गरिने छ ।

१०. निष्कर्ष

वातावरणीय प्रभाव मूल्याकंन अध्ययनका क्रममा देखापरेका वातावरणीय पक्षहरु उचित रुपमा सम्बोधन गर्न सकिनेछन् । प्रस्तावकले वातावरणीय प्रभाव मूल्याकन प्रतिवेदनले सिफारिस गरेको क्षति न्युनिकरणका उपायहरुको अवलम्वन गरी पूर्णरुपमा कार्यान्वयनमा ल्याउनेछ । प्रस्तावित आयोजना कार्यान्वयनबाट विद्युत आपुर्तिलाई भरपर्दो र नियमित गर्न मद्धत पुग्न गई स्थानीय क्षेत्रमा उद्योगधन्दा, रोजगारी आदिको समेत विकास गर्न पुर्वाधार खडा हुने विश्वास गर्न सकिन्छ ।

E-1 NAME AND ADDRESS OF THE INSTITUTION PREPARING THE REPORT

THE PROPONENT

The project proponent, also referred to as project developer, is the Nepal Electricity Authority (NEA). NEA is an undertaking of Government of Nepal and was established in August 16, 1985 (Bhadra 1, 2042) under the Nepal Electricity Authority Act, 2042.

The contact address of the Project Proponent is:

Nepal Electricity Authority,
Transmission Line and Substation Department,
Durbarmarg, Kathmandu,
Phone: 4-231057, 4251845

ORGANIZATIONS RESPONSIBLE FOR THE IEE STUDY

Environment and Social Studies Department (ESSD) of NEA is responsible for the preparation of IEE Report. The contact address of the organization is:

Environment and Social Studies Department:
Engineering Services,
Nepal Electricity Authority,
Durbar Marg, Kathmandu
Telephone # 4231057, 4251845

E-2 GENERAL INTRODUCTION OF THE PROJECT

The Upper Seti (Damauli)-Bharatpur 220 kV Transmission Line Project traverses Tanahu and Chitwan districts of the Western Development Region. The proposed power line will extend from the powerhouse of USSHEP at Kahu Shivpur VDC of Tanahu District to the new substation. The new substation is proposed to be constructed at Ganeshthan of Bharatpur Municipality.

This project will be a double circuit line with the total length of 38.42 km and the RoW of 30 m.

E -2.1 SALIENT FEATURES

Project:	**Upper Seti (Damauli)-Bharatpur 220kV Transmission Line Project**
District:	Tanahu and Chitwan
VDCs/Municipality:	Kahu Shivapur, Pokhari Bhanjyang, Keshavtar, Dharampani, Chipchippe, Devghat, Kabilas and Bharatpur Municipality.
Source of Power:	Upper Seti (Damauli) Storage Hydroelectric Project
Nominal System Voltage:	220 kV
Circuit:	Double circuit
Length of Line:	38.42 km
Nominal span:	300 m
Number of Towers:	approximately 130
No of Angle Point:	23

Right of Way:	30 m
Tower height:	16-22 m (from top of foundation to lowest cross arm)
Permanent Land requirement	
For tower foundation:	5.2 ha
Temporary Land requirement	
Land use restriction under RoW:	93.4 ha

Tower type:	Steel Lattice Structure
Conductor:	ACSR BISON Duplex
Earth wire:	EHS 7/3.35
Foundation Type:	Pad and Chimney isolated
Foundation Area:	12.50 x 12.50 meters (approx. average per foundation)
Bay Extension:	One at Kahu Shivpur substation and another at Bharatpur substation

Cost for the Transmission line: NRs 744675000

E-3 STUDY METHODOLOGY

The IEE process follows the Environment Protection Act, 1997 Environment Protection Rules, 1997and the recent amendment 2009 (2065/11/26) and National EIA Guidelines, 1993. This IEE was prepared in accordance with the legal requirements of GoN, based on field studies and consultation with local people and officials.

E-4 EXISTING ENVIRONMENTAL POLICIES, LEGISLATION, GUIDELINES AND POLICIES

The proponent will be responsible for fulfilling the provisions of all relevant policies, acts, rules/regulations, guidelines and conventions while implementing the project. The regulation and acts related to power and water sector like Hydropower Development Policy (1992) Water Resources Act (1992) Electricity Act (1992) Water Resource Regulations (1993) Electricity Regulation (1993) were referred while preparing the prepared. In addition, important Acts and Regulations like EPA (1996) and EPR (1997), Land Acquisition Act 2034, Forest Act (1993), and Forest Rules (1995), Local Self Governance Act (1999) and Regulation (2000), National Environmental Impact Assessment Guidelines (1993), Forest Produce, Collection and Sales Distribution Guidelines (2057) etc were extensively reviewed while preparing the report.

E-5 EXISTING ENVIRONMENTAL CONDITION

E-5.1 Physical Environment

The T/L corridor crosses traverses 3 physiographic zones of Nepal (Hagen, 1998) namely from north to south, the Midlands, Mahabharat and the Siwaliks. Topographically, the Midland physiographic zone is a zone of subdued hills and valleys, with altitudes varying from 200m to less than 1000m in the T/L corridor area. The topographical variations of the proposed 220 kV transmission line ranges from 200 masl to 1000 masl.

The watershed of the project area appears to be intact. The line runs through terraced agricultural land, forest and barren land. The last stretch runs through flat topography consisting of Sal Forest with no evidence of mass wasting. The landform features along the corridor comprises of undulating

hills, grazing (barren) land, terraced agricultural land and forest land. Approximately 18% of the proposed transmission line runs through rivers, streams, creeks, roads and grazing land and whereas 43% and 39% runs through forests and cultivated land respectively.

E-5.2 Biological Environment

The proposed 220 kV transmission line corridor lies in sub-tropical climatic zone in hill area of Tanahu district. The vegetation along the alignment in Tanahu district comprises of *Schima-Castanopsis* Forest and Hill Sal Forest whereas in Chitwan district which lies in tropical climatic zone consists of Tropical Sal Forest.

There is no distinct separation of the above forest zones in the TL corridor area. Scattered patches of the *Schima–castonopsis* forest are observed only in Keshavtar VDC around an altitude of 900 masl. Below this elevation, rest of the proposed transmission line alignment in Tanahu district passes through hill Sal forest. A small section of the transmission line passes through a hill area of Kabilas VDC of Chitwan district, and then it runs through tropical Sal forest in the plain area.

Schima–castonopsis forest exists at upper slope of transmission line corridor. Chilaune (*Schima wallichii*) and Katus (*Castronopsis indica*) are the main dominant tree species. Other associates (top canopy) of this forest are Botdhayero (*Lagerstroemia parviflora*), Koiralo (*Bauhinia variegata*), Sindhure (*Mallotus philippinensis*), Amala (*Phyllanthus emblica*), Khirro (*Sapium insigne*) and Bhalayo (*Semicarpus anacardium*).

The TL corridor along the Keshavtar, Dharampani and Kabilas VDCs passes mostly through the hill Sal forest zone. The Hill Sal (Shorea robusta) occurs usually between 300 m to 1000 m. Shorea robusta is the dominant tree species of this zone and the land is undulating to flat. Khayer (Acacia catechu) and Simal (Bombax cieba) are also found along the ravine corridors and alluvial tars along the river. This forest is comparatively dense and average canopy cover was observed about 60 percent.

The lower tropical Sal Forest extends in the alluvial plain below 300m elevation. Parts of the forests along the TL corridor in Kabilas VDC and Bharatpur Municipality of Chitwan District are lower tropical Sal Forest. The main associates of this forest recorded are Harro (*Terminalia chebula*) Barro (*Terminalia bellerica*), botdhayero (*Lagerstroemia parviflora*), Karam (*Adina cordifolia*), Tatari (*Dillenia pentagyna*) and Bhalayo (*Semicarpus anacardium*) .Major shrubs associated are Dhayero (*Woodfordia fruticosa*), and Bayar (*Zizyphus mauritiana*).Major climbers and herbs associated are Bhorla (*Bauhinia vahlii*) and Gittha (*Dioscorea bulbifera*).The observed forest canopy cover is 70% and mostly uniform.

There are 16 community forest along the transmission line. Most of these forest have been already handed over to local people as Community Forests and Leasehold Forest as per Forest Act 2049. Some of them are still under process of handover to local people. Local participation and effort has led the forests of project area were to protection and forest cover has also increased in the degraded area.

A number of mammalian species are reported from the project area. Some of them are common animals such as rhesus monkey *(Macaca mullatta*), langur (*Presbytes entellus*), etc. Royal Bengal tiger, one horned rhinoceros, wild boar etc do sometimes movement in the forest of Chitwan district through which the proposed transmission line passes. The bird species found in project area are common and widely distributed in mid hill throughout Nepal. Cuckoos (*Cuculus spp)*, Jungle Crow (*Corvus macrorhychos*), Green Wood Pecker (*Picus squamatus*) and Kalij Pheasants (*Lophura leucomelana*) are the prominent bird species reported from the area. The forest area of Kabilas and

Bharatpur is also the corridor of occasional movement for the mammals like Bengal tiger and one horned rhinoceros.

E-5.3 Socio-economic and Cultural Environment

Altogether the alignment traverses through 7 VDCs and 1 Municipality of Tanahu and Chitwan Districts. The project affected VDCs of Tanahu district are Kahu Shivapur, Pokhari Bhanjyang, Keshavtar, Chipchippe, Dharampani, and Devghat. Similarly, the affected VDC and municipality of Chitwan district are Kabilas VDC and Bharartpur Municipality.

The total population of the project affected area is 1,26,613 with the male population of 63,849 and female 62,764. The average households' size of the project affected area is 5.5

The major ethnic groups in the project affected VDCs/Municipality are Brahmin (30.80%) followed by Magar (14.54%), Gurung (12.16%), Chhetri (9.53%), Newar (8.26%). Similarly, Tamang (4.23%), Kami/Dholi (3.32%), Damai (2.09%) and other (14.20%) are also residing in the project area. The other category comprises of Badi, Thakuri, Bote, Sanyasi, Chepang (Praja), Teli, Sonar, unidentified Dalit, Rajput, Kumal, etc.

About 48% of the project affected population is engaged in agricultural work. However, many people practice agriculture as well as other service or business.

The literacy rate of the sampled households is 68.49% with male literacy rate of 75.62% and female literacy rate of 61.88%.

The total annual production of varieties of crops among the sampled households is estimated to be 145 MT. The total production of paddy, maize, millet and oilseed are 90 MT, 56 MT, 8MT, and 10MT respectively. The field investigation revealed that 14.2% of the sampled households are landless. 85 % of total households reported insufficiency of food. The average duration of insufficiency of food is 6 months.

The average annual income of the household is estimated to be NRs. 71,337 out of which 48.86% is from agriculture and livestock related occupation. The average annual expenditure of the households is estimated to be NRs. 76,090.

About 95% of the sampled households use firewood for the cooking purpose. Similarly, 2.63% use kerosene and 1.97% biogas for the cooking. Use of LP gas is common only in Bharatpur Municipality area. About 19% of the households in the project area use electricity for lighting purpose while 67.76% use kerosene.

E-6 IMPACT ASSESSMENT

E-6.1 Physical Environment

The project will acquire a total area of 101.6 ha of land for tower pads, camps and for the RoW, out of which 5.2 will be permanent and the rest will be temporary. Out of 101.6 ha, 43.8 ha is agricultural land, 57 ha forest land, and the rest barren land. 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. However, it will be restricted for certain land use practices.

E-6.2 Biological Environment

During the field investigation, forest sampling shows that altogether 8948 trees of various species and sizes will be felled for the construction of proposed 220 transmission line and their standing wood volume is estimated as 9070 cubic meters.

Assuming 30 m of RoW, the forest area actually required for clearance along the RoW are 4.06 ha and 22.73 ha in Tanahu and Chitwan districts respectively

Since the area to be cleared is limited and remaining forest area is quite large no significant impact on wildlife habitat and the loss of vegetation is expected. Possibility of avian injuries from collisions is expected.

E-6.3 Social Environment

In terms of the loss of land and assets, 250 households will be affected due to the implementation of the project out of which 157 households are seriously affected.

12 households will have to be relocated.

The land acquisition and disturbance will cause the one time loss of 303 tonnes and permanent annual loss of 5 tonnes agricultural production. In addition 40.8 ha agricultural land under RoW will be devalued and will be restricted to construction and plantation of tall trees.

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 projects.

E-7 ALTERNATIVE ANALYSIS

During the IEE process, the selected alternatives were reviewed interactively by the environmental and the technical teams. Field investigations were combined with technical, ecological and socio-economic expertise to locate the most preferable alignment.

- Alternative I and II passes mostly through the agricultural/grazing areas compared to the Alternative III
- Alternative I has the least ROW area under forest cover compared to Alternative II and III
- The number of built structures under Alternatives I, II and III are almost the same with Alternative III having 17 built structures compared to 12 and 24 in Alternative I and II respectively
- Alternative III is the longest followed by Alternative I and II but the lengths of Alternative I and II are comparable.

In order to minimize the impacts, Alternative I was selected from the environmental point of view with less forest clearance under RoW and less number of relocates. Moreover, the alignment uses the existing RoW which further reduces the forest loss

E-8 MITIGATION AND ENHANCEMENT MEASURES

E-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) during construction period. Minimization of land take, wherever feasible, will be the primary mitigation measure of the project. Other mitigation includes restoration of the area and storage of top soil around the tower pad, bio-engineering works in the disturbed and vulnerable areas susceptible to landslides and erosion, provide adequate drainage around all the towers and management of construction waste and safety hazards.

E-8.2 Biological Environment

Selected felling is one of the best approaches to minimize the loss of vegetation at the project construction site. Replacement plantation will be carried out to compensate the loss of trees in the forests.

Firewood and timber obtained from felling of trees along the ROW will be given to concerned community or leasehold forest users. Trees that are likely to be removed will be counted, marked and harvested with the proper forestry techniques by involving technical staff from the respective District Forest Office in co-operation with the Community Forest Users Groups and Leasehold Forest Users Groups. The cost of felling trees, chopping to sizeable logs, transportation and management of selling and distributing timber/firewood will be provided by the proponent to affected Forest Users Groups.

Illegal cutting of trees and encroachment on forests by labour force for timber and firewood will be controlled. Regular trimming will be done along the RoW to avoid the interference with the conductor.

Awareness programmes will be conducted for the workforce and local people to promote wildlife conservation activities.

E-8.3 Socio-economic and Cultural Environment

The private land affected by the project will be compensated as per the rate fixed by the Compensation Fixation Committee. The committee will be formed under the Chairmanship of Chief District Officer of the concerned districts and includes Chairperson of affected VDCs/Municipality, representative of affected people, representative of Land Revenue Office and Project. The required land will be acquired according to the Land Acquisition Act, 2034 BS. The relocatees will be compensated and supported in re-establishing a basis for maintaining or improving their chosen style of living by the social mitigation program.

Mobile health and sanitation facilities will be provided to the construction workforce to ease pressure on the existing services. Besides, community awareness programmes in collaboration with local NGOs will be provided to the workforce and the communities to reduce the possibility of electrocution and other hazards . Enhancement programs like agricultural productivity intensification program, skill trainings for SPAF and PAF will be conducted to mitigate the socio-economic impacts of the project.

Public Awareness Programs on safety issues will be the major mitigation measures to reduce the accidents.

E-9 ENVIRONMENT MONITORING

In order to implement smoothly the mitigation program, monitoring plan, issues of public concern and other relevant issues, an Environmental Management Plan will be made. Under this plan a unit will be required to implement the day-to-day environment management plan which will consist of experts from ESSD, Ministries, local administrators and other qualified personnel from the local market.

The total cost for implementing the Environmental Management Plan is estimated to be NRs. 51,058,300. This cost includes mitigation enhancement cost and monitoring cost. This total cost is approximately 7 % of the total transmission line project cost.

E-10 CONCLUSIONS

The environmental issues identified during the Environmental Impact Assessment Study are fairly unproblematic. The impacts are moderate, within acceptable limits and can generally be mitigated if the Environmental Management Plan is followed. 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.

CHAPTER 1:

NAME AND ADDRESS OF THE INSTITUTION PREPARING THE REPORT

1.1 THE PROPONENT

The project proponent, also referred to as project developer, is the Nepal Electricity Authority (NEA). NEA is an undertaking of Government of Nepal and was established in August 16, 1985 (Bhadra 1, 2042) under the Nepal Electricity Authority Act, 2042.

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.

The Ministry of Energy (MOE) has granted a survey license for the feasibility study including environmental study for the proposed Upper Seti (Damauli) - Bharatpur 220 kV Transmission Line Project. The survey license was issued on 2063/06/27 B.S. (3/10/2006 A.D.) and is valid till 2067/06/25, a copy of which is presented in Appendix A.

The contact address of the Project Proponent is:

Nepal Electricity Authority,
Transmission Line and Substation Department,
Durbarmarg, Kathmandu,
Phone: 4-231057, 4251845

1.2 ORGANIZATIONS RESPONSIBLE FOR THE IEE STUDY

Environment and Social Studies Department (ESSD) of NEA executes all activities related to the environmental aspects of all projects studied, designed, and constructed or operated by NEA. The activities in the field of environment started in 1987 with the establishment of the Environmental Unit, a first of its kind in the field of environmental studies of hydropower in Nepal. This department is now developed into a full-fledged commercial department and 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.

The contact address of the organization responsible for the preparation of IEE Report is:

Environment and Social Studies Department:
Engineering Services,
Nepal Electricity Authority,
Durbar Marg, Kathmandu
Telephone # 4231057, 4251845
E-mail # neaessd@wlink.com.np

1.3 RATIONALITY FOR CONDUCTING IEE

According to Schedule-1 (pertaining to Rule 3) of Environment Protection Rules, 1997 with amendments, an initial environmental examination is required for the construction of transmission line projects of 132 kV and above voltage level Initially, a scoping exercise and preparation of ToR was conducted as per the prevailing which was approved by then MoEST on 5th November 2008. EIA study was conducted and draft report was submitted to MoE for approval accordingly. Meanwhile, amendments were made on the EPR, 1997 (2065/11/26) which states that only Initial Environmental examination is required for transmission line project with voltage exceeding 132 kV . Since the capacity of proposed project is 220 kV, Ministry of Energy (MoE) has granted permission to conduct the IEE based on the approved scoping and ToR by then MoEST. This linear facility will not pass through any National Park, Wetlands, Buffer Zones Conservation Area or Protected Area.

1.4 STRUCTURE OF THE REPORT

This report contains ten chapters. Chapter 1 gives the general introduction of the project and the Chapter 2 contains the detail of the project and Chapter 3 outlines the methodology of the IEE process. Chapter 4 discusses environmental policies, legislation and guidelines reviewed during the IEE study of the project. In Chapter 5, the baseline conditions of the project area has been presented for the project presented. In this chapter, the baseline conditions of the physical, biological and socio-economic & cultural environment have been presented in detail. Chapter 6 outlines all the negative and positive impacts associated with the physical, bio-physical and socio-economic and cultural environment. Chapter 7 discusses the various proposed route alternatives for the line alignment and assessment of the impacts. Chapter 8 describes the mitigation measures, Chapter 9 presents the Environmental Management Plan and Chapter 10 sums up the major findings of IEE study.

CHAPTER 2:

GENERAL INTRODUCTION OF THE PROJECT

2.1 BACKGROUND

The existing transmission facilities for power evacuation in Nepal are of capacity 132 kV and below. The 132 kV transmission lines are suitable for transmitting power only up to 80 MW. Furthermore, the transmission loss increases as the length of the line increases. Hence, to evacuate the power above 100 MW, higher capacity transmission lines are of utmost significance for the reduction of transmission losses. The line loss decreases at higher voltages due to decrease in the resistance of the line. It is for the aforementioned reasons, a 220 kV transmission line having total length of approximately 38.42 km has been considered most suitable alternative than the 132 kV transmission line to evacuate the power from the powerhouse located at Kahu Shivpur VDC Ward No. 1 of Tanahu District to the proposed new substation at Bharatpur Municipality Ward No 1 of Chitwan District.

This report is the Initial Environmental Examination (IEE) study of 38.42 long Upper Seti (Damauli)-Bharatpur 220 kV Transmission Line project. The Environment Protection Rules (EPR), 1997 and the recent amendment 2009 (2065/11/26) schedule-1, pertaining to rule 3 states that the Initial Environmental Examination is mandatory for the transmission facilities with voltage level of 132 kV and above. Thus, this project having T/L length of 38.42 km and voltage level of 220 kV require an IEE study. The proposed project is not located in any environmentally sensitive areas such as National Parks or Conservation Areas and Wildlife Sanctuary and Buffer zones.

2.2 OBJECTIVES OF THE IEE STUDY

The main objective of the IEE is to examine the most suitable and cost effective configuration of the proposed project that would be sensitive to the region's environment, and to recommend further investigations that might be needed to minimize the adverse impacts while enhancing the socio-economic and environmental benefits.

In essence, the specific objectives of this IEE study are as follows:

- Identify the project impact area;
- Document the major physical, biological and socio-economic and cultural baseline conditions;
- Identify potential positive and adverse impacts;
- Analyze the most critical adverse impacts;
- Examine and select the most optimal alternative from the various relevant options;
- Propose mitigation measures for adverse impacts, and enhancement measures for positive impacts;
- Incorporate the input of public opinions in the decision making process related to the identification of potential impacts, mitigation measures and project alternatives;
- Outline the elements of environmental mitigation, management, auditing and monitoring into a draft Environmental Management Plan (EMP);
- Provide recommendations on the overall feasibility of the project from an environmental perspective.

2.3 PROJECT DESCRIPTION

2.3.1 Project Location

The proposed project is located in Tanahu and Chitwan Districts. The proposed 220 kV transmission line traverses through six VDCs of Tanahu district, namely Kahun Shivapur, Pokhari Bhanjyang, Keshavtar, Dharampani, Chhipchippe and Devghat VDCs, and one VDC and one municipality of Chitwan district, namely Kabilas VDC and Bharatpur Municipality. The location of the project is shown in Figure 2.1.

2.3.2 Proposed alignment

The proposed Upper Seti (Damauli) - Bharatpur 220 kV Transmission Line (T/L) Project has a length of 38.42 km. It consists of one substation and its Right–of–Way (RoW) is 30 m with 15 m on either side from the centreline.

The proposed power line is 38.42 km long and will extend from the Powerhouse of Upper Seti Hydropower Project at Kahu Shivapur to the new Substation at Bharatpur Municipality. The initial stretch of the proposed line is connected to the gravel road which is connected to Prithivi high way in Damauli. Similarly, the end stretch of the line runs close to the Mugling-Chitwan Highway. The line traverses mainly though terraced agricultural land, forest and avoids settlements. The alignment is shown in Figure 2.2 (Sheet No 1/6- Sheet No 6/6) and it identifies stretches are described in the following sections.

The new substation is proposed to be constructed at Ganeshthan of Bharatpur Municipality. The proposed alignment can be described in the following stretches.

2.3.2.1 Dharapani (Powerhouse) to Rumsi (TP1-TP2)

The proposed alignment starts from the Powerhouse on the right bank of Seti River at an elevation of 589 masl. The line is stringed directly from the powerhouse which crosses the Seti River and ascends over the terraced agricultural land to the tension tower located at TP-2. The altitudinal variation along this stretch varies between 583 masl and 860 masl.

At this stretch the line passes through undulating landscapes and through villages like Banchare, Simalswara, Chhapdada, and Rumsi.

2.3.2.2 Rumsi-Huslan (TP2-TP3)

From Rumsi the line runs parallel to the existing 132 kV Transmission Line crosses Dhad Khola and then ascends to Huslan. At this stretch the line crosses terraced agricultural land and patches of forest near Dhad Khola. The altitudinal variation along this stretch two angle towers varies between 860 masl and 930 masl.

2.3.2.3 Huslan -Dharampani (TP3-TP4)

From Huslan the proposed transmission line goes to parallel to Pokhara-Bharatpur 132 kV Transmission Line towards Dharampani through cultivated land and then enters into the forest . This alignment mainly consists of forest land.

Fig. 2.1 :
Upper Seti (Damauli) - Bharatpur 220 kV T/L
Location Map

Upper Seti (Damauli)-Bharatpur 220 kV Transmission Line Project

Route Alignment Map

Sheet No. 1

Thamdādā
Barāhādāḍā
Rāsi Bhanjyāṅ
Kuluṅ
Ramkoṭ
Chārghare
Ṭampale
Dādāchok
Muchchuk
Kuluṅkoṭ
Bel Bhanjyāṅ
Garaudi
Arkhalepāni
Belṭār
Ṭhuṭe Gairha
Pārkuṇā
Ghartiṭār
Belṭār
Serāṭār
Rumsi
KESHAVṬĀR
Guwāṇḍāḍā
Khareṭār
Āphreḍāḍā
Rāhuṭār
Belthumki
Arthumkā
Dhiraldāḍā
Belkuṇā
Harkapur
Suder
Sukaurā
Bhāgerthumki
Rinjāle
Marauṭe
Khārḍāḍā
Thinkot
Beldote
Pokharithok
Darthok
Tikeswārā
Halthumkā Ḍāḍā
Nayāgāukot
Khukreni
Nayāgāu
Sāmdi Bagaicha
Chisapāni
Bhawanswārā
Huslāṅkot
Huslā
Māstipur
Phurkedāḍā
DHARAMPĀNI
Ṭorke
Khanibhanjyā
CHHIPCHHIPE
Dharampāni 5 km
Dāgaṛā 3 km
Thuṇithumme 1.5 km
Bandipur 4 km
84°20'00"
84°22'30"
27°52'30"
27°55'00"
32
33
34
35
36
93
92
91
90
89
88
87
86
85

Upper Seti (Damauli)-Bharatpur 220 kV Transmission Line Project
Route Alignment Map
Sheet No. 2

First edition 1998.

3 4 Kilometres

INDEX TO SHEETS

LOCATION DIAGRAM

School, Post office
Hospital, Health post
Police station, Fire station
Bus terminal, Petrol pump
Revetment

(Blue contours indicate permanent snow or glacier
Index contour
Intermediate contour
Supplementary contour
Embankment
Cutting
Depression: Big
Depression: Small
Soil cliff: Big, Small
Rocks: Large, Small
Cliff: Rock, Ice
Quarry, Gravel or clay pit

Cultivation
Tea or coffee plantation
Orchard, Nursery
Trees: Scattered, Prominent
Row of trees, Bamboo
Bush area, Forest area
Grass area, Barren area
Swamp

Lake, Pond or water tank
Streams
River with waterfall and rap
Canal, Ditch
Sand and gravel area
Aqueduct
Dam, Sluice gate, Weir
Ferry, Ford, Twine service
Water tap, well , Water tow
Spring, Ooze away place
Glacier with moraines and

Triangulation point, Bench
Mountain pass, Spot height
Fence or wall
International boundary
District boundary
VDC or municipality bound
Village Development Com
National park boundary

PRONUNC
ā as
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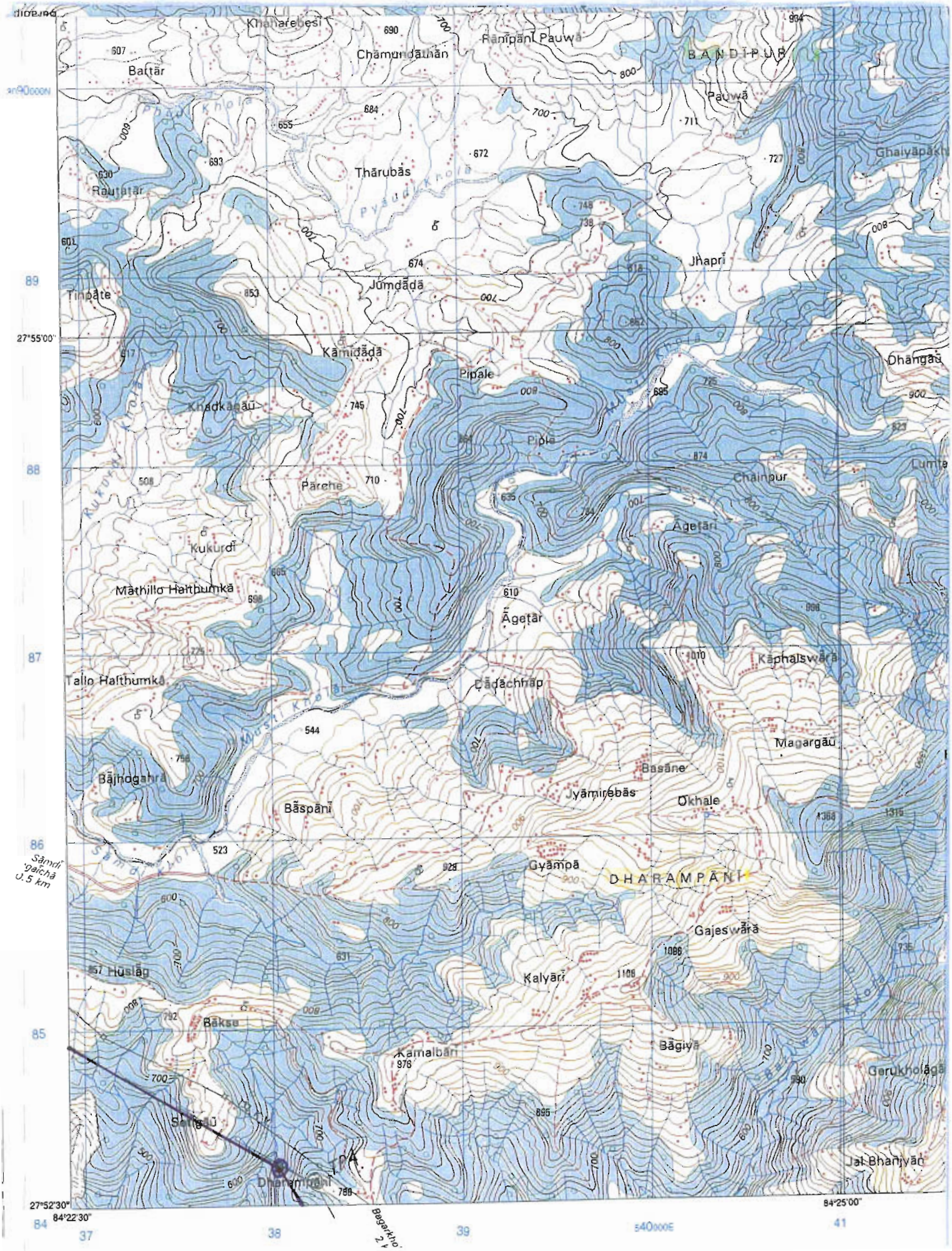


Upper Seti (Damauli)-Bharatpur 220 kV Transmission Line Project

Route Alignment Map

Sheet No. 3

NEPAL 1 : 25 000

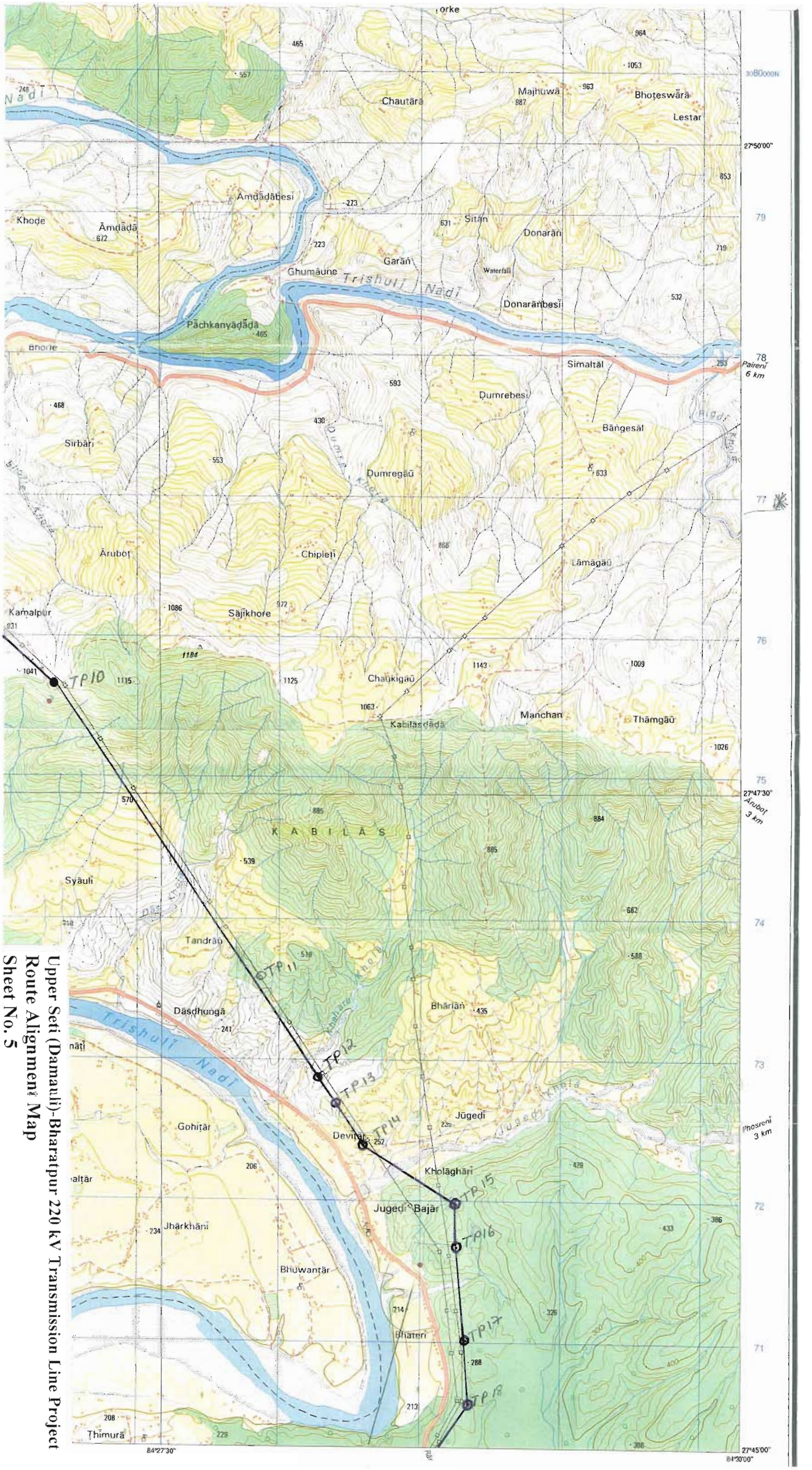
JUGEDI BAJA

Upper Seti (Damauli)-Bharatpur 220 kV Transmission Line Project

Route Alignment Map

Sheet No. 4

Upper Seti (Damauli)-Bharatpur 220 kV Transmission Line Project
Route Alignment Map
Sheet No. 5



Temple or stupa, Māne . . . . . .
Mosque, Church . . . . . .
Cemetery . . . . . .
Factory, Chimney . . . . . .
Mining site, Cave . . . . . .
Monument, View tower . . . . .
School, Post office . . . . . .
Hospital, Health post . . . . . .
Police station, Fire station . .
Bus terminal, Petrol pump . .
Revelment . . . . . .

Transmission tower . . . . .
Transformer station . . . .
Transmission line with pyl

Index contour . . . . . .
Intermediate contour . . . .
Supplementary contour . .
Embankment . . . . . .
Cutting . . . . . .
Depression: Big, small . . .
Soil cliff: Big, small . . . . .
Rocks: Large, small . . . .
Rock cliff . . . . . .
Quarry, Gravel or clay pit

Cultivation . . . . . .
Tea or coffee plantation .
Orchard, Nursery . . . . . .
Trees: Scattered, Prominer
Bush, Grass, Bamboo . . .
Forest . . . . . .
Swamp . . . . . .

Lake . . . . . .
Streams . . . . . .
River with waterfall and ra
Canal, Ditch . . . . . .
Sand and gravel area . . . .
Aqueduct . . . . . .
Dam, Sluice gate, Weir . . .
Ferry, Ford, Twine service
Water tank or pond, Well
Water tower . . . . . .
Spring, Ooze away place .

Triangulation point, Benchm
Mountain pass, Spot height
Fence or wall . . . . . .
International boundary . . . . .
District boundary . . . . . .
VDC or municipality boundar

2.3.2.4 Dharampani-Duighare (TP4-TP9)

The initial stretch from Dharampani to Duighare passes through dense forest. The remaining stretch passes through undulated topography consisting of terraced cultivated and barren land crossing Trishuli River twice and Narayanghat-Mugling highway once.

2.3.2.5 Duighare - Devitar (TP9-TP14)

From Duighare the line climbs up to an altitude of 1000 m and then descends down to an altitude of 262 m crossing forest, terraced cultivated land, barren land and rivulets. At this stretch the line runs almost parallel to the existing 132 kV Pokhara-Bharatpur transmission line and crosses the line at Devitar (TP-14)

2.3.2.6 Devitar- Substation at Ganeshthan (TP14- TP23)

At this stretch the proposed line crosses the existing Marsyandhi-Bharatpur 132 transmission line near Jugedi bazaar. The line then runs through dense Sal forest parallel to Pokhara-Bharatpur and Marsyandhi-Bharatpur 132 kV transmission lines and ends at the proposed Sub-station at Bharatpur.

2.4 Power line selection criteria for the Project

The design and the routing of the powerline must be carried out within acceptable technical constraints but it can also be manipulated to avoid major environmental obstacles and issues. The key technical criteria are as follows:

- The route is short as possible
- The numbers of angle towers is minimum
- Long spans has been avoided
- Forest area, densely populated area, school area. temple area and other historic places is avoided as far as possible
- River crossing in the narrowest section
- Enough ground clearance at highway and road crossings
- Swampy and sliding areas have been avoided
- Minimum sharp bends

The proposed alignment traverses with specific characteristics such as:

- Undulated topography
- Terraced agricultural land
- Sal Forest
- Several small rivulets along the alignment

2.5 Salient technical features

The salient features of the project are given in Table 2.1.

Table 2.1: Salient Features

The salient features of the project are as follows.

Project:	**Upper Seti (Damauli)-Bharatpur 220kV Transmission Line Project**
District:	Tanahu and Chitwan
VDCs/Municipality:	Kahun Shivapur, Pokhari Bhanjyang, Keshavtar, Dharampani, Chhipchippe, Devghat, Kabilas and Bharatpur Municipality.
Source of Power:	Upper Seti (Damauli) Storage Hydroelectric Project
Nominal System Voltage:	220 kV
Circuit:	Double circuit
Length of Line:	38.42 km
Nominal span:	300 m
Number of Towers:	approximately 130
No of Angle Point:	23
Right of Way:	30 m
Tower height:	16-22 m (from top of foundation to lowest cross arm)
Permanent Land requirement	
For tower foundation:	5.2 ha
Temporary Land requirement	
Land use restriction under RoW:	93.4 ha
Tower type:	Steel Lattice Structure
Conductor:	ACSR BISON Duplex
Earth wire:	EHS 7/3.35
Foundation Type:	Pad and Chimney isolated
Foundation Area:	12.50 x 12.50 meters (approx. average per foundation)
Bay Extension:	One at Kahu Shivpur substation and another at Bharatpur substation

Project Cost: **Nrs.** 744675000

2.6 Structures and Conductors

The proposed transmission line will primarily use free standing lattice type of poles. The height of the poles will vary in height depending on the terrain. The conductors require a minimum ground clearance of 7.5 m, while at the road crossing this needs to be increased.

2.7 Construction Planning

2.7.1 Equipment and Methods used in Construction

Foundation Works for tower pads

The excavation of the foundation work will be done manually. Concrete mixer and vibrator will also be used for construction of the foundation. The nominal values required for tower foundation for 220 kV are as follows:

Suspension tower (S1): 12 m × 12 m +/-20%
Suspension tower (T1&T4): 14 m × 14 m +/-20%

However, there is no fixed rule for tower foundation area, but the general rule of thumb for similar tower structures are:

- foundation area increase with decrease in steel weight for normal height
- foundation area decrease with increase in steel weight for normal height
- foundation area increase with increase in height of tower

Excavation for tower foundations will be made to the size and depth required by design. Concreting for the foundations will be performed after proper placement of reinforcing bars. After necessary curing, the foundations will be backfilled with suitable material. For land area calculation purposes the area for tower foundation has been adopted as 20 m × 20 m. A right of way of 30 m width has been adopted for 220 kV transmission line.

Tower Erection

Tower erection will be done manually, which limits access impact to clearing of footpaths to the tower sites.

Stringing

Where tower locations are not accessible by road, conductors, ground wires, insulators and necessary accessories will be carried manually from the nearest road heads where as vehicles will be used to carry the accessories where the tower locations are connected by roads. The stringing of the line will be done using cable puller, tensioner, dynamometer, and conductor drum carrier. Crane will be used for works related with substation.

2.8 Manpower

Skilled, semi-skilled and unskilled labor for the construction works will be available along the project alignment. However, their availability depends, to a large extent, on the time and season because of their engagement in agricultural activities. Total estimated labour force is about 150 people including skilled, semiskilled and unskilled manpower or professionals.

The details of manpower requirement of the proposed project are presented in Table 2.2.

Table 2.2: Manpower Requirement of the Project

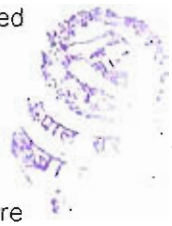
S. No	Types of Manpower	Number of People Employed in Different Organizations			Total
		NEA	Consultant	Contractor	
1	Skilled	10	5	20	35
2	Semi skilled	5	0	30	35
3	Un skilled	0	0	80	80
	Total	15	5	130	150

2.9 Project Activities and Construction Planning

The main project activities associated with transmission line construction are as follows.

- Material transportation and construction of substations
- Construction of tower foundation.
- Tower erection
- Stringing of conductors

The implementation period of the project is estimated to cover a period of approximately one and half years. In order to carry out the project works, the entire stretch of the line route is likely to be segmented into two work sections and will be controlled from two ends. The working group of each section will be more or less mobile; hence it may not be necessary to construct large camps. Small groups of labor will be involved in excavation, concrete works, tower materials transportation, tower erection, stringing in and around each tower spread along the line route. The work will be initiated simultaneously from proposed Bharatpur substation and proposed powerhouse at Damauli



2.10 Construction Material

The essential materials required for civil construction works associated with the transmission line are water, coarse concrete aggregates, sand, cement and reinforcement steel.

Water for the construction work will be available locally from nearby streamlets and springs. From observation it can be concluded that raw materials for coarse aggregates are available in the area. For the construction of the transmission line, the material will have to be produced by crushing boulders mainly from riverbanks. Sand is available along the banks of the Seti and Trishuli River and other rivulets along the alignment. As alignment runs relatively near to the Prithivi and Narayanghat-Mugling Highway cement can be easily transported from Naranghat (Bharatpur) and Damauli Bazaar.

CHAPTER 3:

STUDY METHODOLOGY

3.0 GENERAL

The IEE process follows the Environment Protection Act, 1996, Environment Protection Rules, 1997, its amendment and National EIA guidelines, 1993. This IEE report was prepared in accordance with the legal requirements of GoN, based on field studies and consultation with local people including the affected families and officials.

The overall approach for the IEE study is described in the following subsections.

3.1 EIA SCOPING AND TOR

Initially, a scoping exercise and preparation of ToR was conducted as per the prevailing rules which was approved by then MoEST on 5th November 2008. The approved ToR is given in Appendix E. Then, field study was conducted and draft report was submitted to MoE for approval accordingly. Meanwhile, amendments were made on the EPR, 1997 (2065/11/26) which states that only Initial Environmental examination is required for transmission line project with voltage exceeding 132 kV. Since the capacity of proposed project is 220 kV, Ministry of Energy (MoE) granted permission to conduct the IEE based on the approved scoping and ToR by then MoEST

3.2 PROJECT IMPACT AREA DEFINITION

The project impact area has been confined to the 38.42 km length of the transmission line. The Right of Way (RoW) for the line is taken as 30 m in total or 15 m on either side from the centreline of the transmission line. For impact analysis on land use, houses and forests, 30 m ROW has been considered. However, while discussing other impacts of community development, sites of cultural importance, etc., a wider area has been investigated. The impact area is shown in Figure 3.1

Furthermore, the impact areas have been classified as:

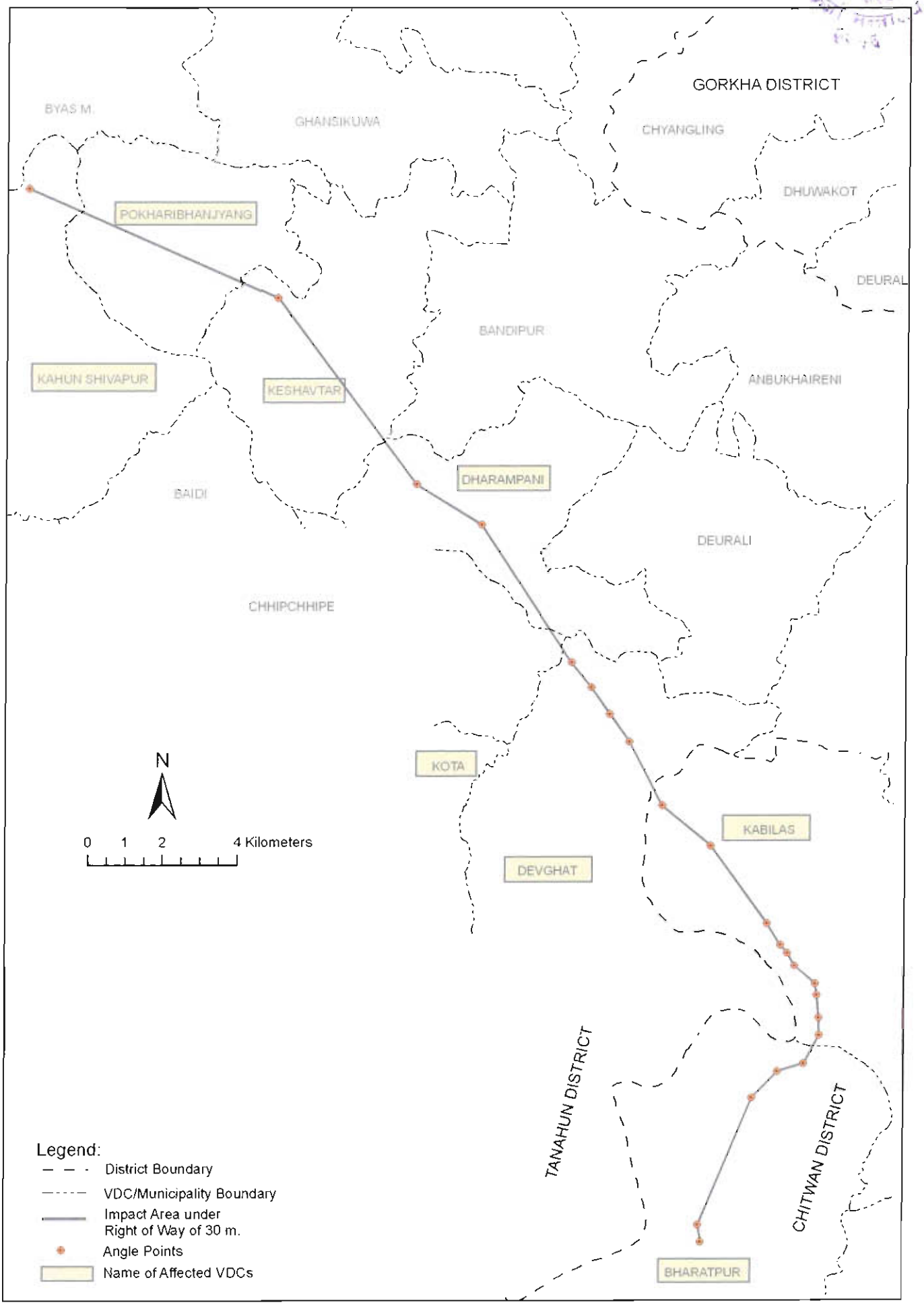
Category A: High Impact Area.
Category B: Moderate Impact Area.
Category C: Low Impact Area.

The impact area in each category is defined in Table 3.1

Table 3.1: Project Impact Area

Category A	Category B	Category C
The area under the 30 m Right of Way	All the project affected Wards of affected VDCs and Municipality	Project affected VDCs and Bharatpur Municipality excluding areas falling under category A and B

Fig. 3.1: Affected VDCs and Impact Area



The baseline data of socio-economic and cultural environment were collected from each category and the potential impacts have been predicted, if any. Required mitigation measures have also been recommended for each impact zone as per the requirement. In case of physical and biological environment, the study was mainly concentrated in Category A to collect base line information, impact prediction and to recommend the mitigation measures.

3.3 DESK STUDY

After the approval of the ToR, relevant literature, maps, and other required information of the project were collected. The following documents which were considered to be relevant for the IEE study were reviewed in the Kathmandu project office.

- Detailed Survey of Upper Seti (Damauli) - Bharatpur 220 kV Transmission Line; Final Report, Masina Continental Associates Pvt.Ltd. September 2006
- Environmental Impact Assessment Report of Khimti - Bhaktapur - Balaju 132 kV Transmission Line, SRC Laboratory, NEA, 1997.
- Maps: district level land use map (1:50,000 scale), district administrative map (1:12,500 scale), and topographical map (1: 25,000 scale)
- District Profile of Nepal 2007/2008.
- District Development Profile of Nepal 2004

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 EIA study.

3.4 BASELINE DATA COLLECTION

3.4.1 Introduction

A field visit was conducted in February, 2007 for scoping exercises. Subsequent to the acceptance of scoping document and terms of reference, a multi-disciplinary team comprising of environmental specialist, ecologist, sociologist, economist, transmission line engineer, civil engineer and an environmental engineer undertook the baseline studies in April-May 2008.

The team covered the 38.42 km stretch on foot to investigate the actual site conditions. The team also investigated the site conditions of the angle points and other critical areas along the transmission line. Semi-structured questionnaire, agricultural and VDC level checklists were designed to collect household-level information from the affected households and VDCs; to collect primary data on the bio-physical environmental parameters appropriate checklists were used. The local people were intensively consulted during the field work.

3.4.2 Physical Environment

3.4.2.1 Literature Review

Information on climate (temperature, rainfall, and moisture) was collected through secondary sources such as the Department of Meteorology and Hydrology. Documents such as district profile, agriculture development profile of the district and other relevant literature were collected and reviewed.

3.4.2.2 Field Study

An intensive field investigation along the proposed alignment was done to collect baseline information on physical environment. Geographic data, such as topography, land use, soil, transportation and environmental features were collected for the entire study area during the site investigation.

3.4.3 Biological Environment

3.4.3.1 Literature Review

Published literature was consulted to acquire secondary data on wild animals and avifauna. The biological baseline information collected for EIA study of Upper Seti Storage HEP was reviewed. Various books and publications on biodiversity, forest resources, forestry practice, and traditional use of plant were cited. Topographical maps of the project area (1:25,000 scale) were studied. EIA reports and environmental documents of other similar projects were also consulted.

Data gaps were identified. Then, direct and indirect methods were followed for wildlife baseline information collection.

3.4.3.2 Field Study

The following methods were used to collect the primary information on wildlife, avifauna, forest resources and biodiversity.

i) Field Investigation

A detailed field investigation for baseline data collection of the biological environment was carried out twice May, 2008 and April, 2009. The site conditions along the proposed alignment was observed and studied.

Forest types along the proposed alignment were observed and identified. Floral species were identified and documented as a list of plant species. Some plants without having flowers or fruits in the season of survey were identified with help of taxonomical literatures.

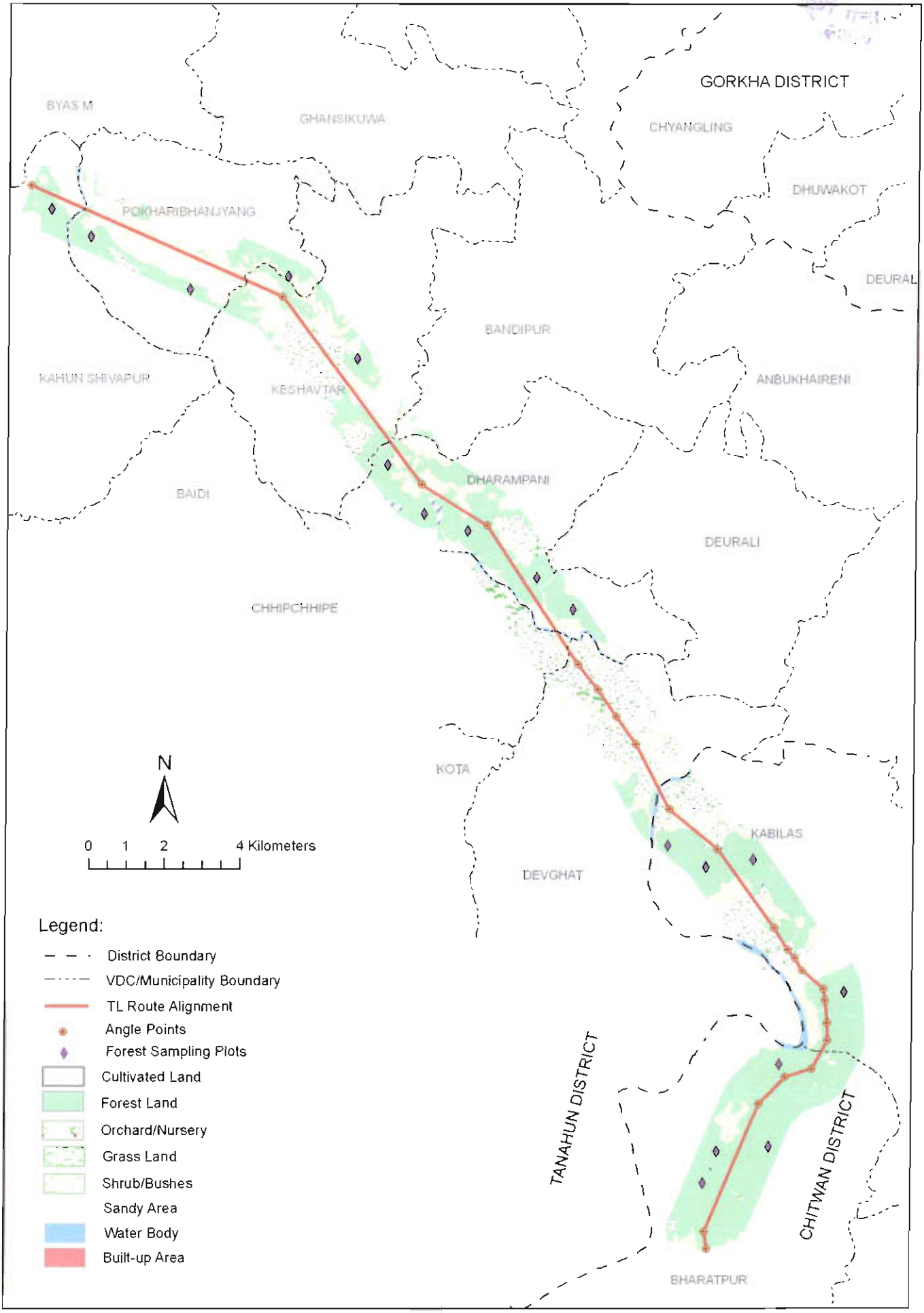
Simultaneously, birds and mammals encountered in the field visit were observed and identified for listing in baseline record. Some of them were identified by their feathers, sounds, pugmarks or droppings while walking along the alignment. Disturbance on the forest and wildlife habitat was assessed observing the human activities in the forest like grazing, harvesting firewood, timber and fodder, forest fire etc.

ii) Forest Sampling

Sampling of the forest was done considering the representation of all kinds of trees in the project site. 15 different sampling plots of 30 m x 30 m quadrates along the alignment were taken for sampling. In each plot tree species having more than 4 inch DBH were identified, counted and measured for diameter at breast height (DBH) for calculation of wood volume. Regeneration (sapling) was determined by plotting of quadrate of 5 m x 5 m within the same quadrates. Trees having less than 4 inch dbh were considered as saplings 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

Fig. 3.2: Forest Sampling Plots



aforementioned parameters were calculated by using the following formula:

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

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

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.

$$\text{Basal area (BA)} = \pi r^2 = 3.142\ (dbh/2)^2$$

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

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

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

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

$$IVI = RF + RD + Rdom$$

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

$$\text{Wood volume} = \frac{(\text{Girth})^2}{16} \times \text{Height}$$

iii) Group Discussion

Group discussion was conducted mainly with villagers in proximity to the forest in the project area. The group discussion usually commenced with projects highlights followed by objectives of the group discussions. Various information on forest resources, non-timber forest products, wild animals, depredation etc were collected through group discussions. Some of information were cross-checked and confirmed. Their views and suggestions were also sought to predict the likely impacts and for prescribing mitigation measures.

iv) Interviews with Local People

Local villagers from project area were interviewed using semi-structured questionnaire to collect baseline information on plant uses, their knowledge and sighting experience regarding local fauna. Color photographs of different species of mammals and birds were shown to local people to confirm their presence.

v) Meeting with District Forest Office

Meetings were conducted in District Forest Offices of Tanahu district in Damauli and Chitwan district in Bharatpur to discuss the likely impacts of the proposed project, mitigation measures, coordination mechanism, existing situation of the forest and wildlife etc. Similarly, secondary baseline information was obtained from published and unpublished data and information of the DFOs.

vi) Survey of Rare and Threatened Species

Rare species were categorized on the basis of their present and past distribution, their decline in numbers over the course of time and their potential biological value. Plants and wildlife species found in the project area were grouped in to different threat categories based on IUCN (1978), CITES (1975) and GoN' Acts such as Forest Act 1993 and National Parks & Wildlife Conservation Act 1973.

3.4.4 Socio-economic and Cultural Environment

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 Information Centre, Tanahu and Chitwan 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.

3.4.4.1 Desk Study

Based on previous experiences and the review of relevant literature associated with EIA studies of various transmission line projects, demographic tables were developed. A desk study was conducted in the office to fill these tables with data. 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

3.4.4.2 Identification of PAFs

Cadastral maps prepared by the District Survey Office, Tanahu and Chitwan were extensively used to identify all the land owners of all the parcel numbers of high impact zone and area required for acquisition,. The cadastral surveyor from the district survey office was hired for exact quantification of the land area belonging to each of the land owner and tenants whose land and house are in the high impact zone. The cadastral maps show all the details associated with land parcels, houses, trails, river, forest, etc. All those families whose land/s or houses lie inside this zone were considered as project affected families (PAFs). Details of the PAFs are given in Appendix D. In addition, any HH losing their house, irrespective of land holding size and other off farm income and household losing more that 50% of land were identified as seriously project affected families (SPAFs) and the rest as PAFs (similar to Kaligandaki "A" HEPs classification).

3.4.4.3 Field Data Collection Techniques

After identification of PAFs, their base line information was collected by using the following techniques:

- Household Survey,
- Key Informant Survey,
- Focus group discussion. and
- Observation.

a) Household Survey

Pre-tested questionnaires were designed and applied by a trained team of enumerators to solicit information from Project Affected Families. Prior to the survey, the land parcels under the RoW were identified using cadastral maps and the landowners were listed using information from the District Survey Office. Then sample households were selected using stratified random sampling and judgment sampling methods. The 145 PAFs were selected from all affected VDCs and Municipality on the basis of their income, cast, ethnicity, religion, education, occupation, etc by using judgmental sampling in order to achieve a fair representation of all PAFs. During the judgmental sampling, suggestion of local leaders, VDC officials and teachers were considered.

The questionnaire has been designed especially to cover the demographic characteristics, basic health conditions, income and expenditure, availability of infrastructure facilities, water and energy related issues, information about project, attitude towards settlement and expectations from the project. A second questionnaire for gender issue was used in the field survey to analyze the status of woman, their attitude towards the project, the possible impacts on woman due to the implementation of the project and other gender issues. The household questionnaire is given in Appendix C.

b) Key informant survey

Key informant survey was also a major survey method, which 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. The agricultural checklist was designed to collect the price rate of various agricultural products in the project affected VDCs and Municipality. Both of these checklists are given in Appendix D.

c) Focus Group Discussion

Group discussions were organized in each VDC and Municipality to give special attention to issues concerning specific target groups such as women, children and farmers. Local elites, leaders, teachers and other intellectuals were also included in the discussion. Other occupational caste groups, women and ethnic minorities were included in the discussion which gave opportunity for the people in the project area to voice their questions and concerns regarding the project and to provide an in-depth information associated with their religion, culture, festivals, etc. Approximately 10 focus group discussions were conducted in which 10-25 people participated in-group discussion at each site.

d) Observation

Observation of the 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.

3.5 PUBLIC INVOLVEMENT

As per the EPR, 1997 the proponent should publish a notice in any national level newspaper and conduct at least one public consultation programme in the project affected VDC or municipality for the intensive involvement of local people and stakeholders in the decision making process. Thus, the following method was adopted for public involvement in the environmental decision making of the proposed project.

a) Public Notice

In accordance with the (4) EPR 1997, a 15-day Public Notice was published in the Gorkhapatra daily on 2063/09/4 BS (December 19, 2006) soliciting suggestions within 15 days at two different addresses (Project Development Department, NEA, Durbar Marg Kathmandu and Environmental and Social Studies Department, NEA, Adwait Marg, Kathmandu). The notice was published for three consecutive days. The copy of the notice is presented in Appendix B. The main objectives of the notice were:

- to inform the public about the project, and its impacts on the villages and VDCs of the project affected areas.
- to request the concerned people, organizations, NGOs and VDC officials, etc. to send comments and suggestions regarding the impacts of project construction and their mitigation measures.

After the publication of the notice, the environmental team visited the site for the scoping exercise. After a short survey, a scoping report and TOR was prepared and submitted to DOED for approval.

A public hearing was conducted on April 23, 2009 at Keshabtar VDC of Tanahun District as per the legal requirement of EPR, 1997 Section 7. The primary objective of this public hearing was to inform the public about the project and collect feedback, public concerns and views The comments and suggestions of the local people have been incorporated in the report.

Glimpses of Public Hearing conducted by NEA at Keshabtar

3.6 IEE REPORT PREPARATION

The field data from each area were compiled in Kathmandu with the analysis of primary and secondary data carried out to prepare this Draft IEE report. The report follows the format of the Environment Protection Rules, 1997, Environment Protection Act, 1996 and the National EIA Guidelines 1993.

3.7 RECOMMENDATION LETTERS

The recommendation letters from concerned VDCs and the municipality have been collected as per EPR 1997 and attached in Appendix G.

3.8 IMPACT ANALYSIS

3.8.1 Impact Identification

A logical, simple and systematic approach has been adopted for impact identification. The impact has been identified for physical, biological, socio-economic, and cultural environment. The following methods have been used for the impact identification:

- Simple Checklists
- Questionnaire Checklists
- Matrices

3.8.2 Impact Prediction

The impact prediction has been done using the following methods:

- GIS Maps
- Expert Judgment
- Field Experimental Methods

GIS maps have been used in predicting the impacts of this T/L project by analyzing the effect of project activities on the resources 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

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

Extent Impacts

I Site Specific (S): The impact is limited within RoW then it is site specific one.
II Local (L): If the impact of the work extends to the adjoining wards and or VDCs then it is termed as local.
III Regional (R): If the impact of the work extends to the entire district or further then it is termed regional.

Duration of the Impacts

I 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.
II Medium Term(MT): An impact that continues for more than 3 years but less than 20 years is considered as medium-term. The construction phase impacts which carry over for few years of operation falls under this category.
III Long Term(LT): An impact that lasts beyond 20 years is considered to be long term. The operation phase impacts are mostly categorized under this category.

3.9 LIMITATIONS OF THE STUDY

In spite of some limitations to resources spent for the field study, detailed studies of literature previous reports and maximum contact with local people provided and adequate background for recommending reliable mitigation measures. The assessment of the site conditions was based mainly upon visual observations, literature, and interviews with the local people. Some information, particularly on physical and biological environment, reflects the characteristic only of that particular season and time of investigation. Due to difficult terrain and inaccessibility of certain areas, the survey of the ecological environment was in those cases carried out through observation from a distance.

Difficulties were also encountered during the socio-economic data collection as the land owners of the affected area were not available during the questionnaire survey. The lack of site-specific location of tower pads and ancillary facilities at the time of surveying also result in some inaccuracies in report details and somewhat generalized impact assessment at few locations. Furthermore, some information provided by respondents during the household survey on some questionnaire sections such as income and expenditure may not be fully reliable.

CHAPTER 4:

ENVIRONMENTAL POLICIES, LEGISLATIONS AND GUIDELINES

4.0 GENERAL

Nepal integrated environment aspects in all its development activities and projects only from the early 1980s. Environment conservation was included in the policies since the Fifth Plan (1975-1980). The second milestone was taken during the Sixth Plan. The Sixth plan under the environment and land use policy emphasized the integration of environmental aspects into the construction of large-scale development projects. Then finally in the Seventh Plan it was stated that developmental programmes would be implemented only after an approved EIA study. The plan outlined the need for carrying out an EIA process for industrial, tourism, transportation, water resources, urbanization, agriculture, forests and other development programmes to identify and mitigate adverse impacts on the environment. The Eighth, Ninth and Tenth five year plans have further emphasized the making of more effective EIA systems. The formulation of sectoral guidelines, promotion of participatory EIA system and inclusion of mitigation cost into the total project cost were some of the activities included in these three five year plans.

The prevailing Acts, Policies, Regulations and Guidelines which are required for the development of hydropower projects in Nepal have been reviewed while preparing the present IEE report. Some of the important guidelines and acts and their relevancy to Transmission line projects have been discussed below in detail.

4.1 POWER AND WATER SECTOR ACTS AND REGULATIONS

The current provisions for the environmental review of power and water sector projects as set out in the Acts and Regulations are shown in Table 4.1.

Table 41: Environmental Provisions in Power and Water Sector Acts and Regulations

1	Hydropower Development Policy (2001)
2	Water Resources Act (1992)
3	Electricity Act (1992)
4	Water Resource Regulations (1993)
5	Electricity Regulation (1993)

4.1.1 Hydropower Development Policy, 1992

The Hydropower Development Policy was promulgated in 1992. The main objectives of the policy include producing clean energy through the development of hydroelectric projects and to help conserve the environment. It is stipulated that one of the policies is to extend the use of electricity for achieving a reduction in the utilization of fuel wood and to render necessary assistance in the conservation of forest and environment.

4.1.2 Water Resources Act, 1992

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

damage to water bodies, especially lakes and rivers through environmental impact assessment studies and the proponents who wish to use water resources for various purposes should prepare EIA report before a license can be granted. The Act stipulates that soil erosion, flooding, landslides or any significant impact on the environment should be avoided in all uses of a water resource.

4.1.3 Electricity Act, 1992

Electricity Act, 1992 is related to survey, generation, transmission and distribution of electricity. Electricity includes electric power generated from water, mineral oil, coal, gas, solar energy, wind energy etc. Under Section 3 of the Act it is stated that survey, generation, transmission or distribution of electricity without obtaining a license is prohibited.

4.1.4 Water Resources Regulation, 1993

It is mandatory under Rule 17(e) of the regulation that any person or corporate body, who desires to obtain a license for utilization of water resources must state in his application that appropriate measures will be taken to lessen the adverse effects due to the project on the overall environment. Rule 19 stipulates that the water resources committee shall publish a notice giving detail information about the project to the people.

4.1.5 Electricity Regulation, 1993

Rules have been formulated for the implementation of the provisions made in the Electricity Act, 1992. Rule 12 (f) and Rule(g) are related to the EIA process which emphasize that the EIA report should include measures to be taken to minimize the adverse effects of the project on social, biological and physical environments and should also elaborate utilization of local labour, source of materials, benefits to the local people after the completion of the project, training to local people in relation to construction, maintenance and operation, facilities required for construction site and safety arrangements.

The requirements of these acts and regulations have been considered and were satisfied in the preparation of the present EIA study.

4.2 OTHER ACTS

4.2.1 Environment Protection Act, 1997

The Act considers that sustainable development is possible through proper consideration of interdependence between economic development and environmental conservation by minimizing adverse impact on physical, biological and socio-economic and cultural environment, proper use and management of natural resources, incorporation of environmental concerns in the development process, participatory role of communities and stakeholders.

4.2.2 Land Acquisition Act, 2034

One of the important acts that has a bearing on the implementation mechanisms and mitigation of adverse impacts of power projects is the Land Acquisition Act. This Act, 2034 covers all aspects of land acquisition and compensation of land and other assets. It authorizes the government to acquire land for public purposes by providing compensation to private landowners.

The compensation paid under this Act will be given in cash To decide the amount of the compensation, the Land Acquisition Act (1977) has made provisions for the constitution of a

Compensation Fixation Committee (CFC). This committee consists of the CDO, Chief District Land Administration and Revenue Officer, Project Chief or an officer designated by the CDO and the Representative of the DDC.

4.2.3 Forest Act, 2049, and Rules, 2052

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

4.2.4 Local Self-Governance Act, 2055

The Local Self-Governance Act, 2056 contains several provisions for the conservation of soil, forest and other natural resources and implementation of environmental conservation activities. Section 28 and 19 of the Act provide that the Village and the District Development Committees are responsible for the formulation and implementation of the programs related to the protection of environmental bio-diversity. Section 96 stipulates that it is the duty of the municipality to protect the environment through the control of air, water and sound pollution It also obligates the Municipality to maintain environmental cleanliness through the implementation of solid waste management, flood and landslide control programmes.

4.2.5 Soil and Watershed Conservation Act, 1982

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

4.2.6 Labour Act, 1991

This act is enforced by GoN in 2049/2/2. This act classified below 15 years as child and 'anabolic' for the age group of above 14 years and below 18 years. The act has also made provision of labour court and department of labour. The act clearly mentioned that the appointment letter should be issued for all the employees which include their working hours, working time, wages and other benefits. The act allows for the time bond contract for the manpower required for development work. The act specifies that working hours for the Anabolic and women must be within 6 AM to 6 PM which clearly restrict to deploy women in night works. The act also stated that equal opportunity shall be given to women as men. Similarly working period for the other employees must not exceed 8 hours a day and 48 hours in a week. If some people work beyond that period, over-time allowances must be paid which is 150% of the normal per hour wages and such over-time must not exceed 4 hours in a day. According to this act wages rate of the employees shall not be less than the rate fixed by the concerned offices of GoN

4.2.7 Aquatic Animal Protection Act, 1961

The provision of the Aquatic Life Protection Act, 1961 obliges the proponent to construct fish ladder at dam sites to ensure the movement of aquatic animal. If it is not possible, the proponent should establish fish hatchery or a nursery. close to the dam site of the water resources projects. for artificial reproduction and ex situ conservation (section 5 b).

4.2.8 Ancient Monument Protection Act, 1951

The provision for Ancient Monument Protection Act, 1951 was made to protect and conserve the historical and archaeological places and monuments. This Act was endorsed for the conservation and controlling illegal trading of ancient monuments and objects of archaeological importance.

This act also controls in the illegal excavation of sites of archaeological importance.

4.3 RULES AND REGULATIONS

4.3.1 Environment Protection Rules, 1997

The Environment Protection Rules (EPR) was endorsed in June 1997 and was made under the provisions of the Environment Protection Act. The EPR was amended in April 1999. The EPR adopts the environmental assessment criteria mentioned in the EIA guidelines. However, the EPR establishes the administrative framework for assessing, exhibition and determination of the EIA, in terms of issues needing to be addressed and the format/layout of the EIA document.

Under section (18) of EPA, any person who contravenes any of the provisions of the Act, or the Regulations or the guidelines issued under the Act, shall be punishable with a fine up to Rs 50,000. If a proposal is implemented without the approval of the MoEnv or relevant government agency, or the person implementing the proposal is not complying with the conditions of the approval or license, the authorized official is empowered to close down that activity and may impose fine of up to Rs. 100,000 on such person or organization.

4.3.2 Local Self Governance Regulation, 2000

Local Self-Governance regulation empowers the local bodies to coordinate and implement development programs and for rationale utilization of local natural resources. Article-7 (69) empowers the VDCs for monitoring and supervision of development work implemented in the VDC. The Article-4 of DDC has provision of three members (Agriculture, Forest and Environment) committee to look after the concerned issues. Article-6 (206) specifies that social, economic, environmental and public facilities should be considered while planning the project. Article-7 (210) focuses on environmental studies and stresses due consideration while implementing the projects like sand quarry, stone quarry, coal mine, etc. although this act empowers DDCs and VDCs these institutions lack proper manpower and training to do such kinds of work.

4.3.3 Forest Regulation, 1995

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

4.4 GUIDELINES

4.4.1 National Environment Impact Assessment Guidelines, 1993

The National EIA Guidelines (1993) developed by the National Planning Commission in conjunction with IUCN, set out the process for the environmental review and management of infrastructure projects in all sectors and the respective roles of certain GoN agencies and project proponents. These guidelines were part of a comprehensive program to develop the national and sectoral guidelines for

establishing a national system for environmental impact assessment which was a part of GoN's National Conservation Strategy and Nepal's Seventh Year Plan. The guidelines were endorsed by GoN on 27 September 1992 and gazetted on 19 July 1993.

The schedules attached to the Guidelines include:

Schedule 1	:	Projects requiring an IEE Report
Schedule 2	:	Projects requiring an EIA
Schedule 3	:	EIA based on project sites
Schedule 4	:	Projects requiring an IEE Report
Schedule 5	:	Format for Terms of Reference
Schedule 6	:	Environmental Impact Report Format

With regard to environmental management in hydropower projects, then Ministry of Water Resources drafted a separate EIA Guidelines for the Water Resources Sector in 1993, which were revised by MoEnv in 1997. The revised draft EIA Guidelines for the Water Resources Sector, 2054 also contains steps for EIA report preparation.

4.4.2 Forest Land leasing for Other Purposes Procedure, 2063

GoN has recently developed the Forest Land leasing for Other Purposes Procedure, 2063. Development project can obtain the forest land as a lease for certain period of time from Department of Forest and acquire it for the use of project during operation phase.

4.4.3 Forest Produce collection and sales Distribution Guidelines, 2057

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

4.5 THE NEPAL BIODIVERSITY STRATEGY

The Nepal biodiversity strategy, adopted by GoN in august 2002, specifies the conduction of EIAs in accordance with the provisions of EPA 1996 and EPR 1997 to assess significant impacts of development activities on biodiversity. The strategy has given emphasis to ensuring effective implementation of the existing laws regarding EIA.

The National Biodiversity Strategy plan describes the protection and wise use of the biologically diverse resources of the country, the protection of ecological processes and systems, and the equitable sharing of all ensuing benefits on a sustainable basis for the benefit of the people and to honour obligations under the Convention on Biological Diversity. Biological diversity in Nepal is closely linked to the livelihoods and economic development of most of her people, and relates to agricultural productivity and sustainability. human health and nutrition, indigenous knowledge, gender equality, building materials, water resources, and the aesthetic and cultural well being of society.

4.6 INTERNATIONAL CONVENTIONS AND AGREEMENTS

Nepal is signatory to a number of broader international conventions concerning habitat, biodiversity and cultural heritage protection, which also must be taken into account during the EIA of projects

which directly or indirectly affect the protected zones or other properties covered by such agreements. For example, Nepal is currently a signatory to:

(i) Biosphere Reserves

Power projects which may be planned for lands which are designated as UN Biosphere Reserves, national parks, nature reserves or conservation areas will be affected by this UN Charter.

(ii) Convention on International Trade in Endangered Species (CITES)

Nepal is a signatory to this agreement (1975) which classifies 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 (CITES 1983); E - Endangered; V - Vulnerable, R - Rare).

(iii) International Tropical Timber Agreement

Nepal is signatory to the Plant Protection Agreement for the Asia and Pacific Region (1956).

4.7 NATIONAL LEGISLATIVE AND ADMINISTRATIVE FRAMEWORK

Nepal has also developed legislative requirements for assessing the environmental impacts of development project. The Ministry of Environment (MoEnv) is responsible in prescribing legal measures to study and require mitigation of all potential sources of air, land and water degradation adversely impacting on natural and social environments. This includes MoEnv authority to frame environmental rules, standards and guidelines, and decide on future environmental permit requirements, as appropriate. The MoEnv is responsible for the administration of the National EIA process.

4.8 TENTH FIVE YEAR PLAN

The Tenth Plan includes five-year period of 2002-2007. The plan focuses on the poverty reduction from 38% to 30 % during the plan period. The plan has identified four pillars of development to achieve the stated achievements of poverty reduction. The plan targets to serve electricity facility to 2450-2600 VDCs of Nepal.

Out of the 12 prime focus area 10th Plan, environment conservation and promotion is mentioned the unified development of social, economic and environmental sector. The plan focuses on infrastructure development, rational use of natural resources and use of bio-diversity with due emphasis on environmental conservation and pollution control.

The Tenth plan has re-emphasized to make the EIA system effective and needs of monitoring of the implementation status of the project, which carried out EIA study. The plan has for the first time recognized the need for carrying out SEA to any policy before adaptation (Upreti 2003). One of the priority areas in the field of environmental management in the Tenth Plan is on EIA. Besides the introduction of EIA system in the periodical plans, the sectoral policies and strategies have also given due attention on the application of EIA procedure.

CHAPTER 5:

EXISTING ENVIRONMENTAL CONDITIONS

5.0 GENERAL

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

5.1 PHYSICAL ENVIRONMENT

5.1.1 Watershed Conditions

The watershed of the project area appears to be intact especially at the initial and end stretch. The initial stretch runs through terraced agricultural land where major mass wasting and soil erosion were not observed. As the erosion and land stability features vary with the geological composition and the metamorphic features of the land systems of the T/L corridor area possibility of mass wasting and soil erosion is seen between TP5-TP9 which runs through relatively higher altitude which are barren and susceptible to slides. The characteristics of the rock formation as well as the slopes of the Siwalik Zone have made them as one of the highly fragile zones of the T/L corridor. The Siwalik Zone yield very easily to erosion and are considered most fragile, unstable and weak against the processes of mass wasting particularly during the monsoon rain and running water. The Bhaver sub-zone of the Siwalik Zone, because of its slope (less than 15 degrees) is less vulnerable to erosion and land instability. However, the geologic character makes it highly susceptible to gulley and rill erosion where vegetation cover is removed.

During the field investigation, some minor instability were observed along the alignment route at Kabilas VDC where the geology is typically of the aforementioned formation

The last stretch runs through flat topography consisting of Sal Forest with no evidence of mass wasting. However, the people residing around the proposed sub-station reported that the site is flooded during the monsoon.

5.1.2 Geology and Soil

Geologically, the T/L corridor area lies in the Lesser Himalayan and Siwalik Tectono-Sratigraphic Units. The two tectono-stratigraphic units are separated by a well discernible, WNW – ESE running Main Boundary Thrust (MBT). The MBT is a crushed zone, along which the rocks of the Lesser Himalayan Tectono-stratigraphic Units are transported several kilometers to the south over the rocks of the Siwalik Tectono-stratigraphic Unit.

In the project area, the Lesser Himalayan Tectono-stratigraphic Unit comprises of rock formations of the Metasedimentary Group namely the Nuwakot Group (Stocklin and Bhattarai, 1980). The prominent rock formations exposed along the T/L Corridor is represented by the limestones and black slate formation of Benighat, bluish grey dolomites of the Dhading Formation, varigated slates, sandstones, limestones and quartizites of the Nourpoul Formation, and white quartzites (Fagfog Quartzites) of the Kuncha Formation.

The Siwalik Tectono- stratigraphic Unit is represented by the thick bedded medium to fine grained sandstones, green, khaki and red colored shale/mudstone of the Middle Siwalik Formation. The Siwalik rocks are poorly indurate and compacted.

Soil is very poorly developed along the T/L corridor. It is mostly alluvial along the river tars, and in the Inner Terai. The colluvial soil is the soil type of the hills and mountains.

5.1.3 Topography

The T/L corridor crosses cuts 3 physiographic zones of Nepal (Hagen, 1998) namely from north to south, the Midlands, Mahabharat and the Siwaliks. Topographically, the Midland physiographic zone is a zone of subdued hills and valleys, with altitudes varying from 200m to less than 1000m in the T/L corridor area. The valley floors are characterized by alluvial tars at 2 to 3 levels, and flanked by steeply sloping hill foot slopes culminating upslope into gently sloping hilly terrain. Peculiarly, the hill tops are gentle and smooth. Owing to the gentler aspect of the Midland hills, it is the loci of human settlements and agriculture. The T/L corridor traverses the Mahabharat Zone following the antecedent valley of the Seti River in the project area.

The topographical variations of the proposed 220 kV transmission line ranges from 200 masl to 1000 masl. The stretch between TP8-TP10 ascends to a highest elevation of approximately 1000 masl. The last stretch between TP13 - TP23 plys through flat topography consisting of Sal Forest. This stretch runs parallel to the two existing 132 kV transmission lines: Pokhara-Marsyandhi and Marsyandhi-Bharatpur.

5.1.4 Landuse and Landtake

The landform features along the corridor comprises of undulating hills, grazing (barren) land, terraced agricultural land and forest land. Approximately 18% of the 38.42 km runs through rivers, streams, creeks, roads and grazing land and whereas 43% and 39% runs through forests and cultivated land respectively. Transition occurs at approximately 30 km where the elevation drops to 270 masl and the transmission line runs through flat topography consisting of Sal Forest.

The landform along the alignment is shown in Figure 5.1.

No lakes or wetlands are present within the route corridors. The land use patterns along the alignment are given in the table below: Figure 5.1shows the land use along the corridor.

Fig. 5.1: Landuse Along the TL Corridor

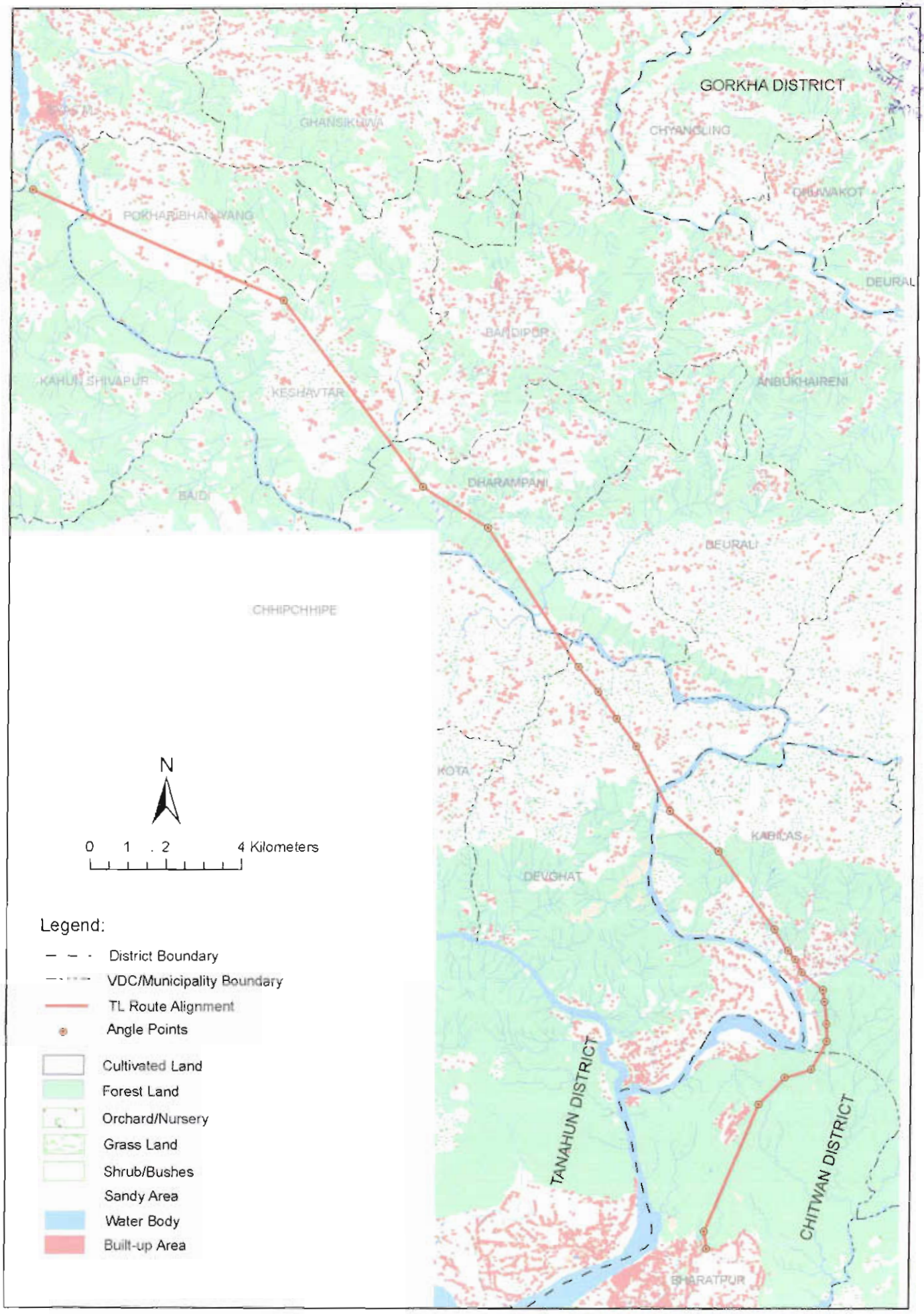


Table 5.1 Landuse along the alignment

S.No	Alignment Stretch	Elevation (masl.)	Transmission line length (km.)	Landuse		
				Cultivated (m)	Forest (m)	Barren (m)
1	TP1-TP2	589.5—858.05	7.04	6.3	0.62	0.12
2	TP2-TP3	858.05—928.43	6.321	2.81	3.25	0.261
3	TP3-TP4	928.43—767.35	1.884	0.7	1.17	0.014
4	TP4-TP5	767.35—515.09	4.484	1.3	2.65	0.534
5	TP5-TP6	515.09—605.52	0.831	-	-	0.831
6	TP6-TP7	602.52—777.06	0.793	0.225	-	0.568
7	TP7-TP8	777.06—811.23	1.205	0.5	-	0.705
8	TP8-TP9	811.23—495.6	1.685	0.75	-	0.935
9	TP9-TP10	495.6—996.19	1.652	1.3	-	0.352
10	TP10-TP11	996.19—422.65	2.454	0.5	1.1	0.854
11	TP11-TP12	422.65—309.25	0.791	0.25	0.191	0.35
12	TP12-TP13	309.25—247.0	0..317	-	-	0.317
13	TP13-TP14	247.0—248.6	0.293	0.293	-	-
14	TP14-TP15	248.6—258.85	0.701	0.35	0.276	0.075
15	TP15-TP16	258.85—281.1	0.211	-	0.211	-
16	TP16-TP17	281.1—283.32	0.711	-	0.771	-
17	TP17-TP18	283.32—272.75	0.388	-	0.388	-
18	TP18-TP19	272.75—270.97	0.822	-	0.822	-
19	TP19-TP20	270.97—268.72	0.728	-	0.728	-
20	TP20-TP21	268.72—259.78	0.956	-	0.956	-
22	TP21-TP22	259.78—214.44	3.647	-	3.647	-
23	TP22-TP23	214.44—209.78	0.473	-	0.473	-
Total			38.4	15.3	17.3	5.9

5.1.5 Climate

The T/L corridor lies in the Sub-tropical to Tropical Climatic Zone. The recorded maximum and minimum temperature for Chitwan District was 36.6^{0}C and 9.1^{0}C, respectively in the year 2005. Similarly, the recorded maximum and minimum temperature for Tanahu District was 21.1 and 13.5^{0}C, respectively in the year 2005. (District Profile of Nepal-2007/2008)

The project area is influenced by the summer monsoon rains. Nearly 80% of the rainfall in the area occurs during the summer monsoon. The recorded maximum rainfall of Chitwan District is 671.1 mm in the month of August and Tanahu District maximum rainfall is 423.6 mm in the month of July (rainfall recorded in the year 2005).

5.1.6 Air and Water Quality and Noise levels

The data on air and water quality and noise level of the T/L corridor area is not available. As the area traversed by the T/L corridor lies in a rural setting except at the end stretch and along the highway with minimum of industrial activities, the status of air and water quality are considered to be good from field observation. The water quality of the streams close to the settlement areas has a high potential of microbiological contamination as the banks are used for defecation by the local people.

Noise levels, away from the settlement areas, are not affected by human activities. However, in the settlement areas, various human activities have elevated the noise levels but are still considered to be within the range of acceptable levels and which is not injurious to human health. Noise pollution along the highway is felt

5.1.7 Drainage and Hydrology

The principal drainage of the area is the Narayani River. The Seti River draining nearly 85% of the TL corridor area meets the Trishuli River at Seti Beni and flows south to the Narayani River at Devghat. The other tributaries across the T/L corridor are Khirkhaur Khola, Sukhaura Khola, Dhad Khola, Dhao Khola, Bar Khola, Das Khola, Khahare Khola and Jugedi Khola. The summer monsoon influences the hydrology of the rivers and streams of the area. Flash floods are frequent in the streams of the Siwalik Zone (i.e. Das Khola, Khahare Khola and Jugedi Khola). Except for the principal streams such as the Seti, the other streams originating in the nearby mountains have very little flow in the winter and summer (December to May), but swell up with high flows in the monsoon (June to September). The detail of the river crossings is tabulated below.

Table 5.2 The details of river crossing

S. No	Alignment Stretch	Name of Major River/Streams	Number of Crossings
1.	TP1-TP2	Seti River Kirandi Khola	1 1
2.	TP2-TP3	Daha Khola Dhada Khola	1 1
3.	TP3-TP4	Bakse Khola	1
4.	TP4-TP5	Bagar Khola Seti River Bad Khola	1 1 2
5	TP5-TP6	Daduwa Khola	2
6	TP8-TP9	Chawa Khola Narayani River	1 1
7	TP10-TP11	Chihan Khola Das Khola	1 1
8	TP11-TP12	Khahare Khola	1
9	TP14-TP15	Jugedi Khola	1
10	TP21-TP22	Ramnagar Khola	1

5.2 BIOLOGICAL ENVIRONMENT

5.2.1 Vegetation/ Forest Resources in the Project Area

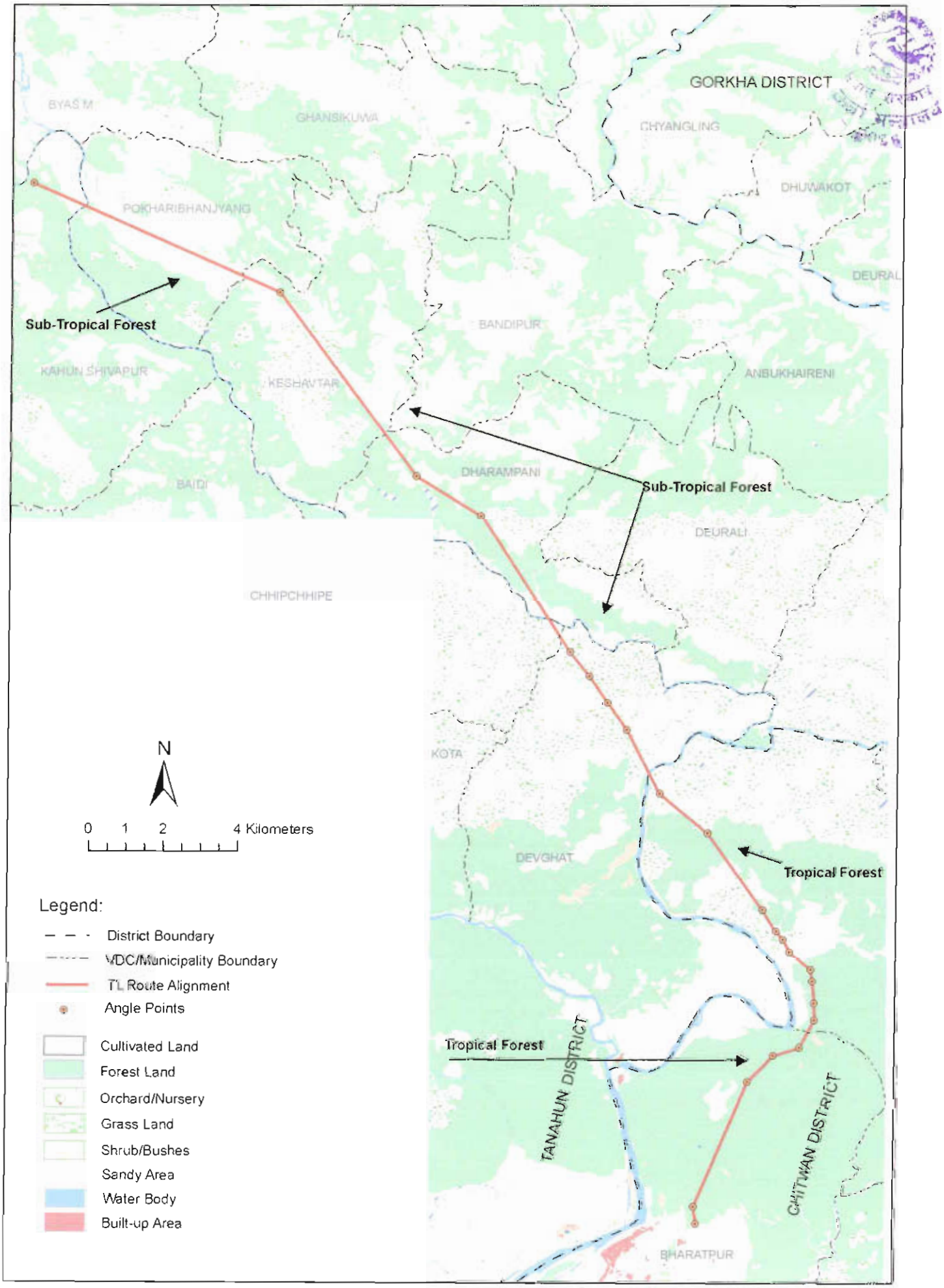
The proposed 220 kV transmission line corridor lies in sub-tropical climatic zone in hill area of Tanahu district. The vegetation along the alignment in Tanahu district comprises of *Schima-Castanopsis* Forest and Hill Sal Forest whereas in Chitwan district which lies in tropical climatic zone consists of Tropical Sal Forest.

There is no distinct separation of the above forest zones in the TL corridor area. Scattered patches of the *Schima–castonopsis* forest are observed only in Keshavtar VDC around an altitude of 900 masl. Below this elevation, rest of the proposed transmission line alignment in Tanahu district passes through hill Sal forest. A small section of the transmission line passes through a hill area of Kabilas VDC of Chitwan district, and then it runs through tropical Sal forest in the plain area. The plant species recorded in the project area are presented in Appendix - B. Forest types and their status recorded in the proposed alignment is presented below:

5.2.1.1 Mixed (*Schima - Castronopsis*) Forest

This type of forest exists at upper slope of transmission line corridor. Chilaune (*Schima wallichii*) and Katus (*Castronopsis indica*) are the main dominant tree species. Other associates (top canopy) of this

Fig. 5.2: Forest Type



forest are Botdhayero (*Lagerstroemia parviflora*), Koiralo (*Bauhinia variegata*), Sindhure (*Mallotus philippinensis*), Amala (*Phyllanthus emblica*), Khirro (*Sapium insigne*) and Bhalayo (*Semicarpus anacardium*). Under story species consist of Dhayero (*Woodfordia fruticosa*), Bhuletro (*Butea minor*), Dhusure (*Colebrookea oppositifolia*) and Arile Kanda (*Caesalpinia decapitata*). Canopy cover varies low, about 10 percent in the disturbed areas to 70 percent in some places.

In the sample plots, only 7 species of tress were recorded in 5 standard sample plots equivalent to 4500 m2 areas, measured along the proposed alignment. Tree density of the sample plots has been estimated as 567 trees/ha. Among the sample species, Chilaune has maximum density of 133 trees/ha followed by Mauwal (100 trees/ha) and of 89 trees/ha, Utis.
Among the recorded and measured species the Important Value Index (IVI) of Chilaune is the highest having value of 69.13 followed by Mauwa (49.17) and Utis (45.69). Table 5.3 (i) shows the tree density per hectare, frequency, basal area in m2/ha, relative density, relative frequency, relative dominance and Important Value Index (IVI) of the sample species in the mixed forest through which the proposed alignment will pass in Keshavtar VDC of Tanahu.

Table 5.3 (i) : Forest Sampling Data of Mixed Forest

SN	Species	Density trees/ha	F%	BA m^2/ha	RD	RF	Rdom	IVI
1	Chilaune (*Schima wallichii*)	133	80	2.21	23.52	21 05	24.56	69.13
2	Utis (*Alnus nepalensis*)	89	60	1.28	15.68	15.79	14.22	45.69
3	Mauwa (*Engelhardia spicata*)	100	40	1.89	17.64	10.53	21.00	49.17
4	Katus (*Castanopsis indica*)	78	40	0.86	13.72	10.53	9.56	33.81
5	Bhalayo (*Semicarpus anacardium*)	56	60	1.48	9.80	15.79	16.44	42.03
6	Khirro (*Sapium insigne*)	67	60	0.63	11.76	15.79	7.00	34.55
7	Botdhayero (*Lagerstromia parviflora*)	44	40	0.51	7.84	10.53	5.67	24.04
	Total	**567**	**380**	**9**	**100**	**100**	**100**	**300**

Source: Field survey April, 2009

5.2.1.1 Hill Sal *(Shorea robusta)* Forest

Subtropical deciduous hill forest has no pure colony in the project area and it has mixed species composition. The TL corridor along the Keshavtar, Dharampani and Kabilas VDCs passes mostly through the hill Sal forest zone. The Hill Sal (Shorea robusta) occurs usually between 300 m to 1000 m. Shorea robusta is the dominant tree species of this zone and the land is undulating to flat. Khayer (Acacia catechu) and Simal (Bombax cieba) are also found along the ravine corridors and alluvial tars along the river. This forest is comparatively dense and average canopy cover was observed about 60 percent.

In the sample plots, only 4 species of tress were recorded in 5 standard sample plots equivalent to 4500 m2 areas measured in the proposed alignment. Tree density of the sample plots has been estimated as 209 trees/ha. Obviously, Sal is most dominant tree species having density of 174 trees/ha and its Important Value Index (IVI) is 221.63. The Table below shows quantitative structure of the Hill Sal forest through which the proposed alignment will pass in Tanahu district.

Table 5.3 (ii) : Forest Sampling Data in Hill Sal Forest

SN	Species	Density trees/ha	F%	BA m^2/ha	RD	RF	Rdom	IVI
1	Sal (*Shorea robusta*)	174	80	3.65	83.25	44.44	93.93	221.63
2	Khair (*Acacia catechu*)	7	20	0.05	3.35	11.11	1.28	15.74
3	Simal (*Bombx cieba*)	2	20	0.10	0.96	11.11	2.57	14.64
4	Botdhayero (*Lagerstromia parviflora*)	26	60	0.08	12.44	33.33	2.14	47.91
	Total	209	180	3.89	100	100	100	300

Source: Field survey, April 2009

5.2.1.2 Tropical Sal Forest

The lower tropical Sal Forest extends in the alluvial plain below 300m elevation. Parts of the forests along the TL corridor in Kabilas VDC and Bharatpur Municipality of Chitwan District are lower tropical Sal Forest. The main associates of this forest recorded are Harro (*Terminalia chebula*) Barro (*Terminalia bellerica*), botdhayero (*Lagerstroemia parviflora*), Karam (*Adina cordifolia*), Tatari (*Dillenia pentagyna*) and Bhalayo (*Semicarpus anacardium*) .Major shrubs associated are Dhayero (*Woodfordia fruticosa*), and Bayar (*Zizyphus mauritiana*).Major climbers and herbs associated are Bhorla (*Bauhinia vahlii*) and Gittha (*Dioscorea bulbifera*).The observed forest canopy cover is 70% and mostly uniform.

Likewise, only 5 species of tress were recorded in 5 standard sample plots equivalent to 4500 m2 areas measured in the proposed alignment traversing through Tropical Sal Forest in Chitwan district. Tree density of the sample plots has been estimated as 226 trees/ha. Among the sample species, Sal has maximum density of 128 trees/ha being dominant tree species. Similarly, Important Value Index (IVI) of Sal is the highest having value of 139.4 in this type of forest. The Table 5.3 (iii) shows the tree density per hectare, frequency, basal area in m2/ha, relative density, relative frequency, relative dominance and Important Value Index (IVI) of the sample species in the Tropical Sal forest of project area.

Tropical Sal Forest along TL corridor in Bhartapur Municipality

Table 5.3 (iii) : Forest Sampling Data in Tropical Sal Forest

SN	Species	Density trees/ha	F%	BA m^2/ha	RD	RF	Rdom	IVI
1	Sal (*Shorea robusta*)	128	100	4.15	56.64	35.71	47.05	139.40
2	Karam (*Adina cordifolia*)	30	60	1.20	13.27	33.33	13.61	48.31
3	Harro (*Terminalia chebula*)	21	40	1.04	9.29	22.22	11.79	35.37
4	Barro (*T. bellerica*)	12	40	0.67	5.31	22.22	7.60	27.20
5	Tatari (*Dillenia pentagyna*)	35	40	1.76	15.49	22.22	19.95	49.72
	Total	226	280	8.82	100	100	100	300

Source: Field survey, April 2009

5.2.2 Plant Resource Use Pattern

In the rural area, agro forestry plays a vital role in the local economy. Forest is the prime source of fuel wood, fodder, timber, medicinal herbs and even agriculture manure. People of the project area depend on forest resources for fodder, firewood, timber and other forest products (wild edible fruits, vegetable of wild origin, etc). Though medicinal plants like Harro (*Terminalia chebula*), Barro (*Terminalia bellerica*), Kurilo (*Aspharagus racemosus*) etc are found in the project area, they are hardly collected and marketed by local. The local people have planted economic plants in their private land to meet their daily requirement and also for income generation. Apart from the fruit trees like mango, guava, banana, most of the houses have their own patches of bamboo grooves. Details of the major economic plants of the project area are presented below:

Table : 5.4 Economic Importance of the Major Plant Species of the Project Area

S. No.	Botanical Name	Local Name	Economic Importance
1.	*Bambusa arundinacea*	Bans	Housing purposes, Basket making and also used for fence
2.	*Albizia spp.*	Siris	House posts, Furniture and Agricultural implements
3.	*Alnus nepalensis*	Uttis	Best species for soil conservation works, Furniture and housing purposes.
4.	*Bauhinia purpurea*	Tanki	Use for fodder and firewood
5	*Bauhinia variegate*	Koiralo	Edible flower
6.	*Castenopsis indica*	Katus	Firewood, Fruit is edible
7.	*Lagerstroemia parviflora*	Botdhayero	For building purposes, Agricultural Implements and Firewood
8.	*Shorea robusta*	Sal	For building purposes
9.	*Asparagus racemosus*	Kurilo	Medicinal use

Source: Field Survey, April 2009

5.2.3 Forest Management

Government policy of enhancing community forest has substantially encouraged the handing over the national forest to the forest users group for conservation and management based on the approved operational plan. The operational plan prohibits cutting of green trees for any purpose unless otherwise decided by the user committees. However, the plan favors the collection of grass, dead trees, the medicinal plants and minor forest products as decided by the forest user group.

Hill Sal Forest in Bagar CF of Dharampani VDC

The Tanahu district, in which the major part of the proposed alignment is lie, has a total of 62,654 ha forest land that comprises 40.5% of the total land area in the district. Community forestry program started in Tanahu in early 1990's and a total of 24,218 ha (38.65%) of forest has been handed over as the community forest that benefits a total of 39,347 house holds (DFO, 2063). Similarly, in the Chitwan district, a total of 6,722.56 ha (5.23 %) forest area out of 128,500 ha forest is handed over to 16 user groups as community forest. The 220 kV transmission line passes through a number of community forests in the project area. Among them, some are still under legal process of hand over.

Moreover, in both Tanahu and Chitwan districts, leasehold forestry program has been going on. Under this program, District Forest Offices has identified marginal degraded land and has handed

over to poor people on lease contract. These Leasehold Forest Units exist along the proposed transmission line but only in Chitwan district. Details of the community forest and leasehold forest through which the proposed alignment traverses are presented in the Table 5.5:

Table: 5.5 List of Community Forest and Leasehold Forest along the transmission alignment

S. N.	Name of CF/LHF	Address	Type of Forest	Remarks
		Tanahu District		
1.	Rumsi CF	Rumsi, Keshavtar-6	Mixed (Schima-Castronopsis)	
2.	Harkapur CF	Harkapur, Keshavtar-4	,, ,,	
3.	Sukaura CF	Sukaura, Keshavtar-1	Hill Sal Forest	
4.	Siddhthani CF	Chisapani, Dharampani-1	,, ,,	
5.	Bakse CF	Bakse, Dharampani-2	,, ,,	
6	Bagar CF	Dharampani, Dharampani-4	,, ,,	
7.	Maindanda CF	Parlang, Devghat-7	,, ,,	Under handover process
8.	Devidanda CF	Nagarthali, Devghat-7	,, ,,	,, ,,
9.	Sinchyang CF	Sinchyang, Devghat-9	,, ,,	
		Chitwan District		
10.	Akladevi CF	Dasdhunga, Kabilas-2	Tropical Sal Forest	under handover process
11.	Syauli LHF		,, ,,	
12.	Chanaute LHF		,, ,,	
13.	Indreni CF	Jugedi, Kabilas-1	,, ,,	under handover process
14.	Satanchuli CF	Bharatpur-1	,, ,,	,, ,,
15.	Jaldevi CF	Bharatpur-11	,, ,,	,, ,,
16	Janjagriti CF	Ganeshthan, Bharatpur-11	,, ,,	,, ,,

Source: Field Survey, April 2009

5.2.4 Forest Land Requirement

The proposed Damauli-Bharatpur 220 kV Transmission Line passes through different community forest and leasehold forests. In Tanahu district, it runs 8.45 km through community forests. Since the RoW is 30 m wide, it shall requires 25.35 ha of forest land in the Tanahu. Similarly, the forest area under the RoW of proposed alignment in Chitwan district is estimated as 31.35 ha. Altogether, the proposed transmission line project shall require 56.7 ha of the forest land.

However, the proposed alignment goes over uneven terrain of hills in Tanahu district and partly in Chitwan. Furthermore, since the proposed alignment will follow the route parallel to existing Pokhara-Marshyangdi 132 kV and Marshyangdi-Bharatpur 132 kV transmission line, tree clearance in the forest is reduced. Thus, the EIA team has assessed the actual forest area required for the project is 26.79 ha.

Detail of the forest land under the RoW of the proposed alignment and the forest land requirement are given below in Table 5.6 and Table 5.7 respectively:

Table 5.6: Forest Land under the RoW of the Proposed Alignment

S.N.	Name of CF/LHF	Area of CF/LHF (ha)	Alignment Stretch	Length of Alignment (m)	Forest Area required (ha)
	Tanahu District				
	Community Forest				
1	Rumsi CF	157	TP2 – TP3	100	0.3
2	Harkapur CF	32	TP2 – TP3	600	1.8
3	Sukaura CF	91	TP2 – TP3	1250	3.75
4	Siddhthani CF	1013	TP2 – Sukaura Khola	750	2 25
5	Bakse CF	55	TP3 – TP4	550	1.65
6	Bagar CF	79	TP3 – Bagar Khola	2900	8 7
7	Maindanda PCF	NA	TP4 – TP6	500	1.5
8	Devidanda PCF	NA	TP5 – TP7	500	1.5
9	Sinchyang CF	94	TP8 – Narayani River	800	2.4
	Sub total	1521		8450	23.85
	Chitwan District				
	Community Forest				
1	Akladevi CF	NA	TP10 -TP11	1400	4.2
2	Indreni CF	NA	TP12 -TP14	3400	10.2
3	Satanchuli CF	NA	Jugedi Khola - TP21	3300	9.9
4	Jaldevi CF	NA	TP21 – TP22	1500	4.5
5	Janjagriti CF	NA	TP22 – TP23	450	1.35
	Sub total	-		10050	30.15
	Leasehold Forest				
1	Syauli LHF	2.8	Das Khola – TP11	200	0.6
2	Chanaute LHF	7.5	TP 11 – Khahare Khola	200	0.6
	Sub total	10.3		400	1.2
	Total	10.3		10450	31.35
	Grand Total	1531.3		18900	55.2

Source: Field Survey, April 2009

Table 5.7 : Forest Land Requirement

SN	T/L Components	RoW (m)	Length of T/L (m)	Forest area under the RoW (ha)	Sharing area of RoW of existing road (ha)	Avoiding area due to terrain (ha)	Actual forest Area required (ha)	Remarks
	Tanahu District							
1	220 kV alignment	30	8450	25.35	1.01	20.28	4.06	Sharing 20% along 6100 m of the alignment. Avoidance@80%
	Chitwan District							
2	220 kV transmission	30	10450	31.35	5.68	2.94	22.73	Sharing 20% along 8650 m of the alignment. Avoidance @ 70% partially in hill area
	Total			56.7	6.69	23.22	26.79	

Source: Field Survey, April 2009

5.2.5 Wildlife

The transmission line corridor extends from the Mid Hills region in the north to the Dun valley (a component of Siwaliks and Terai) in the south. It is the transition zone of the Lowlands and the Mid Hills and it is diverse in its faunal composition. Ecologically, the corridor area is dominated by the Lower Tropical Sal, Hill Sal and *Schima –castonopsis* forests. Local people reported presence of some species of wildlife and birds in the project area. Among them, few important species like Bengal tiger, one horned rhinoceros etc appear in the project area due to vicinity of Chitwan National Park and its buffer zone. Besides that, distribution of wildlife in the project area is found non-uniform and depends upon habitat type, topographic factors and human influences. Details of the wildlife reported in the project area are as follows:

5.2.5.1 Mammals

A number of mammalian species are reported from the project area. Some of them are common animals such as rhesus monkey *(Macaca mullatta)*, langur (*Presbytes entellus*), etc. Royal Bengal tiger, one horned rhinoceros, wild boar etc do sometimes movement in the forest of Chitwan district through which the proposed transmission line passes. According to local information, wild animals raid crops nearby village area. List of the mammals are presented in the Appendix B.

5.2.5.2 Avi-Fauna

Subtropical deciduous hill forest, cultivated land, field and structures associated with village and Kholas, provide suitable habitat for a number of bird species. The bird species found in project area are common and widely distributed in mid hill throughout Nepal. Cuckoos (*Cuculus spp)*, Jungle Crow (*Corvus macrorhychos*), Green Wood Pecker (*Picus squamatus*) and Kalij Pheasants (*Lophura leucomelana*) are the prominent bird species reported from the area. Major reported avi-fauna in the project area are presented Appendix B.

5.2.5.3 Rare Endangered and Threatened Species

Due to the destruction of natural habitats and over harvesting some animals have become rare and endangered in Nepal. In response to this, government of Nepal has signed CITES convention, banning trade on listed species and has promulgated a list of protected species. Few species of wild animals reported in project area belong to the IUCN, CITES and GON protection categories.

Moreover, different varieties of orchids found in the project area belong to category of rare, endangered and threatened species. Except that, Sal (*Shorea robusta*) is protected not to fell green trees for commercial harvesting as per Forest Rules, 2051. Details of the protected species are presented in the Appendix B.

5.3 SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

The Upper Seti (Damauli)- Bharatpur 220kV Transmission Line Project is located in two districts namely Tanahun of Western Development Region and Chitwan of Central Development Region of Nepal. The total area of the project affected districts is 3,764 sq.km (Tanahun 1546 sq.km. and Chitwan 2218 sq.km) with average population density of 208.5 persons/sq km. According to the National Population Census 2001, the total population of the project affected districts is 7,87,285 with 3,81,872 male and 4,05,413 female. This implies that the population of the districts constitutes 3.4% of the country's population. Similarly, the number of households in the project affected districts are 1,55,761 with an average household size of 5.04.

5.3.1 Profile of the Project Affected VDCs/Municipality

The alignment traverses through 6 VDCs of Tanahun district. Similarly, the Transmission line crosses 1 VDC and 1 Municipality of Chitwan district. The project affected VDCs of Tanahun district are Kahu Shivapur, Pokhari Bhanjyang, Keshavtar, Dharampani, Devghat and Chhipchhipe. Likewise, project affected VDC and municipality of Chitwan district are Kabilas and Bharatpur municipality respectively.

5.3.1.1 Demographic Profile

5.3.1.1.1 Population and Households

The total population of the project affected VDCs/Municipality are 1, 26,613 with the male population of 63,849 and female 62,746. The population of the project affected VDC/Municipality covers 16.08% of the total population of the two districts. The average households' size of the project affected VDCs/Municipality is 5.8, which is higher than the district average 5.84. Similarly, the population density of the project affected VDC/ Municipality is 280.28 persons per square kilometer with the population growth rate of 3.021. The table below presents the demographic data of the project affected VDCs/ Municipality

Table 5.8 Demographic Characteristics of the project affected VDCs/Municipality.

VDC/Municipality	Population (VDCs)			HHs	Ave. Hhs Size	Pop.den.	Growth rate (%)	Area (sq.km)
	Total	Male	Female					
Kahun Shivapur	8,066	4,031	4,035	1,087	7 4	79	1.26	27.5
Pokhari Bhanjyang	4,082	1,902	2,180	832	4.9	157	0.001	20.68
Keshavtar	5,423	2.513	2,910	1054	5.1	109	4.53	32.85
Dharampani	3,914	1,780	2,134	709	5.5	85	1.16	16.85
Devghat	7,620	3,691	3,929	1,666	4.6	123	3.2	62
Chhipchipe	2,672	1,309	1.363	378	7.6	109	1 8	24.54
Kabilas	5,513	2,765	2,748	985	5.6	109	2.1	50.46
Bharatpur Municipality	89323	45858	43,465	19,992	4.5	1191	7.1	75
VDC Total / Ave.	126,613	63,849	62,764	26,703	5.84	280.28	3.021	309.88
Tanahu District	315.237	146,788	168,449	62,898	5 01	204	1 27	1546
Chitwan District	472,048	235,084	236,964	92.863	5.08	213	2.86	2218
District Total /Average	7,87,285	3,81,872	4,05,413	1,55,761	5.04	208.5	2.06	3764

Source: Census Report. 2001 and District Profiles: Tanahun & Chitwan

5.3.1.1.2 Ethnicity

The project area is a heterogeneous mixture of different origins, cultures, language and ethnicity because most of the people at the vicinity of the project area have migrated from the hilly part of the adjoining district. The change in ethnic composition has been further accelerated by the arrival of outsiders into the area for various purposes such as business, agriculture, service, labor, etc. Thus, the project area is composed of many ethnic groups making up distinct communities.

The major ethnic groups in the project affected VDCs/Municipality are Brahmin (30.80%) followed by Magar (14.54%), Gurung (12.16%), Chhetri (9.53%), Newar (8.26%). Similarly, Tamang (4.23%), Kami/Dholi (3.32%), Damai (2 09%) and other (14.20%) are also residing in the project area. The

other category comprises of Badi, Thakuri, Bote, Sanyasi, Chepang (Praja), Teli, Sonar, unidentified Dalit, Rajput, Kumal, etc. The detail ethnic composition of the project affected VDCs/Municipality is presented in Table 5.9.

Table 5.9: Caste/Ethnic Population for VDC/ Municipality

VDC/ Mun.	Total	Brah	Chhe	Magar	Gurung	Ka/Dh	Damai	Sarki	Newar	Tam	Other
Kahun Shivapur	8066	63	33	6064	9	567	190	170	11	0	959
Pokhari Bhanjyang	4082	737	273	1724	104	297	367	186	8	34	352
Keshavtar	5423	462	200	3303	370	320	120	12	119	1	516
Dharampani	3914	7	13	369	3194	116	90	3	12	1	109
Devghat	7620	1500	516	1425	2366	171	127	12	82	65	1356
Chhipchipe	2672	36	32	1443	1080	35	0	0	21	0	25
Kabilas	5513	238	158	364	2865	207	109	29	144	611	788
Bharatpur Mun	89323	35953	10843	3712	5409	2492	1638	698	10062	4646	13870
Total	126613	38996	12068	18404	15397	4205	2641	1110	10459	5358	17975
%	100	30.80	9.53	14.54	12.16	3.32	2.09	0.88	8.26	4.23	14.20

Source: Population census, 2001

5.3.1.1.3 Language

Nepali (68.73%) is the widely spoken language of the project affected VDCs/Municipality. Besides, the second most spoken language is Magar (11.24%) followed by Gurung (7.84%), Newar (4.14%), Tamang (2.31%), Hindi (1.08%), Tharu (0.80%), and other (3.55%). The other includes: Kumal, Dura, Maithali and Thakali. The details of the languages spoken in the project affected VDCs/ Municipality and districts as well is provided in Table 5.10.

Table 5.10: Population distribution by Mother Tongue for VDCs/ Municipality

VDC/ Mun.	Total	Nepali	Gurung	Magar	Tamang	Bhujel	Newar	Hindi	Tharu	Others
Kahun Shivapur	8066	2015	10	6018	0	0	0	0	0	23
Pokhari Bhanjyang	4082	2310	86	1611	36	0	0	0	0	39
Keshavtar	5423	1711	277	3203	25	90	81	0	0	36
Dharampani	3914	640	2941	307	0	11	11	0	0	4
Devghat	7620	4340	1919	475	43	293	31	0	0	519
Chhipchhipe	2672	138	1078	1426	0	0	27	0	0	3
Kabilas	5513	4172	844	62	156	0	23	16	0	240
Bharatpur Mun.	89323	71694	2767	1134	2667	0	5064	1351	1019	3627
Total	126613	87020	9922	14236	2927	394	5237	1367	1019	4491
%	100	68.73	7.84	11.24	2.31	0.31	4.14	1.08	0.80	3.55

Source: Population census, 2001

5.3.1.1.4 Religion

The project affected VDC/Municipality is dominated by Hindu population (79.93%) followed by Buddhist (18.56%), Islam (0.87%) and Christian (0.48%). Similarly, Kirant (0.09%), Jain (0.01%), Sikh (0.03%), Bahai (0.004%) and not stated (0.13%) are also residing in the project area. The detail of the religious composition of the affected VDCs/Municipality is shown in Table 5.11.

Table 5.11: Population distribution by Religion for VDC

VDC/ Municipality	Population									
	Total	Hindu	Buddhist	Islam	Kirant	Jain	Christian	Sikh	Bahai	Not stated
Kahun Shivapur	8066	6724	1325	0	0	0	0	0	0	17
Pokhari Bhanjyang	4082	4037	44	0	0	0	1	0	0	0
Keshavtar	5423	4217	1176	1	0	0	29	0	0	0
Dharampani	3914	1343	2567	4	0	0	0	0	0	0
Devghat	7620	5569	2046	3	0	1	0	0	0	1
Chhipchhipe	2672	539	2128	0	0	0	0	0	0	5
Kabilas	5513	1365	4119	21	0	1	4	0	0	3
Bharatpur Mun.	89323	77280	10098	1071	119	6	575	32	5	137
Total	126613	101074	23503	1100	119	8	609	32	5	163
%	100	79.83	18.56	0.87	0.09	0.01	0.48	0.03	0 00	0 13

5.3.1.1.5 Population Migration

A historical perspective of the population of the project area indicates an important role of migration in changing the population size and socio-economic status of project affected families. Migration is common phenomenon in project area. The field investigation indicates that the most of the families in Chitwan district have migrated from nearby hilly area to Bharatpur Municipality, along the Damauli-Dharampani village road and Tribhuvan Highway. Thus, the whole region of the project affected area is a mixture of people of different income status, origin, culture, languages and ethnicity. The general factors leading to migration of the population in the project affected area are: poverty, flood or other natural calamities, construction of development projects in their original settlements, better social services and other facilities in project area. Generally, seasonal migration in capital city Kathmandu, Narayanghat, Birgunj, Pokhara and some towns of India and the other countries in search of job with the aim of supplementing household income is also widely practiced. However, migrations for educational purpose and services have not been reported by the sampled households.

5.3.1.2 Land Use Pattern

Cultivated land, forest, barren, grazing and other type of land are the main land use pattern of the project affected VDCs/municipality. Out of total land (35,830ha) the cultivated land constitute 33.52% of which low land khet is 31.10% and up land bari 68.90%. Similarly, there is 20.57% forest land, 9.74% barren land, and 2.75% other category. However, out of total cultivated land only 28.77% land is irrigated in the project affected VDC. The detail land use pattern of the project affected VDC/Municipality is shown in Table 5.12.

Table 5.12: Land Use Pattern in the Project affected VDCs/Municipality

Name of VDC/Municipality	Cultivated land (ha)			Land for other Purpose (ha)				Irrigated land (ha)	Total (ha)
	Total	Khet	Bari	Barren	Grazing	Forest	Other		
Pokhari Bhanjyang	1598	318	1280	125	15	330	1598	318	3666
Keshavtar	2255	509	1746	25	10	995	2255	509	5540
Chhipchipe	0	0	0	0	0	0	0	0	2454
Dharapani	643	225	418	521	105	416	643	225	2328
Kahun Shivapur	1600	200	1400	350	110	690	1800	200	4550
Devghat	755	327	428	695	358	337	1390	327	2900
Kabilas	389	76	313	100	106	4451	388	76	5435
Bharatpur Municipality	4771	2080	2691	1675	281	150	2080	1800	8957
Total	12011	3735	8276	3491	985	7369	10154	3455	35830
Percent	33.52	31.10	68.90	9.74	2.75	20.57	28.34	28.77	

5.3.1.3 Health and Sanitation

Despite the existence of sub-health post, health post, and hospitals in the project affected area, there is lack of health workers. The entire population depends upon the facilities available in the district headquarters. Falls/injuries/fractures, gastric, diarrhea, skin diseases, mouth complaints/toothaches, abdominal pains, bronchitis and ear complaints were the most common diseases reported from the project area. There are sub-health posts in each of the project affected VDCs. The hospital level services are available only in the district headquarters Damauli Bazaar and Bharatpur Municipality.

According to District Health Offices, the common reported incidence of chronic illness is quite low (chronic illness is a long-term suffering and includes the following: Cancer, asthma, heart disease, diabetes, kidney problem, epilepsy, respiratory problem, high and low blood pressure, drug abuse, occupational illness (disability to do any kind of work caused by spine or leg fracture that occurred t in work). However, incidence of acute illness has significantly increased during the past few years. According to the source, about two third of acute illness cases is fever during the past two years.

The present sanitation condition in the project affected VDCs/Municipality is not satisfactory. Open defection in the field is observed in some settlements of the project affected VDCs. However, use of toilet along the road side settlements is common.

5.3.1.4 Water Supply System

About 70% of the households in both the districts have benefit of drinking water facility. In pursuance of Tenth Five Year Plan many drinking water schemes have been implemented in the project affected districts by several organizations such as DDC, Red Cross, British welfare, Helvetas, etc. Some notable drinking water projects in the project area are shown in Table 5.13. However, some of the drinking water schemes were found to be non operational during the household survey. In the project area most of the households are supplied with water from pipes, river, well and others. Though majority of the people have access to drinking water schemes the supplied water is untreated. Its quality worsens during the rainy season. It was observed that open defecation is one of the reasons for source contaminations.

Table 5.13: Distribution of Drinking Water Projects

Name of project	Benefited VDC
Devghat Drinking Water Supply Project	Devghat
Kalleri- Lakhbari Drinking water project	Dharampani
Danda Khudi Drinking water Project	Kahu Shivapur
Keshavtar–Belthumki Drinking water Project	Keshavtar

Source: Field Survey, 2008

5.3.1.5 Transport and Communication

The transportation facilities are comparatively developed in the project area because the most of the part of the project area has road network. The project area except the Chhichhipe VDC is accessible through Damauli-Dharampani (an earthen fair weather road exists in most of these areas). The rest of the project area lies either along the existing Tribhuvan Highway or nearby. However, labor transportation will be required to bring all the construction equipment and materials to some of the tower pads from the existing road.

The communication facility in the project area is satisfactory. There are telecommunication facilities in the major settlements of the affected VDCs and Municipality of the core project area. Mobile network is accessible throughout the project area. The e-mail, Internet, and Fax services are available in Vyas Municipality and Bharatpur Municipality. The additional post offices and Ilaka Post offices also exist in the main settlements of the project affected VDCs/Municipality. The district post office is located in district headquarters Damauli and Bharatpur Municipality.

5.3.1.6 Economic Activity

Approximately 2.7% of the households in the project affected VDCs/Municipality depend on business and trade activities. Trade and business activities in the project area include all types of business such as food crops, vegetables, fruits and others such as grocery, tea & shop, clothes, etc. Such business activities are mainly found in the settlements along the Tribhuvan Highway and Damauli-Dharampani Village Road. Some small grocery and teashops also exist along the foot trails. Damauli, Bharatpur and Keshavtar are the main trade centers of the project affected VDCs/Municipality.

5.3.1.7 Other Development Activity

Both the District Development Committees have implemented special Program like Participatory District Development Program and Rural Community Infrastructure Development Program in the project area. Some of the infrastructure development programs implemented are Bagarkhola–Saranghat Village Road (Devghat VDC), Barahkulo Irrigation Project (Keshavtar VDC), Sandebagar Irrigation Project (Devghat)).

In each of the project affected districts, the NGOs, are deliberating various services to the societies. Most of the NGOs are the member of the NGO Network located at Damauli and Bharatpur Municipality. An NGO funded by Practical Action Nepal with an objective of access for opportunities is functioning currently in Devghat and Dharampani VDCs of the project area. Some currently operated NGOs are shown in Table 5.14.

Table 5.14: NGOs in the Project Area

S. No.	Name of Institution	Address	Phone No.
1	Mahila Swawalamban Samaj	Bharatpur Municipality, Chitwan	
2	Nari Ekata Kendra	Bharatpur Municipality, Chitwan	
3	Nagarik Chetana Samaj Nepal	Bharatpur Municipality, Chitwan	23687
4	Made Nepal	Bharatpur Municipality, Chitwan	28604
5	Jana Sewa Abhiyan	Bharatpur Municipality, Chitwan	25054
6	Matribhumi Yuba Club	Bharatpur Municipality, Chitwan	20807
7	Gramin Vikash Tatha Batabaran Samrakchhan Samaj	Bharatpur Municipality, Chitwan	
8	Jana Swasthya Sewa Kendra	Bharatpur Municipality, Chitwan	
9	Nepal Netrahin Sangh	Bharatpur Municipality, Chitwan	
10	Utthan Samaj	Bharatpur Municipality, Chitwan	
11	Bhole Ama Samudaya	Kabilas VDC, Chitwan , Chitwan	
12	Himalayan Resources Institute	Bharatpur Municipality Chitwan	

Source: DDC Profile, Chitwan, 2062BS

5.3.1.8 Historical and Archeological Sites

There are many religious and historical sites in the project area. Devdaha, located at Chitwan district is famous for Hindu people. Similarly, the project area particularly, Tanahun district, is well known for having caves such as Ananta Gupha, Vyas Gupha, Parasar Gupha and Siddha Gupha. Some Hindu temples (Shiva, Narayan, etc) and Gumbas are also reported in the project area. Ghanshikuwa is famous for having well and park with statue of the poet Bhanubhakta Acharya. Moreover, the Hindu people take bath in the holy river like Madi, Seti in each of the Janai Purnima, Teej and Maghe Sankranti festivals.

There is a historical and cultural place located in the Rumsi of Keshavtar VDC-8 near angle TP-2. It is believed that weapons of Kusunda tribe have been lying there since one hundred years and Magars have been worshiping there from long.

The project affected districts are famous for tourism activities. Some places of attraction are Bandipur (tourists scenic view center), Chaundi Ramgha (birth place of great poet Bhanu Bhakta Acharya), Chhabdi-Barahi (religious place), Dhor Barahi (religious place), and Devghat (religious place).

5.3.1.9 Festivals

The major festivals of the project area are Vijaya Dashami, Tihar, Maghe Sankranti, Holi, Ram Nawami, Buddha Jayanti, and Teej for Hindu communities. Loshar is the major festival of the Gurung, Tamang and Ghale community. Similarly, Muslim celebrates the Id, Bakarid, etc. The Christian celebrate the Christmas. The popular cultural activities in the project area are Teej mela, Bhailo and Deusi in Tihar, Bhajan-Kirtan in Ram Nawami. The Hindu people worship in temples and other holy shrines and religious places. They worship gods as Shiva, Visnu and goddess Durga.

5.3.1.10 Law and Order Situation

The existing law and order situation of the project area is normal due to the overall political consensus of major political parties of Nepal. District Police Station at Byas Municipality and Bharatpur Municipality are maintaining the law and order situation in the project area. Similarly, there is a temporary police post located at Keshavtar along the Damauli-Dharampani Road.

5.3.1.11 Gender

Women in the project area are mostly engaged in household chores and agricultural activities. Work burden for women is still higher. The rate of work participation for women is very high and it starts at an early age. Very few (0.5%) women are involved in decision making process and outside job. Normally, the girls get married at 16-22 years of age. Child labor especially in among the girls is high. The literacy rate of the women in the project area is lower (61.88%) than that of the male literacy rate (75.62%).

5.3.1.12 Settlement Pattern

According to field investigation the population of 152 HHS is 1,128. The main settlements of the VDCs/Municipality through which the transmission line passes are Banchare, Simalswara, Chhapdanda, Marauto, Rumsi, Huslan, Devitar, Kamaltar, Jugedi, and Ganeshsthan. The settlements of project affected VDC/Municipality through which the transmission line passes are shown in the Table 5.15.

Ganesthan settlement (Bharatpur Municipality)

Table 5.15: Settlement distribution by Project affected VDCs/ Municipality

S. No.	VDC	Settlement
	Tanahun district	
1	Kahun Shivapur	Banchare
2	Pokhari Bhanjyang	Simalswara, Chhapdanda, Gundi Archalegaun
3	Keshavtar	Rumsi, Marauto
4	Dharampani	Huslan, Pokhari Bhanjyang
5	Devghat	Kamaltar
	Chitwan district	
6	Kabilas	Devitar, Jugedi Bazaar
7	Bharatpur Municipality	Ganeshthan

Source: Field study, April 2008

5.3.1.13 Agriculture

The percentage composition of population in project area involved in agriculture sector is about 48. The cropping pattern of the project area caries from site to site depending on land quality and availability of irrigation. In the absence of irrigation (at Bari), the cropping pattern is mostly dominated by two cropping systems comprising of maize and wheat or maize and millet or other appropriate combination of leguminous plants in the hill side of the project area. More fertile and year round irrigated lands are cultivated two times a year whereas non-irrigated lands are cultivated once a year. Some irrigation projects of the project area which are at present functioning are Serapachpanne Irrigation Project (Keshavtar VDC) and Bachyangdi Phant Irrigation Project (Pokhari Bhanjyang VDC). Some identified potential pocket area for agriculture products are shown in Table 5.16

Fig. 5.3: Settlements Along the TL Corridor

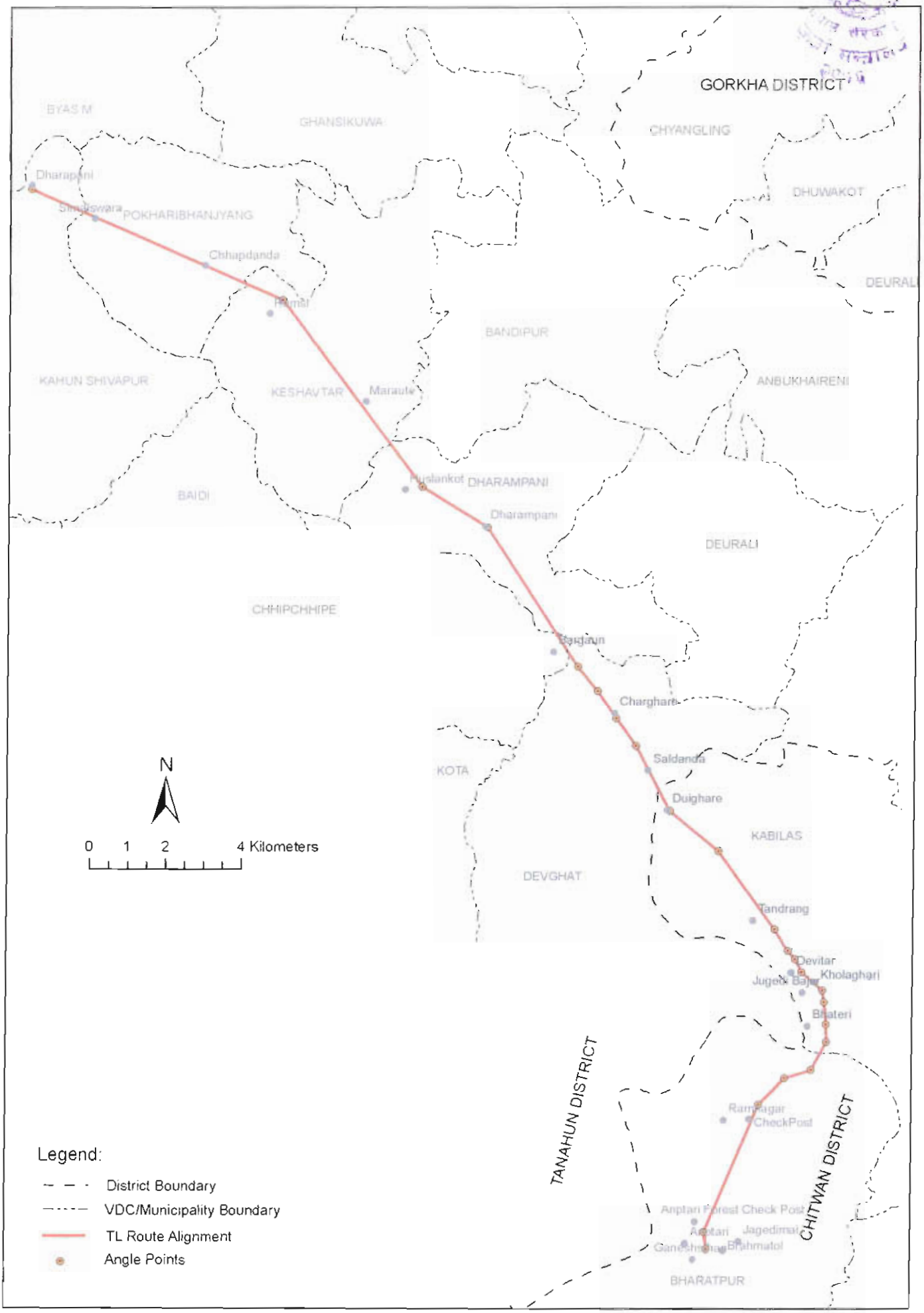


Table 5.16: Potential pocket area for agricultural product for VDCs

VDC	Potential Pocket area for Agriculture Products
Keshavtar	Resham, Maize,
Devghat	Silk *(Rehsam)*
Dharampani	Maize, Orange
Kahun Shivapur	Orange
Pokhari Bhanjynag	Orange

Source: District Agriculture Development Centre, Tanahun

The pocket area for food crops and cash crops in the project affected VDCs are shown in the Table below.

Table 5.17: Potential Area for different Crop Production in the Project Affected VDCs

S.NO.	Name of Crops	Potential pocket area (VDC)
1	Wheat	Keshavtar
2	Maize	Dharampani
3	Orange	Dharampani, Pokhari Bhanjyang, Kahun Shivapur
4	*Rehsam*	Keshavtar,

Source: District Agriculture Development Centre, Tanahun

5.3.1.14 Income pattern

According to the district profile of Tanahun the average income of the households of the project affected VDCs is NRs. 16,412, which is lower than the district average 23, 802. The income from non-agricultural activities contributes more (78.67%) than income from agricultural activities (21.32%).

Table 5.18: Income status of the project affected VDCs of Tanahun district

VDC/Municipality	Income from		Total
	Agriculture Activities	Non agriculture activities	
Pokhari Bhanjyang	10789	10697	21486
Keshavtar	1312	28258	29570
Chhipchipe	290	2932	3222
Dharapani	222	8231	8453
Kahun Shivapur	5793	12609	18402
Devghat	2593	14747	17340
Total	**20999**	**77474**	**98473**
Average	**3,499.83**	**12,912.33**	**16,412.17**
%	**21.32**	**78.67**	**100.0**

Source: District Profile, Tanahun

5.3.2 Profile of the Sampled Households

5.3.2.1 Demographic Profile

5.3.2.1.1 Population and Households

Households' survey was carried on 144 households of 32 settlements. The total population of the sampled households is estimated to be 1,060 with male 540 and female 521. Table 4.16 shows that the percentage of female is 50.95% and that of male is 49.16%. The population up to 15 years of age is 351, which is 33.11% of the total population. On the basis of CBS criteria, the economically active population (age group 16-59 years) in the sampled households is 592, which is 55.84% of the total population. The remaining 117, which is 11.05% of the total population, is 60 years and above age. The population distribution by age group and settlements is shown in Table 5.19.

Table 5.19: Population distribution by Age Group and Gender

S. No.	VDCs	Total	Female	Male	<15 yrs	16 - 59 yrs	60 yrs and Above
	Tanahun District						
1	Pokhari Bhanjyang	356	170	186	115	201	40
2	Keshavtar	351	172	179	113	190	48
3	Dharapani	73	38	35	26	39	8
4	Kahun Shivapur	29	19	10	14	13	2
5	Devghat	90	45	45	28	58	4
6	Chhipchhipe	21	12	10	8	10	3
	Sub total	920	456	465	304	511	105
	Chitwan District						
6	Kabilas	117	70	47	40	66	11
7	Bharatpur Municipality	23	14	9	7	15	1
	Sub-total	140	84	56	47	81	12
	Total	1060	540	521	351	592	117
	Percent	100	50.95	49.05	33.11	55.84	11.05

5.3.2.1.2 Ethnicity

The sampled households of the project area is dominated by Brahmin/Chhetri (46.79%) followed by Dalit (21.27%), Gurung (19.85%), Magar (18.44%), Newar (5.67%) and other (2.83%). The ethnic population of the sampled households is more or less similar to the population of the VDCs/Municipality. The detail of the ethnic composition of the sampled population is shown in Table 5.20.

Table 5.20: Ethnic Composition for VDC of the Sampled Households

VDCs	Total Hhs	Gurung	Magar	Chhetri	Brahmin	Newar	Damai	Bika	Others
Chitwan District									
Kabilas	16	6	2	1	1	4	1		1
Bharatpur	5	0	0	1	1	2	0	0	1
Tanahun District									
Pokharibhanjyang	53	0	11	14	13	2	5	7	1
Keshavtar	46	0	5	24	0	0	4	12	1
Dharapani	8	8	0	0	0	0	0	0	0
Kahun Shivapur	3		2	1	0	0	0	0	0
Devghat	10	5	0	4	0	0	1	0	0
Chhipchhipe	3	1	1	1	0	0	0	0	0
Total:	144	20	21	46	15	8	11	19	4
Percent	100.00	19.85	18.44	34.03	12.76	5.67	7.80	13.47	2.83

Source: Field survey, 2008.

5.3.2.2 Occupation

Even though the project area has satisfactory access to transportation, subsistence farming is the main occupation of the majority of the population because the area lacks year round irrigation facilities. About 48% of the project affected population is engaged in agricultural work. However, many people practice agriculture as well as other service or business. Agriculture alone has been found not sufficient to maintain their livelihood and many of them are compelled to do labour work either in nearby Municipalities or Kathmandu and Pokhara Although traditional agriculture farming constituents the predominant form of occupation like the other rural parts of Nepal, the percentage of

the population employed in the agriculture sector of the project area is less than that of the national average, which is greater than 80%. Involved of project affected people in business/trade, service, labor, student and other are 2.7%, 7.1%, 4.0%, 35 2% and 3.1% respectively. Table 5.21 shows the occupational distribution of the PAFs.

Table 5.21: Occupational Distribution of the Sampled Households

Occupation	Male	(%)	Female	(%)	Total	(%)
Agriculture	178	39.8	276	55.1	454	47.9
Business/Trade	16	3.6	10	2.0	26	2.7
Labor	15	3.4	23	4.6	38	4.0
Service	55	12.3	12	2.4	67	7.1
Student	175	39.1	159	31.7	334	35.2
Others	8	1.8	21	4.2	29	3.1
Total:	**447**	**100.0**	**501**	**100.0**	**948**	**100.0**

Source: Field survey, 2008.

5.3.2.3 Literacy

The literacy rate of the sampled households is 68.49% with male literacy rate of 75.62% and female literacy rate of 61.88%. Graduate scholars are only 0.5% among the sampled population (Table 5.22).

Table 5.22: Literacy Status of the Sampled Households

Educational Level	Male	(%)	Female	(%)	Total	(%)
Illiterate	118	24.38	199	38.12	317	31.51
Can only read and write	99	20.45	85	16.28	184	18.29
Primary	103	21.28	106	20.31	209	20.78
Lower Secondary	85	17.56	75	14.37	160	15.90
Secondary	51	10.54	30	5.75	81	8.05
Higher Secondary	25	5.17	25	4.79	50	4.97
Graduate and Above	3	0.62	2	0.38	5	0.50
Total:	484	100.00	522	100.00	1,006	100.00

Source: Field survey, 2008.

5.3.2.4 Agriculture Practice and Livestock

The sampled households produce varieties of food crops and cash crops. The major crops grown by them are paddy, maize, wheat, millet, barley, potato, etc. Fruits like banana, potatoes, pear, orange, and mango are also grown in the project affected area.

The area allocation for the crop production of paddy, maize, millet and oilseed are 21.57 ha, 53.71 ha, 3.71 ha and 10.77 ha respectively. This shows that the area allocation for maize is higher among the crops. This is because of the high percentage of upland (*pakho bari)* than the low land khet occupied by sampled households.

There are altogether 897 fruit trees owned by the 144 households. The number of households having fruit trees is estimated to be 68% in the sampled area. Among the fruit trees, the highest number of fruit tree grown is Banana (81.38%) followed by orange (6.8%). Similarly, main vegetables grown are: cauliflower, cabbage, radish, chilly, cucumber, pumpkin, brinjal and tomato.

The cash crops of the project site constitute of fruits and vegetables. The main cash crops grown are mustard, potato, tobacco, oilseed and ginger. The area, production and yield under each crop are shown in Table 5.23, 5.24 and 5.25 respectively. The average holding of fruit tree per households is 6.36. There is a sub-agriculture service centre in Kabilas VDC of Chitwan district.

Table 5.23: Fruit Trees Owned by Sampled Households

Type	Orange	Lemon	Mango	Guava	Banana	Others
Total	61	15	55	28	730	8
(%)	6.80	1.67	6.13	3.12	81.38	0.89
Average/Hhs	0.40	0.10	0.36	0.18	4.80	0.05

Table 5.24: Net Cropped Area (ha) of the Sampled Households

S. No.	VDCs	Paddy	Maize	Millet	Oilseed
1	Pokhari Bhanjyang	7.23	24.13	1.27	5.19
2	Keshavtar	5.29	10.49	0.41	2.19
3	Dharampani	2.14	3.51	0.61	0.51
4	Kahun Shivapur	0.51	-	0.05	0.76
5	Devghat	3.51	6.36	0.41	0.05
6	Chhipchhipe	0.65	3.82	0.35	0.85
	Chitwan District				
7	Kabilas	1.73	5.09	0.51	1.22
8	Bharatpur	0.51	0.31	0.10	-
	Total:	21.57	53.71	3.71	10.77

Source: Field Survey, 2008

The total annual production of varieties of crops among the sampled households is estimated to be 150.5MT. The total production of paddy, maize, millet and oilseed are 80.22MT, 51.81MT, 8.72 MT and 10.68 MT respectively. The productivity of paddy, maize, millet and oilseed are estimated to be 3.68MT/ha, 0.96MT/ha, 2.35MT and 0.99MT respectively.

Table 5.25: Agriculture Production (in MT)

S. No.	VDCs	Paddy	Maize	Millet	Oilseed
	Tanahun District				
1	Pokhari Bhanjyang	11.40	18.25	5.90	5.70
2	Keshavtar	11.95	8.05	0.40	2.70
3	Dharapani	5.35	5.90	0.10	0.30
4	Kahun Shivapur	1.30	0.75	0.30	0.45
5	Devghat	4.05	4.90	0.15	-
6	Chhipchhipe	1.02	2.86	1.62	0.93
	Chitwan District				
7	Kabilas	44.35	9.85	0.25	0.35
8	Bharatpur	0.80	1.25	-	0.25
	Total:	80.22	51.81	8.72	10.68

Source: Field Survey, 2008.

Table 5.26: Area, Production and Crop Yield

Description	Paddy	Maize	Millet	Oil Seeds
Area (ha.)	21.57	53.71	3.71	10.77
Production (MT)	79.30	51.81	8.72	10.68
Yield (MT/Ha)	3.68	0.96	2.35	0.99

Source: Field Survey, 2008.

The field investigation revealed that 5.9% of the sampled households are landless, 6.77% marginal farmers, 26.65% small farmers, 17.95% medium farmers and 42.62% large farmers. Table 5.27 shows the distribution of PAFs by land holding size. Table 5.28 shows the land ownership of the sampled household. The average landholding size is 12.9 ropani out of which 3.65 ropani is khet, 8.85 ropani bari and 0.41 ropani grazing land.

Table 5.27: Land Holding Size of the Sampled Households

S. No.	VDCs	Total	Landless	Marginal	Small	Medium	Large
		HHs	HHs (%)	Farmers holding less than 1Ropani of land	Farmers holding 1to 5 Ropani of land	Farmers holding 5-10 Ropani of land	Farmers holding more than 10 Ropani of land
				HHs (%)	HHs (%)	HHs (%)	HHs (%)
	Tanahun District						
1	Pokhari bhanjyang	53	7.5	7.5	18.9	13.2	52.8
2	Keshavtar	46	10.9	6.5	23.9	23.9	34.8
3	Dharapani	8	12.5	-	-	-	87.5
4	Kahun Shivapur	3	-	-	33.3	-	66.7
5	Devghat	10	-	-	30.0	10.0	60.0
6	Chhipchhipe	3	-	-	28.75	71.25	-
	Chitwan District						
7	Kabilas	16	-	-	37.5	25.0	37.5
8	Bharatpur	5	10.0	40.0	40.0	-	-
	Total/average:	144	**5.9**	**6.77**	**26.75**	**17.95**	**42.62**

Source: Field Survey, 2008

Table 5.28: Land Ownership of the Sampled Households

S. No.	Land Type	Average Area (Ropani / Hhs)		
		Own	Rented In	Rented Out
1	Khet (low land)	3.65	0.46	-
2	Bari (up land)	8.84	0.30	0.03
3	Grazing	0.41	0.03	-
	Total:	**12.90**	**0.79**	**0.03**

Source: Field Survey, 2008

5.3.2.4.2 Food Sufficiency Status

Out of total sampled households interviewed 84 03% reported insufficiency of food (Table 5.29). The average duration of insufficiency of food is 6 months. They adopt different coping strategies to meet their food deficiency and expenditure.

Table 5.29: Food Sufficiency Status

S.No.	VDCs	Total Hhs	< 3 Months	3-5 Months	6-8 Months	9-12 Months	> 12 Months
	Tanahun District						
1	Pokhari bhanjyang	53	5	6	29	9	4
2	Keshabtar	46	6	4	18	8	10
3	Dharapani	8	1	-	6	-	1
4	Kahun Shivapur	3	-	-	2	1	-
5	Devghat	10	2	2	2	1	3
6	Chhipchhipe	3	1		1		1
	Chitwan District						
1	Kabilas	16	2	3	6	2	3
2	Bharatpur	5	2	-	2	-	1
	Total:	144	19	15	66	21	23
	Percent	100	13.19	10.41	45.85	14.58	15.97

Source: Field Survey, 2008

5.3.2.4.3 Livestock

The Households of the project area raise livestock both for cash income and farming purpose. Livestock raising activities are carried out by all households in the project affected area irrespective of their caste, culture, economic status etc. However, the number and type of livestock vary in the villages and ethnic groups. The major types of livestock raised in the sampled households are goat (795), cattle (682), buffalo (143), pig (113) and poultry (824). Most of the households are involved in cattle and poultry farming in the project area. Cow and buffalo are raised by all ethnic groups mainly for milk, ghee and manure. Similarly, goats and pig are raised mainly for meat and poultry are kept mainly for meat and eggs.

Table 5.30: Livestock Distribution of the Sampled Households for VDCs/Municipality

S. No.	VDCs	Cattle	Buffalo	Goat	Pig	Poultry
	Tanahun District					
1	Pokhari bhanjyang	194	50	277	42	229
2	Keshabtar	315	45	155	63	233
4	Dharapani	51	12	72	-	37
5	Kahun Shivapur	6	11	18	2	29
6	Devghat	56	6	165	-	134
7	Chhipchhipe	21	2	15	1	87
	Chitwan District					
7	Kabilas	39	17	93	5	75
8	Bharatpur	2	-	6	-	-
	Total:	682	143	795	113	824

Source: Field Survey, 2008

5.3.2.5 Annual Income of Households

The average annual income of the household is estimated to be NRs. 71,337 out of which 48.86% is from agriculture and livestock related occupation. Similarly the income from service, labor, and remittance occupy 27.32%, 10.81% and 12.99% respectively .

Table 5.31: Annual Income of the Households

Type	Income from Agriculture	Income from Livestock	Service/ Trade	Income from Labor	Income from Remittance	Total/ Average
Income (NRs)	20,433	14,427	19,492	7,715	9,270	71,337
(%)	28.64	20.22	27.32	10.81	12.99	100.00

Source: Field Survey, 2008

5.3.2.6 Annual Expenditure of Households

The average annual expenditure of the households is estimated to be NRs. 76,090. The major portion of the total expenditure is allocated for food (54.94%), 12.86% for cloth, 12.45% for energy, 8.78% for medicine, education (9.4%) and other (1.57%). The other category includes festivals, Jatra, visits, etc.

Table 5.32: Annual Expenditure of the Households

Type	Food	Meat & Veg.	Tea, Oil & Spices	Energy	Medicine	Cloth	Education	Others	Total/Average
Expenditure (NRs.)	21,243	11,486	9,070	9,477	6,684	9,787	7,152	1,191	76,090
(%)	27.92	15.10	11.92	12.45	8.78	12.86	9.40	1.57	100.00

Source: Field Survey, 2008

5.3.2.7 Energy Requirement and Supply

About 95% of the sampled households use firewood for the cooking purpose. Similarly, 2.77% use kerosene and 2.08% biogas for the cooking. However, some households also use the combination of two or three sources of fuel for cooking purpose. Use of LP gas is common only in Bharatpur Municipality area. The type of use of energy for cooking purpose is shown in Table 5.33.

Table 5.33 Energy Requirement and Supply for Cooking Purpose

Type	Firewood	Biogas	Kerosene
No. of Households with Source of Energy	137	3	4
(%)	95.13	2.08	2.77

Source: Field Survey, 2008

The firewood is collected from the nearest Community Forest by 81.58% of the households while 5.92% have own forest to fetch the firewood. Similarly, 5.26% of the households purchase the firewood and 7.24% obtained it from Government Managed Forest. The source of firewood by number of households is shown in Table 5.34.

Table 5.34: Source of Firewood

Type	Government Forest	Community Forest	Private Forest	Purchase
No. of Hhs with Sources of Firewood	11	116	9	8
(%)	7.24	81.58	5.92	5.26

Source: Field Survey, 2008

About 65.97% of the households in the project area use kerosene for lighting purpose while only 20.14% use electricity. Likewise, 9.72% of the households use Diyo and 4.17% use others such as battery, etc.

Table 5.35: Energy Requirement and supply for lighting purpose

Type	Electricity	Diyo	Kerosene	Others	Total
No. of Households with Source of Energy	29	14	95	6	144
(%)	20.14	9.72	65.97	4.17	100

Source: Field Survey, 2008

5.3.2.8 Drinking Water

According to the field survey that about 57.64% of the households are benefited by piped water supply and 36.81% use well as a source of drinking water. River water is also used for drinking purpose by 2.78% of the households .

Table 5.36: Source of drinking water for sampled households

Type	Piped	River	Well	Others
No. of Households	83	4	53	4
(%)	57.64	2.78	36.81	2.378

Source: Field Survey, 2008

5.3.2.9 Choice of Compensation

About 74 percent of the sampled households of the project area expressed that they prefer to have cash compensation if they have to leave their place or property for the project. Similarly, about 12% of the households said that they want land for land and 8% house for house (Table 5.37).

Table 5.37: Choice of Compensation

Type	Cash	Land for Land	House for House	Others	Total
No. of Households	107	17	12	8	144
(%)	74.31	11.81	8.33	5.56	100.00

Source: Field Survey, 2008

5.3.2.10 Households with desired use of compensation

More than 74% interviewee have expressed that they will use the compensation amount paid by the project for purchasing their land. Other 13.19% said that they would construct house using the compensation. Likewise, 7.89% were eager to run business from the compensation amount .

Table 5.38: Use of compensation

Type	Purchase Land	Construction of House	Business	Debt. Pay	Total
No. of Households	107	19	12	6	144
(%)	74.31	13.19	7.89	4.17	100.00

Source. Field Survey. 2008

5.3.2.11 Expectation from the Project

Out of the total sampled PAFs, 25% households have no electricity facility On the basis of the field survey, 2008, all of these households are willing to pay minimum tariff for electricity. About 35% of the households expect employment opportunity from the project and 16.7% expressed their desire for good compensation. Further, about 23% of the households expect local development due to the implementation of the project.

Table 5.39: Expectation from the Project

Expectation	No. of Hhs	%
Electricity	36	25.0
Employment	51	35.4
Good Compensation	24	16.7
Local Development	33	22.9
Total	152	100.0

Source. Field Survey. 2008

CHAPTER 6:

IMPACT ASSESSMENT

6.0 INTRODUCTION

This chapter addresses the likely adverse impacts in the construction and operation of the Upper Seti (Damauli)-Bharatpur 220 kV Transmission Line Project, which will result in changes to the existing baseline conditions. 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. In support of the narrative descriptions of impacts given in this chapter, Table 7-11 in Chapter 7 provides summary descriptions of assessments.

6.1 PHYSICAL ENVIRONMENT

The main physical impacts on the environment are those associated with land take for stringing of the line, for construction of tower pads and changes in slope stability and drainage patterns. The major impacts anticipated during the construction phase are discussed in the sections below.

6.1.1 Watershed Condition

The proposed transmission line corrider runs through three physiographic zones of Nepal namely from north to south the Midlands, Mahabharat and the Siwaliks.

6.1.1.1 Construction Phase

The transmission line traverses through undulating landscape, which surfacially appears to be relatively stable. However, as the line traverses through the geologically fragile areas of Mahabharat zone and Siwalik zone the activities like site clearing, stringing of the line, excavation for tower construction, trail construction for material transportation and access road construction may disturb the watershed and increase erosion due to removal of vegetation.

Approximately 400 m^2 of land will be disturbed for each tower pad construction. However, the area for tower pad may vary as per the height and location and weight of towers. The earthwork associated with tower construction will be limited to concrete footings; soil disturbances will be confined to tower bases, therefore no significant impact is expected. However, the cultivated area around the tower pads may be affected due to compaction during the construction and transportation of materials. Furthermore, the construction of tower pads may impede the natural drainage and storm run off patterns.

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

6.1.1.2 Operation Phase

No significant impact on the watershed, soil and geology is expected during the operation and maintenance period.

6.1.2 Topography, Land Use and Land Take

6.1.2.2 Construction Phase

The land use' changes involved in the implementation of Upper Seti (Darnauli) - Bharatpur 220 kV Transmission line implementation will be basically due to the permanent and temporary land acquisition under the Right-of-Way and for construction of tower pads.

A total of 101.6 ha will be required for the implementation out of which 3.2 ha will have to be acquired permanently for tower pads construction; 3 ha will be acquired temporarily for construction camps and 93.4 ha under the Right-of-way will be restricted for certain land use practices. The corridor between the stretch TP10-TP12 and TP15-TP23 will share one side of the RoW existing 132 kV Pokhara-Marsyandhi. This will save 13.5 ha of Sal Forest from being felled. However, the land under the Right-of-Way will be temporarily acquired and the people will be able to use the land for cultivation.

Typical Stretch for R-o-W

The change in land use pattern will mostly occur in forested area along the transmission line corridor and in places where the tower pads will be constructed. The permanent land use change may result in permanent loss of production resource base particularly of the cultivated land and private forest . The transmission line corridor will also create land fragmentation. The estimate of different types of land involved in land take is shown in Table 6.1.

The impact can be classified as moderate in magnitude, local in terms of extent and of long-term in terms of duration.

6.1.2.3 Operation Phase

No impacts on topography, land take and land use is expected during the operation phase. Except for the maintenance of RoW, impact on the land use changes is expected to be minimal but will remain for long duration. All temporary land acquired will be converted to its original use or agreed new uses towards the end of the construction period. A total of 8.2 ha of land will be needed to be acquired permanently for the construction of 130 tower pads along the transmission line and substation.

Table 6. 1: Land Requirement

S. N	Project Component	Land Types			Total Land Take		Total (Ha)
		Agriculture Land (Ha)	Forest (Ha)	Barren Land (Ha)	Temporary (Ha.)	Permanent (Ha.)	
1	Land to be required under the RoW	40.8	35.1	17.6	93.4		93.4
2	Land to be acquired for the Tower Pad	2.02	3.17		0	5.2	5.2
3	Camps	3	0		3	0	3
	Total	45.82	38.27	17.6	96.4	5.2	101.6

6.1.3 Air Quality

6.1.3.1 Construction Phase

The impact on air quality during the construction period is expected to be insignificant, as the construction activities like site clearance, excavation, concreting cause minimal impact and the effects from it will be short termed at any location. Besides this, the construction of the transmission line will be carried out as a labor intensive that will also reduce impacts on air quality.

However, some minor air quality changes will occur in and around the tower construction sites and trails. Considering the topography and setting of the area, only few settlements like in Ganesthan, Huslan and Rumsi along the proposed alignment are more exposed to air quality changes during the construction period where the tower pads are close to the settlements and roads. The impact is expected to be low in magnitude, site specific in terms of extent and of short duration.

6.1.3.2 Operation Phase

No impact is envisaged during the operation phase.

6.1.4 Noise Quality

6.1.4.1 Construction Phase

The emission of noise and vibrations are inevitable during construction but is not expected to be significant as the major section of the transmission line will mostly run through the interior part of the district. However, the last section from TP-17 to TP-23 runs almost parallel to the Narayanghat-Mugling Highway. During the impact due to vehicle movements and construction activities will be felt more along this section.

Settlements like Diughare, Ganeshthan, Huslan close to tower pad will feel noise pollution during construction of tower pad and erection of towers. Noise pollution will be temporary and will not different from the conditions which already prevailing due to traffic movement. The impact is expected to be low in magnitude, site specific and for a short duration.

6.1.4.2 Operation Phase

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 be insignificant.

The impact is expected to be low in magnitude, long term and site specific.

6.1.5 Water Quality

6.1.5.1 Construction Phase

During the construction period, water will be used from nearby streams and springs for construction, as well as for drinking and other purposes. Therefore, there is every possibility of water pollution especially in sectors where the line crosses the small streams and where the tower pads are situated close to the rivers and streams. 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 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.

6.1.5.2 Operation Phase

The operation and maintenance activities of the transmission will not have impact on the water quality in the project impact area. However, some impact on the water quality may be expected near the substations (Ganesthan and Damauli) due to the leakage of oils from the transformers. The impact will be low in magnitude, site specific and for a short duration.

6.2 BIOLOGICAL ENVIRONMENT

This section addresses the likely adverse impacts from the construction and operation of the Upper Seti (Damauli) - Bharatpur 220 kV Transmission Line Project, which will result in changes to the existing baseline conditions. Impacts are discussed below:

6.2.1 Forest and Vegetation

The major impacts on the biological environment will include the loss of individual plants and vegetation cover for site clearance of the proposed transmission line corridor. Out of the total length of 38.4 km, 18.9 km of the corridor passes through different patches of forest area. Assuming 30 m of ROW, the total forest area under the transmission line alignment is about 56.7 ha. However, some section of the RoW and is shared with existing 132 kV Pokhara – Marsyangdi and Marsyangdi - Bharatpur T/L lines. Thus, the forest area actually required for clearance along the RoW are 4.06 ha and 22.73 ha respectively in Tanahu and Chitwan districts. Altogether 8948 trees of different species and sizes are estimated to be felled down. Details of the losses are presented below:

Table 6.2 Forest Loss at Different Project Components

SN	Project component	Type of Forest	Forest Area (ha)	Actual Forest Area (ha)	Loss of Vegetation			Crown Cover %	Basal Area (m^2/ha)	Forest Type
					Seedling /ha	Sapling /ha	No. of trees > 10cm dbh			
1	TL RoW	Community	54.82	25.35	275	109	8467	10-70	7.23	Both mixed and Sal
2	TL RoW	Leasehold	1.88	1.44	113	87	481	30	8.82	Sal
		Total	56.7	26.79			8948			

6.2.1.1 Construction Phase

6.2.1.1.1 Tree Loss

A total of 56.7 ha of forest will be affected from the 30 m wide transmission line RoW. It is estimated that only 26.79 ha of the forested sections of the transmission line RoW will have to be cleared.

Vegetation clearance will be required from the Community Forest (54.82 ha) and leasehold forest (1.44 ha). A total of 8948 trees (dbh more than 10 cm) consisting of 8460 cubic meter of standing wood volume will be cleared for the proposed alignment. Majority of the trees to be lost are Chilaune, Utis, Mauwa, Sal etc in hills and Sal, Karam, Harro, Barro etc in Terai. A total of 104,150 kg of biomass (17,630 kg of foliage and 169,200 kg of wood) will be lost from the ecological system. Total monetary loss from the forest, based on the existing market prices and local estimates, will be NRs 7,65,09,007 that constitutes both the Direct Use Value (DUV) and Indirect Use Value.

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. Similarly, other impacts such as increased access to forest are not expected since no permanent roads will be constructed Therefore the magnitude of impact is considered to be low, extent is local and duration is long termed.

6.2.1.1.2 Protected Species

Sal (Shorea robusta) and Simal (Bombax ceiba) are the 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 the duration is long termed.

6.2.1.1.3 Harvesting of Non Timber Forest Product

The proposed project does not directly affect the NTFPs of the project vicinity and no impact is envisaged for NTFP.

6.2.1.1.4 Changes of Demand for Fuel Wood and Timber

The existing forest cover in the project area is large enough to support the demand of forest resources such as firewood and timber to the dependent households. Therefore, even cutting down a large number of standing trees is of little significance to the livelihood of the local people. The economic impact will be insignificant because timber and firewood obtained from the felled trees can be sold in local markets.

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 a short period of 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. This impact will be low in magnitude, site specific and short-termed.

6.2.1.2 Operation phase

6.2.1.2.1 Clearance of vegetation

The vegetation of the RoW will maintain compatible clearance with safe operation. The trees will be trimmed and cut down in every 3-4 years to maintain these clearances. RoW clearance will not only change the

vegetation cover but also will alter the ecological conditions 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.

6.2.1.2.2 Increased Access to Forest

During the operation phase, site-specific and short-term effects such as increase in pressure on forest resources will decrease. Patrolling and maintenance activities along the transmission line will involve only a few people occasionally. This activity will not have a noticeable effect on the forest and vegetation.

6.2.2 Wildlife

6.2.2.1 Construction Phase

Possible impacts on wildlife population due to the project construction will be minimal. Existing forest in the project area are is fragmented in small patches and surrounded by human settlement. In general, the project area is not a suitable habitat for wildlife. The potential adverse impacts on wildlife and birds are listed below.

6.2.2.1.1 Loss of Habitat

The construction of transmission line which will require site clearance and other construction related disturbances 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 quite large, the overall magnitude of impact is considered to be low, extent is site specific and duration is long termed.

6.2.2.1.2 Disturbances from Construction Activities

Construction disturbances and other related activities will interrupt normal movement, feeding and other activities of mammals. These activities will kill less mobile, frequently smaller species such as frogs, lizards and small mammals. This is short-term localized impacts and will subside gradually as the construction work at each site is completed. Hence the magnitude of impact is considered to be low, extent is local and the duration is short term.

6.2.2.1.3 Hunting and Poaching by Labor Force

Hunting and poaching will be one of the likely impacts on the wildlife due to the presence of construction workers. The local hunters or hunters among the workforce might be attracted to hunt birds and other wild animals. The possibilities of hunting and trapping by workers during construction period will have some adverse impact on local wild fauna. However, such pressure on wildlife will be site specific and will decrease once the work is completed. The overall magnitude of impact is considered to be low, extent is local and duration is short term.

6.2.2.2 Operation Phase

6.2.2.2.1 Habitat Changes

The vegetation of the RoW will maintain a conductor clearance compatible with safe operation. The result will be the loss of some habitat along the alignment. The vegetation clearance will be carried out manually and will have a minor disturbance on the wild life. In addition, the RoW will create the barrier for the movement of some wildlife However, the operation and maintenance impact on wildlife will be low because of the ridge to

ridge alignment in the hills and sharing of existing RoW of 132 kV transmission line alignments. The impact will be low in magnitude, site specific and long term.

6.2.2.2.2 Avian Hazards

The existence of 220 kV line will affect bird mobility to some extent. Inability of birds to notice the wires can cause fatal injuries from collisions. This type of impact is predicted to be high in low visibility conditions such as bad weather and foggy days and during nights. However, the transmission line route does not pass through any identified bird migration route. This impact is of low magnitude, site specific and will remain for long duration.

6.3 SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

This sub-chapter of the report considers the potential socio-economic and cultural impacts. The key impacts like land take, relocation of households, population displacement, social and cultural problems due to influx of laborers, and economic spin-offs, etc will emerge from the implementation of the project.

The following are the anticipated impacts on the socio-economic and cultural environment of the area.

6.3.1 Acquisition of land

6.3.1.1 Construction Phase

The proposed project will affect 101.6 ha of land out of which 43.8 ha is cultivated land. The total permanent land to be acquired for the tower pad is estimated to be 5.2 ha. Similarly, 463 land parcels belonging to 250 households will be affected directly due to land acquisition and restriction of land use under the RoW. Out of 250 families, 157 families are seriously project affected families (household losing more than 50 % of the land). The land ownership survey of the project affected families show that the average land loss is low in comparison to the total land holding size. The magnitude of impact is considered to be moderate, site specific and long termed in duration. Beside permanent acquisition, the land under the RoW of transmission line will be restricted permanently for the construction of houses, cow sheds and plantation of trees. However, there will be no restriction on agricultural farming after construction of the line. Approximately 43.8 ha of cultivated land will be temporarily affected by the project.

Appendix D depicts the number of parcels of different ownership and households impacted by the T/L corridor. The level of impact may vary with the proportion of land acquired.

6.3.1.2 Operation Phase

Acquisition will not be required during operation and no significant impacts are expected during this phase. Due to the safety reason, houses and other permanent structures are not allowed to construct within the R-o-W as per the Electricity Regulation, 2050 BS As the land will be applicable for construction of house, the value of land especially at Bharatpur Municipality will be reduced. It is difficult to quantify the level of impact on the pricing of the land because there are no other factors too that would play the significant role. Thus, the overall magnitude of impact is high, extent is site specific and duration is long term.

6.3.2 Loss of Standing Crop

6.3.2.1 Construction Phase

Preferably the construction of transmission line is to be carried out during lean season so that standing crops are not 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.

About 2.02 ha of cultivated land for 130 tower pads will be permanently acquired and there will be permanent annual loss of 4.44 Tons of food grains (including winter crops and summer crops). Paddy, wheat, maize, millet, potato, mustard and pulses are the crops likely to be affected by the land acquisition. Based on the prevailing price, the permanent yield loss per year is estimated to be NRs.15,554.00 (assuming cost for 1 MT of grains is NRs.3500). Considering three crops are grown 13.32 MT will be lost which amounts to NRs 46620.00.

Approximately 101.6 ha land will be affected by the project. Assuming that 30 m of RoW would be the potential impact zone, 40.8 ha of agricultural land will be affected by the RoW and also considering 3 ha agricultural area acquired for temporary camps, 43.8 ha of agricultural land will be affected. Considering that three seasonal cropping is done within the RoW and camps, the loss of food crops will be 290 MT(assuming on the average productivity of all types of food grain grown in the project area is 2.20 tons/ha). This loss is calculated considering that stringing of the line will be completed in one year and compensation will be paid for three seasonal cropping.The total loss of food crops during construction period is estimated to be 303.3 MT. Its total monetary value is calculated as NRs. 1,06,1620.00 (assuming the average prevailing market price for one ton food production is NRs. 3500/-)

The table below shows the summary of the land utilization, production and cost for one season. The magnitude of this impact is considered to be moderate, extent is site specific and duration is long termed.

Table 6.3 Crop Loss

Component	Total Area (ha)	Production (MT) 1crops	Crop Loss (MT) 3 crops	Average Price per Ton (NRs)	Amount loss (NRs)
Tower pads	2.02	4.44	Permanent-13.32	3500	46620.00
ROW and camp	43.8	96.36	Temporary - 290	3500	1015000.00
Total	**45.82**	**100.80**	**303.3**		**1061620.00**

6.3.2.2 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 Acquisition of Houses and other Structures

6.3.3.1 Construction Phase

Altogether, 30 houses are under the Right-Of-Way out of which 12 houses needs to be relocated. Apparently, the remaining 18 houses need not be relocated as the transmission line passes through valleys and have ground clearance at least double the accepted standard level as per the Electricity Regulation, 2050 BS. The houses are "kachi" houses made with wood, mud and stone and is thatched with tin and stone etc.

The magnitude of impact is considered to be high, extent is local and duration is long term.

6.3.3.2 Operation Phase

Land acquisition will not be required during operation and no significant impacts are expected during this phase.

6.3.4 Health and Sanitation

6.3.4.1 Construction Phase

Maximum number of labourers will be employed for concreting of tower foundation, tower erection and stringing of line. The excavation and concreting work for particular site will be carried out at 7-10 days interval. Hence, maximum number of people for single tower erection will be around 15. The labourers will be recruited from local area as far as possible and the remaining workforce will be from outside. The labourers living in temporary camps may lack proper water supply and other sanitary measures which may affect their health condition and the locals living around.

The concentration of labor force may encourage prostitution, which could lead to the spread of HIV/AIDS and other Sexually Transmitted Disease.

Considering the small number of labourers and their short mobility at one site the impact is considered to be low, site specific and for short term.

6.3.4.2 Operation Phase

No impact is anticipated during the construction phase

6.3.5 Occupational Hazards and Safety

6.3.5.1 Construction Phase

Construction related accidents are common in Nepal, primarily because of unsafe construction practices. The erection of towers and stringing of line in steep slopes are difficult and risky job and any negligence may cause an accident. Work related injuries and vehicle accidents are likely impact expected during the implementation of the proposed project. The magnitude of impact is high the extent is local and the duration is short termed.

6.3.5.2 Operation Phase

During the operation phase, the people residing in the immediate vicinity of the line will be vulnerable to electrical hazards such as fire, electrical shocks or even electrocution. Furthermore, lack of training, operation and maintenance skill and unavailability of the essential safety equipment 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 lines, surveyors using metal leveling staffs under the conductors, etc. These risks have a 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.

These impacts which moderate in magnitude, site specific and long termed in nature, are not really within the realm of environment but rather of technical management in nature.

6.3.6 Electric and Magnetic Field Effect

6.3.6.1 Construction Phase

No significant impacts are expected during this phase.

6.3.6.2 Operation Phase

Electric power transmission lines create electric and magnetic field together known as electromagnetic field or EMF. Electric fields are created by the presence of voltage and are expressed in volts 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. In addition, human exposure to external electric and magnetic fields induces electric fields within the body. These induced fields can cause interference with implanted pacemakers.

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

6.3.7 Interference

6.3.7.1 Operation Phase

Most of the tower pads are located on the hills at considerably high level from the riverbed and road except for the stretch between TP 18 -TP 23. Thus the operation of the proposed project will not cause any interference to road traffic even it crosses it at several places.

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. Since transmission line alignment does not pass through the dense settlement areas, the magnitude of the impact is considered to be insignificant.

6.3.8 Gender and Vulnerable Group

6.3.8.1 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.

6.3.8.2 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.

6.3.9 Economic Activities

6.3.9.1 Construction Phase

The interaction among different people and ethnic group may attract the rural people towards more advance society. 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.

6.3.9.2 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.

6.3.10 Historical and Archeological Sites

6.3.10.1 Construction Phase

No major impact is anticipated on the historical and archeological sites in the project area. However, during the excavation and construction activities for the foundation work of angle tower TP-2 the cultural place located in Rumsi of Keshavtar VDC-8 will be affected.

This impact is considered to be low, site specific and short termed in duration.

6.3.10.2 Operation Phase

No impact is expected during the construction phase

6.3.11 Infrastructure and Communal Resources

6.3.11.1 Construction Phase

A total of 10-15 people will stay at a particular site for about 7 days. Considering the nature of job, limited workers will stay with their family in the project area There will not be any significant impact on infrastructure and communal resources due to implementation of the project. There are no infrastructure which will be affected by the project.

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

6.3.11.2 Operation Phase

No significant impacts are expected during this phase.

6.3.12 Social and Cultural Practices

6.3.12.1 Construction Phase

The social and cultural life style of the local people will hardly be affected by the influx of workers due to the type of the project. This is because of the linear type of the affected project area, low number of the construction workers and their fast mobility. Eventually, some changes are anticipated on ethnic and community solidarity, changes on occupational patterns, etc.

These impacts are expected to low in magnitude, local and short termed in duration.

5.3.12.2 Operation Phase

After completion of the construction, the impact on culture by the construction work force will subside and will slowly return to its normal social condition. Therefore, no significant impact on cultural aspects is anticipated during this phase.

6.3.13 Law and Order

5.3.13.1 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 experiences reveal that local people have misunderstanding with the employer's and contractor's staff thereby posing threats to law and order situation. Considering the nature of the project, the magnitude of impact is considered to be low, extent is local and duration is short termed.

6.3.13.2 Operation Phase

No significant impacts are expected during this phase.

6.3.14 Impacts of Aesthetics

6.3.14.1 Construction Phase

No significant impacts are expected during this phase.

6.3.14.2 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 aesthetic value of the initial section of the transmission line will be reduced as the route passes through pristine and wilderness area where giant towers and stringing is absent. However, the line does not run through or in close proximity to sensitive areas. Hence low impact in magnitude, local and long term in duration is expected with respect to aesthetic importance

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. Altogether, 100- 80 people will be deployed during the construction of the project, which includes 40 unskilled, 30 semi-skilled and 10 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 in rural area.

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.

B. Operation Phase

6.4.3 Increase in Local Skills

The past experiences shows that the local people who are employed in the project will gain experience in especially in erection of towers, stringing of line, driving and transportation of equipment. The work will enhance the traditional skills and some marketable new skills will emerge in the project area. The local people will be able to get employment in similar projects elsewhere in Nepal with the acquired skills.

The magnitude of impact is considered to be moderate, extent is national and duration is long termed.

6.4.4 National/Regional Economy

This transmission line project will be able to evacuate the energy produced from Upper Seti Storage Hydropower Project (127 MW) to be developed in Tanahun District and other large hydro projects planned in the Western Development Region. New industries can be set up from the help of this electric power supply which will boost economic activity in the region.

6.4.5 Employment

Vegetation clearance will be necessary for regular maintenance of ROW. This activity will provide short employment opportunity for the local people, thus providing some additional income.

6.4.6 Rural Electrification

The proposed transmission line will open the door for expansion of distribution network through substation to be constructed at Ganeshsthan, Bharatpur Municipality.

CHAPTER 7:

ALTERNATIVE ANALYSIS

7.0 INTRODUCTION

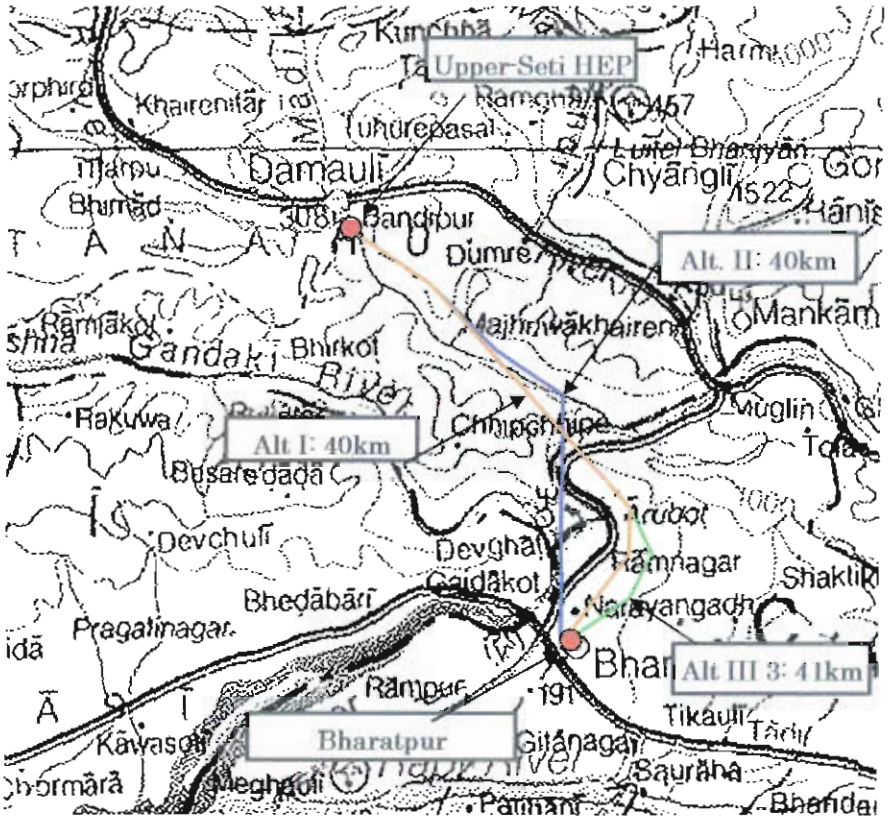
A key aspect of good environmental practice is the evaluation of potential alternatives. In order to achieve this goal the environmental and social considerations need to be brought into the planning from the very early stages. In case of this project, a range of route alternatives was investigated and the lowest and highest impacts on engineering, environmental and land use of these routes were determined to select the best route.

The alternative alignments of the proposed transmission line were selected taking into consideration the following criteria:

- Right-of-ways which have minimal environmental impact
- Improvement of reliability of the power system
- Increase in competition in the generation market to lower the cost of electricity

Based on the above principles, three possible alternative alignments were selected to evacuate power from the powerhouse of Upper Seti (Damauli) Storage Hydroelectric Project switchyard to Bharatpur substation (NEA, May 2006). Figure 7-1 presents the three proposed alignments.

Figure 7-1 Alternative Route of Transmission Line



7.1 Alternatives Considered

Initially the three selected alternatives were studied on the map. The first stretch of the all the three alignments from Dharapani (proposed powerhouse)–Rumsi- Huslan to Dharapani (Bagarkhola) was common for all three alignments.

After Dharampani (Bagarkhola) point the rout of the three alternative were

Alignment – I :	Dharampani(Bagarkhola) – Charghare – Saldanda – Trishuli crossing near Gaighat – Upper Syauli- Upper Jugedi-Ganesthan
Alignment – II :	Dharampani(Bagarkhola) –Saldanda – Upper Syauli- Jugedi Bazar-Ganesthan(Bharatpur)
Alignment – III :	Dharampani(Bagarkhola) – Saranghat- Saldanda – Beldanda – Kyonditar- Upper Syauli- -Ganesthan

Tables 7-1 compares the land use characteristics of the three alignments and approximate land required for acquisition and land use restriction under the ROW of the alignments. Land use under the ROW of the three alignments shows that:

- Alternative I and II passes mostly through the agricultural/grazing areas compared to the Alternative III
- Alternative I has the least ROW area under forest cover compared to Alternative II and III
- The number of built structures under Alternatives I, II and III are almost the same with Alternative III having 17 built structures compared to 12 and 24 in Alternative I and II respectively
- Alternative III is the longest followed by Alternative I and II but the lengths of Alternative I and II are comparable.

From the environmental viewpoint to avoid or minimize impacts, Alternative I is selected for detailed survey and design for the following reasons:

- The loss of forest due to clearance of trees under the ROW is minimized in comparison with the other two options including the opening up of new areas of the Narayani Protected Forest
- Total ROW area under Alternative I can be minimized by alignment of the ROW to the existing TL for about 11 km distance, which further reduces the forest losses
- Agricultural areas along the ROW could continue and the impact to local socio-economy is envisaged to be minimal.

Tables 7-1 The land use characteristics of the three alignments

S. no	Alternatives	Length of the T/L in Kms	Agriculture land (ha) to be affected	Forest (ha) to be affected	Houses under the RoW
1	Alternative I	40	50	39	12
2	Alternative II	40	56	49	24
3	Alternative III	41	18	93	17

7.2 No Project Options

The power generated by the Upper Seti (Damauli) Storage Hydroelectric Project will be evacuated by the proposed Upper Seti (Damauli) - Bharatpur 220 kV 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 Bharatpur.

7.3 Construction 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 Siwalik 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.

7.4 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.

CHAPTER 8:

MITIGATION MEASURES

8.0 INTRODUCTION

The mitigation and enhancement measures outlined in this chapter have been proposed to ameliorate potential adverse impacts and enhance opportunities for development identified during the study. Adverse and beneficial impacts that are not identified or predetermined during the study, if identified later during the construction and operation phases will be mitigated or enhanced. The general discussion is organized into three categories of physical, biological, and socio-economic and cultural aspects, and has been split into construction and operation phases in an equivalent manner as for Chapter 6 – Impact Assessment. The mitigation measures to be carried out have been listed below. The project proponent will be responsible for carrying out all the proposed mitigation measures and enhancement measures. In addition the project will take responsibility of compensating as per prevailing law for any losses or damage caused to lives and property during construction and operation phases.

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 include alteration in drainage pattern, slope failures, change in land use practice, localized noise and air pollution. Stabilization of slopes, controlled drainage, and construction waste and safety management are some of the measures required during the construction and operation of the project. The mitigation measures address the identified physical impacts of Chapter 5. Following chapters address the foreseen mitigation measures in detail. The estimated required cost for the mitigation of physical environmental impacts is given in Table 8.9.

8.1.1 Watershed Condition

About 101.6 ha of land will be disturbed that will have an adverse impact on the existing watershed. The possibility of erosion and sedimentation is envisaged in and around tower construction sites. Vegetation clearance within the RoW along the transmission line corridor and for tower pads is the only physical intervention that may destabilize the slopes and induced erosion and sedimentation. Following measures are proposed to protect the watershed and reduce the mass wasting:

8.1.1.1 Construction Phase

- Restoration of the area around the tower pad for cultivation and regeneration of vegetation will be done.
- Vegetation clearing and ground disturbances will be confined within the 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.
- Bio-engineering works will be carried out in the disturbed and vulnerable areas susceptible to landslides and erosion.
- Clearing works will be carried out in dry season to avoid erosion problems.

- Tower pads which are near the road (TP18.), streams (TP12) and on vulnerable areas (TP5, TP6, TP7, TP8) (for e.g. Matt or combined footing type of foundation) work and proper foundations will be chosen and implemented.
- Adequate drainage around all the towers will be provided.

8.1.1.2 Operation Phase

Proper inspection and maintenance of tower pad areas will be done to reduce the risk of erosion and landslides. The annual costs for such site verifications will be borne by the project developer and thus included in Operation & Maintenance budget.

8.1.2 Topography Land Use and Land Take

As discussed in Chapter 5, the total land requirement will be approximately 101.6 ha out of which the permanent land take will be only 5.2 ha for tower pad construction. 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 current use and the land use impacted by the construction camps etc will be reinstated to the present condition after the construction is over. Following measures are proposed for the construction and operation phase.

8.1.2.1 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 in steep slopes will be avoided.
- Revegetation and slope maintenance will be carried out in the disturbed areas to avoid erosion.

8.1.2.2 Operation Phase

Subsequent to clearing and construction, the Right-of-Way will be restored as much as is possible to its state prior to construction.

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. For example, some impact on the air quality will be felt especially between the stretch near the Mugling-Narayanghat highway TP19-TP23 and stretches are near to the gravel along the alignment due to the movement of vehicles for carrying construction materials and during the stringing of lines. Water spraying will be necessary in such stretches to control dust pollution and will be carried out accordingly. Following measures will be implemented to control air pollution in the project area.

8.1.3.1 Construction Phase

- Water spraying at least twice a day, especially in the vicinity of tower pad construction area, will be carried during construction.
- Proper maintenance of all vehicles and construction machinery will be done regularly
- General compliance with GON health and safety regulations will be made

8.1.3.2 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.

8.1.4.1 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 labourers
- Temporary relocation of particularly vulnerable people (old/sick, etc.) to acceptable locations will be done

8.1.4.2 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.

8.1.5.1 Construction Phase

- Garbage and solid wastes generated by the workforce will be dumped safely away from water bodies.
- 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 of through incineration.

8.1.5.2 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 Vegetation/Forest Resources

The adverse impacts foreseen due to the construction of the project on forest and vegetation can be minimized 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 paragraphs discuss the required mitigation measures in detail. Mitigation costs for each mitigation activities are given in Table 7.7

8.2.1.1 Construction Phase

i) Minimization of Forest Area and compensation and harvesting cost

About 26.79 ha of forest land will be directly affected by the construction of the transmission line. Removal of trees will be minimized as far as practicable. Trees that are likely to be removed will be counted, marked and harvested with proper forestry techniques by involving technical staff from the District Forest Office. In addition, selective felling of the trees will be done to minimize the forest loss and trees in the valleys will be avoided from felling to the possible extent.

Replacement plantation (refer section iii below for more details) will be carried out to compensate the loss of trees in the affected Community Forests and Leasehold Forests. In addition, a lump sum cost of NRs 13,40,000.00 (for 26.79 ha of forest area @ Rs 50,00 per hectare) is allocated for tree harvesting management cost. The cost of harvesting, logging and transporting in community and/or national forest will be provided as per the district norms to the concerned agency as per Forest Regulation 1995.

ii) Utilization of Forest Products

The products from forests recovered during site clearance will be handed over to the concerned Forest Users

iii) Replacement Plantation

As a compensatory measure for the loss of trees and forest area due to the site clearance, the establishment of replacement plantations in a 1:25 ratio will be done. The plantation sites will be discovered and determined consulting with the District Forest Office and Forest User Groups. Similarly, plantation will be carried out as per species composition and the local users' preferences.. The plantation area will be managed by the local community with support from the project for five years. The costs for plantation are given below in Table 8.1.

Table 8.1: Estimated Cost for Plantation

SN	Particulars	Estimate
1	Total no of trees to be cleared : 8948	
2	Replacement plantation @ 1:25 ratio	2,23,700 seedlings
3	Replacement plantation cost including site preparation, pitting, transplanting, composting, mulching and seedling purchase @ 40 NRs./seedling	NRs.89,48,000
4	Tending operations and protection for 5 years (lump sum)	NRs. 500,000
	Total in NRs.	NRs.94,48,000

v) Control of Illegal Harvest

Illegal cutting of trees and encroachment on forests by labor force for timber and firewood will be controlled. The contractor will provide kerosene and LPG in the construction and labor camps to reduce pressure on forest resources. Special instructions will be given to its workforce to refrain from collecting firewood and other forest products. Since there will not

be a large number of outside laborers, it will be easy to control illegal cutting of trees and encroachment on forests.

8.2.1.2 Operation Phase

Regular trimming will be done along the corridor to avoid the interference with the conductor. The project will encourage the FUGs to cultivate low height fodder plants and Non Timber Forest Products (NTFP) plants in the Row.

8.2.2 Wild Fauna and Avifauna

8.2.2.1 Construction Phase

The clearance of vegetation and other project related activities will have very limited impacts on terrestrial faunal habitat. However, the off-site project activities have a potential to impart some minor impacts. To mitigate this, special instructional and awareness-raising trainings will be conducted for the workforce and local people to promote wildlife conservation activities. The construction contractor will provide special instructions to all its staff and workforce on conservation issues and benefits. Purchase and sale of illegally hunted animals and birds will be banned during the construction period. The cost for the wildlife conservation program is given in Table 8.2.

Table 8.2: Mitigation Cost for Wildlife Conservation

S. No	Particulars	Quantity	Rate	Amount (NRs)
1	Conservation Trainer	1 man months	30,000	30,000
2	Training (20 groups during construction)	LS	LS	100,000
3	Training material and logistics	LS	LS	100,000
	Total in NRs			230,000

8.2.2.2 Operation Phase

During the operation phase, impact on wildlife due to habitat loss and fragmentation will subside gradually. Moreover, the growth of the replacement plantation will increase the forest cover in the project area that will enhance the wildlife habitat in the long run. Therefore, specific mitigation measures for the impact on wildlife in operation phase are not necessary. However, the residual impacts of habitat fragmentation due to RoW corridor and the impact due to the bird collision on the wire are unavoidable and no mitigation measures are proposed.

8.3 SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

8.3.1 Acquisition of land

8.3.1.1 Construction Phase

The private land affected by the project will be compensated as per the rate fixed by the Compensation Fixation Committee. The committee will be formed under the Chairmanship of Chief District Officer of the concerned districts and includes Chairperson of affected VDCs/Municipality, representative of affected people, representative of Land Revenue Office and Project. The required land will be acquired according to the Land Acquisition Act, 2034 BS.

During the field investigation affected people were asked about the mode of compensation. All the households to be affected by the land acquisition requested for compensation option. Most of them expressed their desire for cash compensation.

Considering the nature of the project one time compensation will be given to the affected people to avoid administrative problem. Cash compensation will be given to the land affected people. Land for land compensation is impracticable and tedious to allocate similar piece of agricultural land in the vicinity of the project area. Besides, during household survey majority of the affected people of the project area have expressed their views for cash compensation.

The land required for the temporary facilities will be compensated at the prevailing market price based on the productivity of land. Standard rent agreement forms will be developed by the project, which will identified the rent based on the productivity and will be adjusted annually in line with local price variations. After the completion of the project the leased land will be restored and returned to the respective land owner.

Each of the households whose land will be acquired temporarily will be provided with adequate compensation for the temporary loss of yield. Furthermore, they will be given first preference for jobs during project construction period.

The private land under the R-O-W will be compensated as per the rate fixed by Compensation Fixation Committee headed by Chief District Officer. The committee will be formed as per Electricity Regulation, 2050 BS. The current practice for the compensation of R-O-W is 10% of the amount of the affected area based on current market rate. The land within ROW will be utilized as usual by the respective landholders and restricted for construction of permanent structures.

The land price varies form place to place, parcel to parcel and according to proximity of road and market centres. The estimated compensation amount for the land to be acquired permanently by the project is NRs - 20,800,000.00.

Tables 8.3 shows the average rate of directly affected land types in the project affected VDCs.

Table 8.3: Average Price of Land and Other Physical Assets

SN	Type of Assets	Rate(NRs)/Unit
1	*Cultivated land*	40,00,000/ha.
2	*Kachhi* House	480/sq.ft.

Source: Community Census Valuation (CCV) in the Project Area, 2008.

8.3.1.2 Operation Phase

The temporary land acquired during the construction phase will be returned to the owners in their original state, so the owner will be able to continue his/her activities on that land as before the project interference. However, the land owner can not use the land under the RoW for the construction of any structures and/or for large tree plantation. Apart from one time 10 % compensation for the restricted use, this impact is unavoidable and no additional mitigation measure is proposed for this activity.

8.3.2 Acquisition of Houses and other Structures

8.3.2.1 Construction Phase

12 families are categorized under the SPAFs and which will be relocated. The preliminary estimation reveals that the cost for resettlement and rehabilitation for 12 houses is approximately NRs. 57, 46,000. The SPAFs shall be given first priority for available jobs in the project as per their skills.

In addition to compensation for lost assets the 12 families eligible for relocation are entitled for:

- Developed house plot:

A relocated is entitled for a developed house plot of 8 Anas in grant depending upon the degree of impact and owner or tenant.

- Disturbance Allowance:

A relocated is entitled for monthly disturbance allowance for a period of six months. The amount for disturbance allowance will be as per the NEA Board approved amount.

- Loss of Business Allowance:

Relocated business households are entitled for business disturbance allowance for a maximum period of 3 months to re-establish their business. The amount for business disturbance allowance will be as per the NEA Board approved amount; and

- House Rental Allowance:

Relocates are entitled for house rental allowance for a period of four months. The amount for house rental allowance will be as per the NEA Board approved amount.

Most of the relocatees have expressed their desire to be relocated on their own. Since 12 households are engaged in different agricultural activities they are strongly motivated by agricultural and business opportunities. Their foremost desire is to move themselves to such an area, which would help them to continue their agricultural and economic activities. For this reason, the people have preferred the areas along the Damauli-Dharampani Village Road and Mugling-Narayanghat Highway. It is envisaged that the relocatees will not face any social and cultural adaptation problem as the preferred relocation site lies in the vicinity of the affected project linear alignment.

Table 8.4 Estimated costs for the resettlement, rehabilitation and mobilization

Description	Amount (NRs.)
Permanent private land acquisition (5.2 ha)	20,800,000
Acquisition of private house and structures (12 nos.)	5,760,000
Infrastructure development (relocation site)	10,00,000
Mobilisation cost for the relocatees	10,00,000
Total	**26,560,020**

8.3.2.2 Operation Phase

No mitigation will be required during the operation phase.

8.3.3 Compensation for the Loss of Standing Crop

8.3.3.1 Construction Phase

Construction work will be scheduled at best to avoid cropping season. People of the concern land will be informed in advance so that these disturbances can be minimized. Compensation is proposed for 43.8 ha land in R-O-W considering 30m high impact zone. Compensation for standing crops will be paid three seasonal crops. Compensation will also be paid for the loss of fruit trees. The compensation cost of single year for crop damage of 303.4 is estimated to be NRs. 1,061,550.00.

8.3.3.2 Operation Phase

The local people will be given priority for RoW maintenance and the employment procedures will be negotiated through labour task.

8.3.4 Health and Sanitation

8.3.4.1 Construction Phase

The project proponent will make available the labours with potable water. Similarly, clean toilets with adequate water facilities will also be maintained. Toilets will be made in temporary camps at the rate of approximately 8 people in each toilet. First aid kits will be maintained for preliminary treatment in emergencies. For serious injuries especial arrangement (ambulance provision) will be made to send the injured person to nearest hospitals. 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.

8.3.4.2 Operation Phase

8.3.5 Occupational Hazards and Safety

8.3.5.1 Construction Phase

The construction area will be cleared up and all the necessary precaution and warning sign will be placed at worksite This area will be restricted for the entry of unauthorized people. The project proponent will provide hardhat, 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. The training program will be at least two days, which will include practical class, use of safety equipments, first aid. Community safety awareness program about the transmission line and potential risks associated with transmission line construction will too be implemented. The project workers involved in construction work will also be trained for health and occupational measures.

8.3.5.2 Operation Phase

Safety equipment required for the operation of the transmission line will be provided. During the maintenance major project area will be restricted for entry of unauthorized person to avoid disturbances and risk. Hard hat, eye glass, safety boot, ear plugs, good electric light system, good earthling devices, fire fighting accessories, caution signals, safety belt and other safety equipment as required at particular site and work area will be provided. Thirty meter R-O-W will be strictly maintained to minimize the likely risks of conductor breakage, induced voltages, etc.

An awareness program will also be launched at the beginning of project operation to inform the local people about the likely risk and safety measures to be applied. The awareness will also include awareness regarding not to getting close to the transmission line especially those person who have pacemaker and other similar devices transplanted in their body.

8.3.6 Electric and Magnetic Field Effect

8.3.6.1 Construction Phase

The Right of Way shall be maintained as per Electricity Regulation. Very sensitive and fully redundant transmission line protection will be adopted for the proposed line. A precautionary approach for reducing the effect of EMF will be adopted by following the guidelines for limits on magnetic field stipulated by the International Radiation Protection Association (IRPA). No houses or other buildings will be permitted within the RoW, with existing houses and other structures relocated outside the RoW.

Awareness programs on safety will be conducted for project staff and local residents. Fencing of towers at some locations (e.g. near schools, highway crossings etc), warning signs and metal guard structures on the towers are proposed to dissuade people from climbing or tampering with towers. Phase split will be done wherever required, where the alignment passes within 100 m from the settlement at key localities in the project area. The key settlements are tabulated below:

Table 8.5 Settlements within 100 m from the alignment

AP section	Settlement	VDC/ Municipality				Remarks
TP 1 -TP2	Simalswanra, Chhapdanda					Temple
TP2 -TP 3	Simalswanra, Chhapdanda, Ankhlepani , Guwandanda, Sudev, Maraute, Chisapani					School
TP 3-TP4	Seti gaun					
TP 4-TP5	Keshavta					
TP 6-TP7	Changhare					
TP 8-TP9	Saldanda					
TP 9-TP10	Duighare					
TP 10-TP11	Syauli, Tandran					
TP 11-TP12	Khahare Khola					
TP 13-TP14	Devitar					
TP 14-TP15	Kholaghari					
TP22-TP23	Ganeshsthan	Bharatpur Municipality				

8.3.6.2 Operation Phase

The R-O-W shall be maintained as per Electricity Regulation, 2050, standard practice of design and construction will be applied to minimize such impacts. Awareness program will also be conducted at the project site about the impact of the substation and transmission line.

8.3.7 Gender and Vulnerable Group

8.3.7.1 Construction Phase

The project will ensure not to discriminate the local people based on their gender, caste, colour and place of origin. Local women will be hired to the extent possible. Similarly, priority to the job opportunity will be provided to the vulnerable group in the project area in order to raise their living standard. Use of children in construction activities shall be strictly prohibited.

8.3.7.2 Operation Phase

No Mitigation required during the operation phase.

8.3.8 Social and Cultural Practices

8.3.8.1 Construction Phase

To minimize the impact on cultural practice of local communities, it is important for the developer to ensure that strong code of conduct will be enforced to the outside construction workers. Employment should be prioritized to the local people to reduce conflicts and tensions with local resident. The workers will be instructed to act in a responsible manner during and after the working hours, respecting the rights, property, practice and values of local people Alcohol and gambling will be prohibited in camps area. Priority will be given to the local people in project works.

8.3.8.2 Operation Phase

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

8.3.9 Law and Order

8.3.9.1 Construction Phase

Due consideration will be given to the local and district level administrative offices of Government of Nepal. The existing facilities of GoN will be used to maintain the law and order situation as and when required basis. The proposed awareness programme will also minimize this impact to some extent.

8.3.9.2 Operation Phase

8.3.10 Aesthetic Values

8.3.10.1 Construction Phase

As the transmission line lies parallel to the motorable road there will be some visual and aesthetic impacts, which will remain as long term residual impacts. However, further realignment of the transmission line at some critical area is recommended during the final design phase and in the implementation phase to minimize the adverse impacts if technically possible.

8.3.10.2 Operation Phase

8.3.11 Historical and Archaeological Sites

8.3.11.1 Construction Phase

The historical and archaeological site located near the angle point TP-2 will be fenced up and protected. Precautions will be taken so that during the construction phase

8.3.11.2 Operation Phase

No mitigation required

8.4 ENHANCEMENT MEASURES

The construction of the Upper-Seti (Damauli) - Bharatpur 220 kV Transmission Line project will provide the local communities, and the region itself, with numerous opportunities for socio-economic development. Although the project area is not located in very remote setting and is closer to the highway away from the highway it is envisaged that the rural area will benefit to some extent from the project implementation. Direct and indirect job creation in the case of transmission line project will be low. However, there will be a range of opportunities open to government, private sectors and local

communities to both build upon. and enhance positive impacts of the project. Some of the enhancement measures from which the area will benefit are as follows.

8.4.1 Improvement in Agricultural Practices

As an enhancement program, the rural area will benefit from the training programme on improved agricultural farming. This type of training will provide opportunities for increasing agricultural production in their farmlands. It was observed during the social survey that new farming techniques are required in these areas as the agricultural practices in these areas are primitive. Altogether, 45 people will be trained in three phases. The following areas are proposed for training: Use of fertilizers; Irrigation techniques; appropriate cropping patterns; and Methods of harvesting, processing and storage. A training programme will consist of lectures form experts, demonstration of new techniques and dissemination of information. These training programmes are proposed at three different places one at Rumsi(Keshavtar VDC), Ganesthan(Bharatpur Municipality) and the other at Charghare (Kota VDC). This training program will consist of lectures from experts, demonstration of new techniques and dissemination of information. The estimated cost of the programme during project construction is provided in Table 8.6

Table 8.6: Cost for Agricultural productivity Intensification

S. No.	Particulars	No of persons	No of days	Unit cost (Daily allowances)	Total cost in NRs.
1	Local Farmers	15	15	450	1,01,250/-
2	Horticulturist and Plant Protectionist	2	15	3,500	105,000/-
3	Training Materials and Logistics			LS	30,000/-
	Total Cost				2,36,250/-
	Total Cost for conducting 3 programs				7,08,750/-

8.4.2 Training for SPAFs and PAFS

The project will impart some adverse impacts on life styles and economic status of a few SPAFs and PAFs because of acquisition of houses and agricultural land. Construction related training programs such as electrical wiring, plumbing, and welding will be conducted for the affected population to tackle this impact. 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 estimated cost for these trainings is given in Table 8.7

Table 8.7: Cost for Construction Related Training

Particulars	Total No.	Allowance @ Day	Total No. Days	Total Rs
1. Electrical Wiring				
Trainees	30	300	10	90,000.00
Training Expert	1	3,000	10	30,000.00
Training Material			Lump Sum	50,000.00
			Total	150,000.00
2. Welding				
Trainees	30	300	10	90,000.00
Training Expert	1	3,000	10	30,000.00
Training Material			Lump Sum	50,000.00
			Total	150,000.00
Grand-Total				2,70,000.00

8.4.3 Health, Education, 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 contractor will be responsible for providing mobile health and sanitation facilities to its work force and this will ease the pressure on the existing facilities. In addition, awareness program on construction related safety issues and electrocution will also be conducted for the labour force and local residents.

An additional budget will be allocated for education as a project initiative for enhancing the education facilities in the project affected area. A lump sum of Rs. 10,00,000 has been allocated for health, education, sanitation and safety program.

8.4.4 Environmental Awareness for Conservation

Environmental Awareness for Conservation (EAC) is suggested to minimize the adverse impacts on local flora and fauna. The Project will facilitate the implementation of an EAC program with the help of local NGOs, CBOs, and international and government organizations. A community forestry enhancement will mitigate the adverse effects on natural habitats and NTFPs of the Community Forests. Community forestry enhancement will also focus on improving the traditional techniques of NTFP management and harvest. This will encourage the locals to preserve the local herb resources and will also make them aware of controlling illegal harvest by outsiders.

The Community Forestry Support Program will be carried out in two steps. In the first step, appropriate training will be provided for the cultivation of medicinal plants and NTFP management to the affected Community Forest User's Groups in co-ordination with the District Forest Office. Cultivation of medicinal plants and NTFP management activities will be included in the annual operational and management plan of each of the affected community forest. In the second step, the affected CFUGs will be supported in the cultivation efforts and NTFP management in accordance with their annual operational and management plan. Seeds, seedlings or propagating stumps will be distributed to the CFUGs and other logistic support will be also provided. Two training programs in Tanahu and Chitwan districts will be conducted. A lump sum of NRs 1,000,000 has been allocated for these trainings.

8.5 ENVIRONMENTAL MITIGATION COST

The total cost for implementing the environmental mitigation and enhancement measures described in this chapter is estimated to be NRs 48,168,300.00. A listing of the elements and a break down of the costs is given in Table 8.8.

Table 8.8:	Cost Estimate of Environmental Mitigation & Enhancement Measures					
S.N	Item	Reference	Unit	Quantity	Estimated Rate in NRs.	Total Cost in NRs.
	Mitigation measures					
1.0	**Physical Environment**					
	Rehabilitation work, bioengineering and slope protection structure and miscellaneous work	*LS*				1,000,000.00
	Mitigation Measures included in technical part of the Project (mostly related to physical environment)					
Total for Physical Environment Mitigation						**1,000,000.00**
2.0	**Biological Environment**					
2.1	Replacement Plantation as compensation	Table 8.1	Sum			9,448,000.00
2.2	Tree harvesting mangement cost				Lumpsum	1,340,000.00
2.2	Wildlife Conservation and awareness programmes	Table 8.2	Sum			230,000.00
Total for Biological Environment Mitigation						**11,018,000.00**
3.0	**Socioeconomic and Cultural Environment**					
3.1	*Compensation for land acquisition (Tower pads and camp areas)*					
3.1.1	Agriculture Land (Permanent)	Table 8.4	ha	2.02	4,000,000.00	8,080,000.00
3.1.2	Agriculture Land (Temporary- RoW)		ha	40.80	400,000.00	16,320,000.00
3.1.3	Agriculture Land (Temporary-Camp)		ha	3.00	150,000.00	450,000.00
3.1.3	Crop Loss		M/T	303.30	3,500.00	1,061,550.00
3.2	*Relocation Cost*					
3.2.1	No of Houses to be relocated	Table 8.4	Nos.	12.00	480,000.00	5,760,000.00
3.2.2	Mobilization and Rehabilitation Cost	Table 8.4	Nos.		Lumpsum	1,000,000.00
Sub-Total						**32,671,550.00**
3.3	**Detailed Study Stage**					
3.3.1	Preparation of ACRP and misc. costs/contingencies				5,00,000	500,000.00
Sub-Total						**500,000.00**
4.0	**Enhancement measures**					
4.1	Improvement in Agriculture Practices	Table 8.6	Sum	3.00	236250	708,750.00
4.2	Construction related training(welding and electrical etc.)	Table 8.7	Sum	3.00	200,000.00	270,000.00
4.3	Health, Education, Sanitation and Safety Program				Lumpsum	1,000,000.00
4.4	Environmental Awareness for Conservation				Lumpsum	1,000,000.00
Sub-Total						**2,978,750.0**
Total in Rs						**48,168,300.00**
Total in US$						**642,244.00**

Table 8.9: Matrix of Environmental Impact Mitigation Measures

	Potential Impacts	Magnitude	Duration	Extent	Mitigation Measures	
					Action	Agency to be Consulted
Construction Phase	**Physical Environment**					
	Watershed condition					
	Possibility of Soil erosion and landslides	L	ST	SS	Proper disposal of muck, minimization of land clearance	MOFSC, DDC, VDC
	Change in existing drainage system	L	ST	SS	Proper drainage system aronnd the foundation of the tower pad, minimize natural slope disturbance	MOFSC, DDC, VDC
	Topography					
	Change in existing topography	M	LT	L	Proper dumping and disposal of excavated materials especially around the tower pad, clearing to be confined within the right of way	DDC, VDC
	Landuse and land take					
	Acquisition of land	M	LT	L	Appropriate Compensation, Reclaim and maintain the land using overburden soil and vegetation work	MoEnv, MoE, VDC, DDC
	Land fragmentation	M	LT	L	No mitigation measures	
	Change in landuse	M	LT	L	Minimize landtake	MoEnv, MoE, VDC, DDC
	Air quality					
	Air pollution due to construction activities	L	ST	SS	Water spraying	MoEnv, MoE
	Noise and Vibration					
	Disturbances to the local people	L	ST	SS	Working hours to be restricted in the day time only	MoEnv, MoE,
	Water Quality					
	Deterioration of water quality due to construction activities for the foundation work and discharge of wastewater	L	ST	L	Proper handling and disposal of construction materials and garbage, constructing toilets for labourer away from water bodies	MoEnv, MoE
	Biological Environment					
	Loss of forest resources 38.3 ha					
	Loss of 8948 trees	L	LT	L	Compensatory plantation and improved forest management	DFO,CFUGs
	Loss of rare and endangered species	L	LT	SS	Protection of rare and endangered species, Awareness to workforce and local people	CFUGs, DFO, Local Clubs
	Pressure on existing forest resources due to the influx of workforce					
	Felling of Trees for fuel wood	L	ST	SS	Supply of Kerosene	DAO, VDCs
	Encroachment in the forest by the labours	L	ST	SS	Special instructions to the labours	CFUGs
	Disturbance to wildlife and wildlife habitat					
	Obstruction to the flying of birds	L	LT	SS	Mitigation measure is not applicable	
	Illegal poaching of wildlife	L	ST	SS	Control of illegal hunting and poaching	MOFSC, MoEnv

	Potential Impacts	Magnitude	Duration	Extent	Mitigation Measures: Action	Mitigation Measures: Agency to be Consulted
	Socio-economic and Cultural Environment					
Construction Phase	**Project Affected Households**					
	388 families affected due to landtake	H	LT	L	Adequate Compensation and according to the agreed procedures/rates	VDC, DDC, MoEnv
	Relocation of 12 families	H	LT	L	Adequate Compensation and according to the agreed procedures/rates	VDC, DDC, MoEnv
	One time loss of agricultural production will be 303 tones during the construction phase					
	Loss of yield, impact on the economic status of the local people	M	LT	L	Compensation, agriculture intensification program and training etc.	VDC, DDC, MoEnv
	Impact on the cultural practices					
	Disruption of the traditional way of living	L	ST	L	Awareness programmes, prohibition on consumption of alchohol abd gambling+G56	VDC, DDC
	Gender and Vulnerable Group					
	Work burden on women , child labour	L	ST	L	Ensure no children employed by projects, ensure suitable works for the women	VDC, DDC, MoEnv
	Impact on Community Services and Institutions					
	Pressure on the existing infrastructures due to influx of workers	L	ST	SS	Development of adeqnate infrastructure; establishment of subsidized works	VDC, DDC, MoEnv
Construction Phase	**Impact on health and sanitation**					
	Increase in HIV/AIDS and other diseases	L	ST	L	Public awareness programme, free distribution of condoms, providing health facilities, water supply	VDC, DDC, MOH
	Impact on Safety					
	Accident risks while stringing the line, erecting tower, and other construction work	M	ST	SS	Warning Systems, Sign Boards, safety training for workers, safety awareness programs• Provision of safety measures like helmets, gloves, dress, boots, fire fighting gears and safety belt, etc to the workers during working hours.	MoEnv
	Construction Labour Force Impact					
	Increase in incidence of diseases, increase in prostitution, increase in gambling, law and order	L	ST	L	Provision of social infrastructures and facilities, clean sanitation program, awareness training, Prohibition of gambling and alcoholism.	VDC, DDC, MoEnv
	Impact on aesthetic and tourism					
	Intrusion of the scenic beauty by the stringing of the line and disturbances to the tourist	L	LT	R	Alternative study to ameliorate the impact on the aesthetic	VDC, DDC
	Impact on movement of peoples and foot trail during construction phase	L	ST	L	Selection of access footpaths will be done carefully to avoid fragile and vulnerable areas. Footpaths will be maintained regularly by the contractor.	VDC, DDC, MoEnv

	Potential Impacts	Magnitude	Duration	Extent	Mitigation Measures	
					Action	Agency to be Consulted
	Physical Environment					
Operation Phase	**Watershed condition**					
	Possibility of Soil erosion and landslides	L	ST	L	No mitigatiou required	MOFSC, DDC, VDC
	Change in existing drainage system	L	ST	L	Proper inspection and maintenance of tower foundation	
	Topography					
	Change in existing topography	L	LT	L	No mitigation required	DDC, VDC
	Landuse and landtake					
	Acquisition of land	L	LT	L	People will be able to use the land for cultivation under the RoW	
	Land fragmentation	L	LT	L	No mitigation required	
	Change in landuse	L	LT	L	No mitigation required	
	Air quality					
	Air pollution due to construction activities	L	ST	SS	No mitigation required	MoEnv, MoE, DDC, VDC
	Noise and Vibration					
	Disturbances to the local people residing near to the power line due to corona effect	L	ST	SS	No mitigation required	MoEnv, MoE, DDC, VDC
	Water Quality					
	Detioration of water quality due to spillage of oils from the transformers aud substations	L	ST	L	No mitigation	
	Biological Environment					
Operation Phase	**Loss of forest resources 36.3 ha**					
	Trees under the RoW needs to be cleared regularly	L	LT	L	Compensatory Plantation, dwarf species to be planted	DFO, CFUGs
	Danger of forest fire hazard	L	LT	L	Awareness programmes on prevention of forest fire	
	Loss of rare and endangered species	L	LT	SS	Special instructions to the labours, Awareness to the labours and local people	CFUGs, DFO, Local Culbs
	Pressure on existing forest resources due to the influx of workforce					
	Felling of Trees	L	ST	L	Supply of Kerosene	DAO, VDCs
	Encroachment in the forest by the labours	L	ST	SS	Special instructions to the labours, Awareness to the labours and local people	CFUGs, Local Culbs
	Disturbance to wildlife and wildlife habitat					
	Obstruction to the flying of birds	L	LT	R	Mitigation measure is not applicable	
	Habitat Fragmentation	L	LT	L	Community Forestry Support Program	DFO, CFUGs
	Illegal poaching of wildlife	L	ST	L	Control of illegal hunting and poaching	CFUGs,Local Clubs

	Potential Impacts	Magnitude	Duration	Extent	Mitigation Measures	
					Action	Agency to be Consulted
	Socio-economic and Cultural Environment					
Operation Phase	**Project Affected Households**					
	388 families to be affected	M	LT	SS	Temporary land acquired during the construction phase should be returned	
	12 families under the RoW to be relocated	M	LT	SS	No mitigation measures	VDC, DDC
	Loss of permaneut yield (approximately 1.05 tones per year), impact on the economic status of the local people	L	LT	L	No mitigation measures	VDC, DDC
	Impact on the cultural practices					
	Disruption of the traditional way of living	L	ST	L	No mitigation measures required	VDC, DDC
	Gender and Vulnerable Group					
	Work borden on women , child labour	L	ST	L	No mitigation measures	VDC, DDC,MoEnv
	Impact on Community Services and Institutions					
	Pressure on the existing infrastructures due to influx of workers	L	ST	SS	No mitigation measures	VDC, DDC, MoEnv
	Impact on health and sanitation					
	Impact due to EMF and corona Effect	L	LT	SS	Awareness program on dafety issues for local people especially with pace makers	
	Iucrease in diseases	L	LT	L	No mitigation required	VDC, DDC
	Impact on Safety					
	Accidents due to electrocution and other hazards like tower climbing	L	LT	L	Awareness program to the local people on electroculation	VDC, DDC
	Impact on Aesthetic and tourism					
	Intrusion of the scenic beauty by the stringing of the line and disturbances to the tourist	L	LT	R	No mitigation required	VDC, DDC

Magnitude: H - High M - Medium L - Low

Duration ST- Short Term LT- Long Term

Extent L- Local SS- Site Specific R- Regional

CHAPTER 9:

ENVIRONMENTAL MONITORING

9.0 INTRODUCTION

This section discusses and outlines the environmental monitoring and management programs of Upper Seti(Damauli) - Bharatpur 220 kV for the 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.

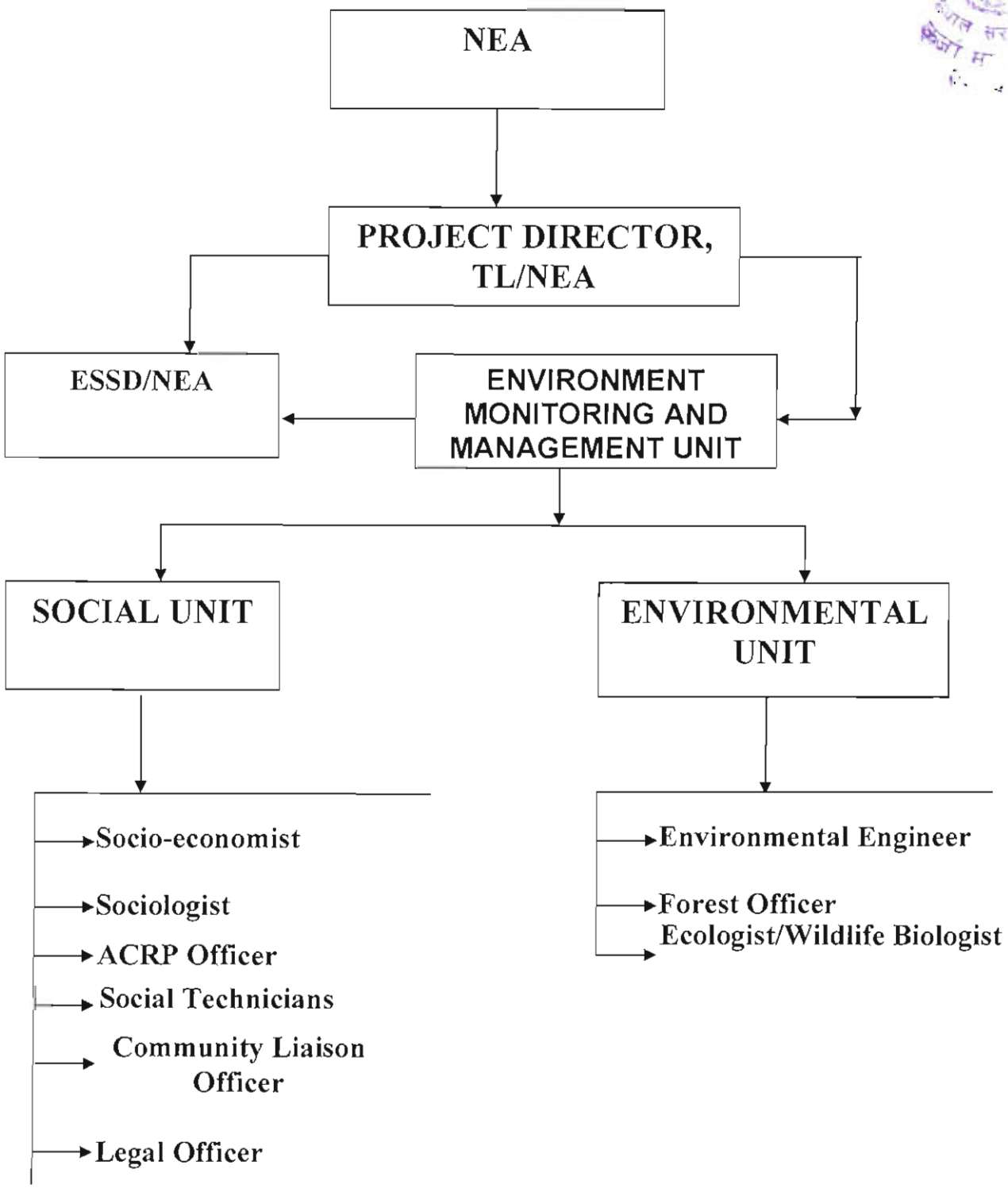
9.2 ENVIRONMENTAL MANAGEMENT AND MONITORING UNIT

The Upper Seti (Damauli)-Bharatpur 220 kV Transmission line Environmental Management and Monitoring Unit (EMU) will be formed which will be responsible for implementing mitigation measures, monitoring and conduct community related mitigation measures on behalf of the project (which are not specifically related to the activities of the construction contractors. This unit will consist of experts from ESSD, 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 NEA-ESSD. The Unit, 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 Unit will work for the monitoring of compliance issues of construction contractors. The Unit will have the responsibility for

Figure 9.1: Organizational Setup for Environmental Monitoring



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, NEA-ESSD, MoE and MoEnv.

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 EIA process.

ii) **Compliance Monitoring**

In this monitoring, the GoN licensing entity (MOE/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 220 kV 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

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 and FUGs	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 people	Housing assets, living conditions, income etc.	Affected local people	Regularly for at least three years following land acquisition
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 employed by project	Records kept by management	Project area	Continuous during construction period and annually during operation
11	Impact on Women/Cleildren	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 EIA recommendations into project documents	Yes/No	Review/cross checking of tender and design documents	Kathmandu 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	Kathmandu Office/site office	During contract negotiations
3	Integration of mitigation measures in the detail design and contract documents	Yes/No	Review process	Kathmandu office	During project approval
4	Allocation of adequate budget for the implementation of the environmental mitigation measures and monitoring works		Review, inquiry and consultation	Kathmandu 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

As per the EPR, Ministry of Energy will be responsible for monitoring. However, the project proponent Nepal Electricity Authority will have the prime responsibility for monitoring activities.

9.3.2 Monitoring Cost

The monitoring costs have been estimated in Table 9.2. The total cost for the monitoring activities has been estimated as NRs 23,90,000.00.

Table 9.2: Environmental Monitoring Cost

Particulars	Man month	Rate in NRs	Total in NRs
1. 0 Baseline Monitoring			
Man power requirement			
i) Environmental Engineer	2	70.000.00	140.000.00
ii) Sociologist	1	60,000.00	60,000.00
iii) Biologist/Ecologist	1	60.000.00	60.000.00
Logistics			50,000.00
Sub-total			**310,000.00**
Construction Phase			
2.0 Compliance Monitoring			
Man power requirement			
iv) Environmental Engineer	1	70,000.00	70,000.00
v) Sociologist	0.5	60,000.00	30.000.00
vi) Biologist/Ecologist	0.5	60.000.00	30,000.00
Logistics Support			50.000.00
Sub-total			**180,000.00**
3.0 Impact Monitoring Man power requirement			
vii) Environmental Engineer	6	50,000.00	300.000.00
viii) Sociologist	5	50.000.00	250.000.00
ix) Biologist/Ecologist	4	50,000.00	200.000.00
Logistics Support		LS	500,000.00
Sub-total			**1250,000.00**
Operation Phase			
4.0 Compliance Monitoring		LS	200,000.00
Sub total			**200,000.00**
5.0 Impact Monitoring Man power requirement			
x) Environmental Engineer	3	50,000.00	150.000.00
xi) Sociologist	2	50,000.00	100,000.00
xii) Biologist/Ecologist	2	50.000.00	100,000.00
Logistics Support			100,000.00
Sub Total			**450,000.00**
Total			**2390,000.00**

This sum is converted and rounded to USD 31866.00 and is carried forward to Table 9.5.

9.4 SUMMARY OF THE COST BENEFIT ASSESSMENT

The total estimated environmental management and monitoring cost for the proposed project is 51,058,300 million NRs, which is 6.5% the total project cost NRs. 744675000. This cost is estimated for the implementation of mitigation and enhancement measures, and environmental monitoring during pre –construction, construction and operation phases of the project. The cost breakdown is as shown below and details are given in Table 8.7 above & 9.3 below.

Table 9.3 Environmental Management and Monitoring Cost

Item	Cost NRs
Cost for Environmental Mitigation Measures and enhancement measures	48,168,300.00
Strengthening program for ESSD	500000
Cost for Environmental Monitoring	2390000.00
Total Environmental Cost	51,058,300

CHAPTER 10:

CONCLUSIONS

10.0 INTRODUCTION

This chapter sums up the findings and conclusions of the Environmental Impact Assessment Study of the Upper-Seti (Damauli) - Bharatpur 220 kV Transmission Line Project. An overall assessment is provided first, followed by sections giving specific conclusions and recommendations.

10.1 SUMMARY

The environmental issues identified during the Environmental Impact Assessment 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 101.6 ha of land for tower pads, camps and for the RoW, out of which 5.2 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 8948 trees of various species and sizes and their standing wood volume is estimated as 8460 cubic meters.

(iii) Assuming 30 m of RoW, the total forest area under the transmission line alignment is about 56.7 ha out of which 25.35 ha lies in Tanahu District and 31.35 ha in Chitwan District. As the alignment crosses undulating topography only 26.79 ha (Tanahu 4.06 and Chitwan 22.73 ha) under the RoW will have to be cleared.

10.2.3 Social Environment

iv) In terms of the loss of land and assets, 250 households will be affected due to the implementation of the project out of which 157 are SPAFs and the rest are PAFs.

(iv) 12 households will have to be relocated.

(v) The land acquisition and disturbance will cause the one time loss of 303 tonnes and permanent annual loss of 4.44 tonnes agricultural production. In addition 40.8 ha agricultural land under RoW will be devalued and will be restricted from construction and free plantation.

(vi) 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. 51,058,300 which is about 7% 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 will be carried out 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.

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