

Initial Environmental Examination – Appendices

Project No. 41155-013
April 2016

NEP: Electricity Transmission Expansion and Supply Improvement Project

Appendix H - Chapter 1-4

Prepared by Nepal Electricity Authority for the Asian Development Bank.

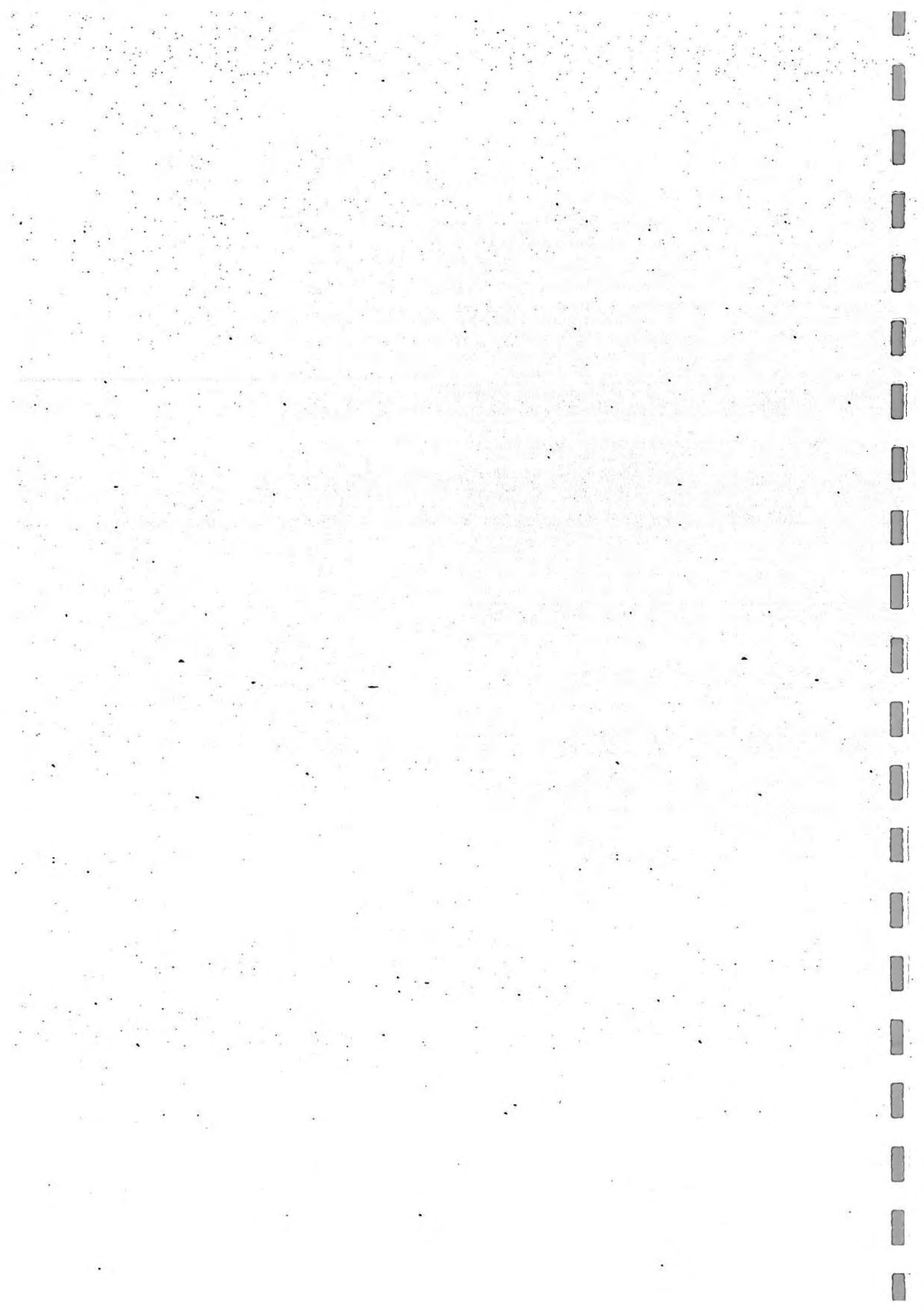
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Appendix H

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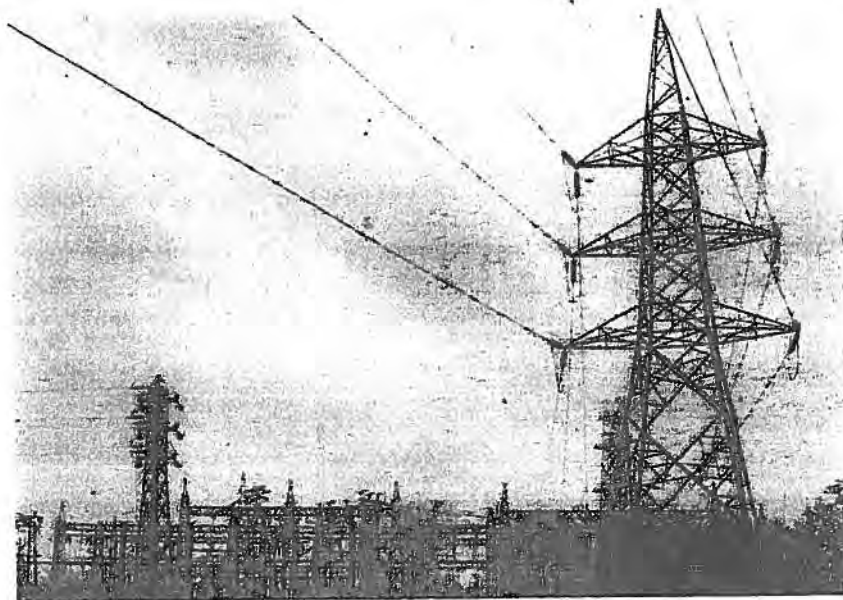






NEPAL ELECTRICITY AUTHORITY

TERMS OF REFERENCE FOR INITIAL ENVIRONMENTAL EXAMINATION OF TAMAKOSHI-KATHMANDU 400 kV TRANSMISSION LINE PROJECT



Submitted to:

**Ministry of Energy
Through
Department of Electricity Development**

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Submitted by:

Nepal Electricity Authority

Durbar Marg, Kathmandu

June, 2014





ABBREVIATIONS AND ACRONYMS

AP	Angle Point
CBO	Community Based Organization
BS	Bikram Sambat (Nepali Era)
DDC	District Development Committee
DoED	Department of Electricity Development
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMP	Environmental Management Plan
EPA	Environment Protection Act, 1997
EPR	Environment Protection Rules, 1997
ESSD	Environment and Social Studies Department
CFUG	Community Forest Users' Group
GoN	Government of Nepal
GIS	Geographical Information System
Hhs	Households
kV	Kilovolt
MW	Mega Watt
MOFSC	Ministry of Forest and Soil Conservation
MoE	Ministry of Energy
MoSTE	Ministry of Science, Technology and Environment
NEA	Nepal Electricity Authority
NGO	Non Governmental Organization
PAF	Project Affected Family
SPAF	Seriously Project Affected Family
RoW	Right of Way
T/L	Transmission Line
ToR	Terms of Reference
VDC	Village Development Committee

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Chapter 1 INTRODUCTION

1.1 The Proponent

The Nepal Electricity Authority (NEA) is the proponent of the proposed Tarakoshi-Kathmandu 400 kV Transmission Line Project. NEA is a semi-government organization established in 2042 B.S. (1985 AD) and is responsible in generating, transmitting and distributing 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 has granted a survey license for the feasibility study including the environmental study of the proposed project. The survey license was issued on B.S.2070/01/31 and is valid till B.S.2072/01/30. A copy of license has been attached in Annex-I.

The contact address of the project proponent is as follows:

Nepal Electricity Authority,
Durbarmarg, Kathmandu,
Phone No. : 01-4153025
Fax No. : 01-4153040

1.2 Organization Responsible for the Preparation of Initial Environmental Examination

The Environment and Social Studies Department (ESSD) of Nepal Electricity Authority is responsible for the preparation of the ToR for the IEE study of the proposed project. ESSD executes all activities related to identifying, conducting and coordinating the environmental aspects of the projects studied, designed, and constructed or operated by NEA. The department has more than one decade of experience in conducting Environmental Impact Assessments (EIA), Initial Environmental Examination (IEE), monitoring and implementation of mitigation measures, monitoring plan for hydropower, transmission line and distribution line projects and environmental auditing of hydropower and transmission line projects.

The contact address of the organization responsible for the preparation of ToR is:

Environment and Social Studies Department,
Engineering Services Directorate,
Nepal Electricity Authority,
Kharipati, Kathmandu
Phone No. : 01 66 11 580
Fax No. : 01 66 11 590
Email : neaessd@wlink.com.np



1.3 Objectives of the ToR

The primary objective of the ToR for IEE is to inform the stakeholders about the project, receive their comments and feedback on relevant environmental impacts / issues and identify the priority-based components on social and environmental parameters for assessment.

The other objectives of ToR are to:

- Collect brief information on physical, biological and socio-economic and cultural environment of the project area;
- Identify all the beneficial and adverse impacts likely to arise as a result of the implementation of the proposed project;
- Collect issues from the local community and summarize the significant issues
- Describe the study methodology and provide guidance for the IEE study;
- To identify data requirement and describe methodology to collect these data;
- To identify the acts, rules, policies that needs to be reviewed and consulted; and
- To develop the alternative study plan and monitoring plan
- Clarification of the responsibilities of the different institutions involved in the IEE procedures;
- Setting out a time frame, with required expert manpower for carrying out the IEE study, together with estimated budget required; and
- Technical guidance relating to the main aspects of the environment that will require delineation during the courses of the IEE study.

1.4 Objectives of IEE Study

The aim and objective of the IEE is to assess and inform decision makers by identifying the potentially significant environmental effects and risks of the proposed project and to suggest appropriate mitigation measures to mitigate and/or minimize the adverse impacts so that the project is implemented in an environmentally sound manner. The specific objective of the study is to prepare an IEE report. The other general objectives of the study are to:

- to document physical, biological, socio-economic and cultural baseline conditions of project area;
- to analyze alternative transmission line routes;
- to identify, predict and assess the adverse and beneficial environmental impacts of the transmission line in project affected areas in terms of magnitude, extent and duration during project construction and operation phases;
- to suggest appropriate and pragmatic mitigation and enhancement measures for potential adverse impacts;
- to familiarize various stakeholders with the IEE outcomes through public consultation and participation programs and to incorporate their relevant concerns and issues in environmental mitigation plan;

- to prepare an environment monitoring plan; and
- to facilitate informed decision making including setting the environmental terms and conditions for implementing the proposed project.

1.5 Rationality for Conducting IEE Study

As per the Environment Protection Rules (EPR), 1997 and the subsequent amendment (published in 2066/10/13 BS on Nepal Gazette) an Initial Environmental Examination (IEE) study is mandatory for transmission line of voltage level of 132 kV or above. Thus, this project having a voltage level of 400 kV requires an IEE study. Further, about 145.3 ha of forest land will be affected due to the project implementation.

The proposed project does not lie in any National Parks, Conservation Areas, Wildlife Sanctuary, Buffer Zone, Wetlands or any other environmentally sensitive and fragile zones and the proposed alignment does not cross any settlement in its entire length.

Chapter 2

PROJECT DESCRIPTION

2.1 The Project and its Objective

In order to meet the growing electricity demand of the country, NEA has initiated for construction of Upper Tamakoshi hydroelectric power (HEP) project (456 MW). With the Government policy to encourage independent power producers (IPP), many private companies are trying to develop HEP projects in the Tamakoshi and Likhu basin. Kirne (70 MW), Balephi (50 MW), Likhu IV (120 MW), Likhu 1 (65 MW), Likhu 2 (50 MW), Likhu A (60 MW) are planned to be commissioned on 2023.

However, development of most of the identified hydropower projects could not be realized due to limitation and unavailability of transmission network in the vicinity of identified projects. To be more specific, transmission line has been the limiting factor in the development of hydro power plant in Nepal. To evacuate the power generated from the upcoming hydropower plants, development of transmission system with adequate capacity has become essential.

Tamakoshi- Kathmandu 400 kV Transmission Line (T/L) Project is a major step in this effort. Nepal Electricity Authority (NEA) is going to construct 400 kV voltage level transmission line from Khimti to Kathmandu to evacuate power generated (about 1,500 MW) from the HEPs in these basins.

2.2 Salient Features of the Project

The salient features of the proposed project are as follows:

Table 2.1 : Salient Features of the Project

S. No.	Description	
1	Name of Project	Tamakoshi-Kathmandu 400 kV T/L Project
2	Affected VDCs and Municipality	<p>42 VDCs and one Municipality</p> <p><u>Ramechhap District</u>: Phulasi (फुलासी), <u>Dolakha District</u>: Melung (मेलुङ्ग), Bhedapu (भेडापु), Pawati (पवटी), Ghyangsukathokar (घ्याङ्सुकाठोकर), Fasku (फास्कु), Magapauwa (मागापौवा), Boch (बोच), Lakuridanda (लाकुरीडाँडा) and Bhimeshwar Municipality (भिमेश्वर नगरपालिका) <u>Sindhupalchok District</u>: Kubhinde (कुभिन्डे), Maneshwora (मानेश्वरा), Tauthali (तौथली), Chokati (चोकटी), Piskar (पिस्कर), Dhuskun (धुस्कुन), Karthali (कारथली), Barhabise (बाह्रबिसे), Ramche (राम्चे), Mankha (मङ्खा), Phulpindanda (फुलपिनडाँडा), kadambas (कदमबास), Irkhu (इर्खु), Thulosirubari (ठूलोसिरुबारी), Bhotasipa (भोटासिपा), Sanusirubari (सानुसिरुबारी) Bhimtar (भिमटार) <u>Kavrepalanchowk District</u>: Chandeni (चण्डेनी), Mahadevsthan (महादेवस्थान), Naya gaun (नयाँ गाउँ), Baluwapati</p>

		(वाल्गुवापाटी), Gairibisaune (गैरीबिसौनी) Bhaktapur District: Nagarkot (नगरकोट), Chhaling (छलिङ्ग), Changunarayan (चाँगुनारायण) and Duwakot (दुवाकोट) Kathmandu District: Indryani (इन्द्रयणी), Lapsipedi (लप्सेफेदी), Naglebhare (नाङ्गलेभारे), Pokhulachi (पुखुलाछी), Suntol (सुनटोल), Dachhi (डाँछी) and Mulpani (मुलपानी)
3	Number of angle points	125
4	System Voltage	400KV
5	Capacity	1500 MW
6	No of circuit	Double circuit
7	Length of TL	Approximately 100 Km
8	Nominal span	Average 300 m
9	Tower type	Steel Lattice Structure, self supported (DA, DB, DC, DD)
10	Tower Height	45m
11	Tower Foundation Area	15mx15m (approx. average per foundation)
12	Conductor	Aluminum Conductor Steel Reinforced 525 mm ² "Moose"
13	Right of way (RoW)	46m (23 m on either side of centerline)
14	Minimum ground Clearance	9m
15	Minimum clearance for road, river crossing lines and other utilities	9m
16	Project construction period	42 months
17	Funded by	ADB/NEA-GoN
18	Substations	New Khimti Substation, Phulasi, Ramechhap Barhabise hub, Barhabise Bazaar, Sindhupalchowk Halade Substation, Nanglabare, Kathmandu and Mulpani Substation, Mulpani, Kathmandu

2.3 Location of the Project

The proposed Tamakoshi-Kathmandu 400 kV Transmission Line Project is located in Ramechhap, Dolakha, Sindhupalchok, Kavrepalanchok, Bhaktapur and Kathmandu Districts of the Janakpur and Bagmati Zones of Central Development Region, Nepal. In total 42 VDCs and 1 municipality namely Phulasi (फुलासी) of Ramechhap District, Melung (मेलुङ्ग), Bhedapur (भेडापुर), Pawati (पवटी), Ghyangsukathokar (घ्याङ्सुकाठोकर), Fasku (फास्कु), Magapauwa (मागापौवा), Boch (बोच), Lakuridanda (लाकुरिडाँडा) and Bhimeshwar Municipality (भिमेश्वर नगरपालिका) of Dolakha District;

Kubhinde (कुभिन्डे), Maneshwora (मानेश्वरा), Tauthali (तौथली), Chokati (चोकाटी), Piskar (पिस्कर), Dhuskun (धुस्कुन), Karthali (करथाली), Barhabise (बाहबिसे), Ramche (राम्चे), Mankha (माङ्खा), Phulpindanda (फुलपिन्डाँडा), Kadambas (कदमबास), Irkhu (इर्खु), Thulosirubari (ठूलोसिरुबारी), Bhotasipa (भोटासिपा), Sanusirubari (सानुसिरुबारी), Bhimtar (भिमटार) of Sindhupalchok District; Chandeni (चण्डेनी), Mahadevsthan (महादेवस्थान), Naya gaun (नयाँ गाँउ) Baluwapati (बालुवापाटी) and Gairibisaune (गैरीबिसौनी) of Kavrepalanchowk District; Nagarkot (नगरकोट), Chhaling (छालिङ्ग), Changunarayan (चाँगुनारायण) and Duwakot (दुवाकोट) of Bhaktapur District and Indryani (इन्द्रयणी), Lapsipedi (लप्सेफेदी), Naglebhare (नाङ्लेभारे), Pokhulachi (पुखुलाछी), Suntol (सुनटोल), Dachhi (डाँछी) and Mulpani (मुलपानी) of Kathmandu District. The project location map has been presented in Figure 2.1.



Figure 2.1: Project Location Map

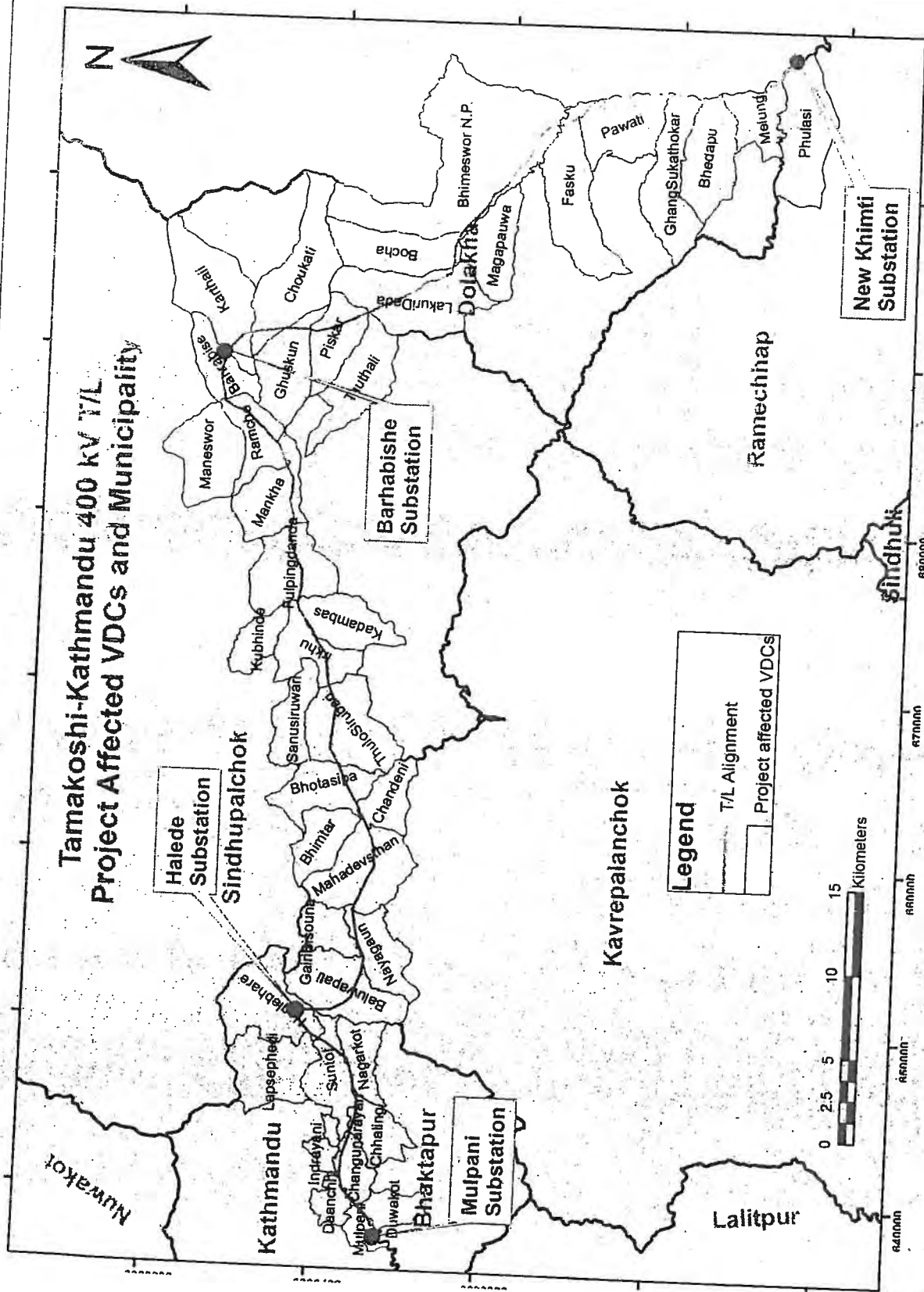


Figure 2.2 Project affected VDCs and Municipality

Legend

- RHOLA
- KHOLSI
- NFL
- SUSPENSION BRIDGE
- WOODEN BRIDGE
- ROAD
- DRAIN
- FOOTTRACK
- 33 KV TL
- GABION WALL
- MASONRY WALL
- GAUGE STATION
- DRILL HOLE
- SMAL TREE
- BAMBOO TREE
- CULTIVATED LAND
- TREE
- GROUND CONTROL POINT
- TEMPLE
- TAP
- HOUSE
- GOTH
- BOULDER
- LANDSLIDE
- 33 KV Line
- 11 KV Line
- 220 V LT
- ANGLE POINT
- DIRECTION POINT



Sheet Index

6 5 4 3

Title
Route Alignment Map
of

Detailed Survey

Scale 1:25000

Date : March-2015

TAMAKOSHI(KHIMTI) - KATHMANDU 220 KV/ 400 KV TRANSMISSION LINE PROJECT
Revised Bernabise - Kathmandu
400 KV Transmission Line Survey

Submitted By:
NEPAL ELECTRICITY AUTHORITY
ENGINEERING SERVICES DIRECTORATE
PROJECT DEVELOPMENT DEPARTMENT

Submitted To:
NEPAL ELECTRICITY AUTHORITY
TRANSMISSION DIRECTORATE
MAJOR TRANSMISSION LINE PROJECT 200 KV



3069 000 N

3067 000 N

3065 000 N

Proposed Sub-station
Mulpani

SS4

(27°42'20" 85°24'17")

(27°42'28" 85°24'25")

(27°42'55" 85°24'50")

AP-124

(27°43'22" 85°25'25")

AP-123

(27°43'25" 85°25'56")

AP-122

(27°43'20" 85°26'28")

AP-121

(27°43'11" 85°27'14")

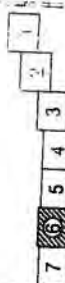
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- ROAD
- DRAIN
- FOOTTRACK
- 33 KV TL
- GABION WALL
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- DIRECTION POINT



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Sheet No. 377
Route Alignment Map of Detailed Survey



TAMAKOSHI(KHIMTI) - KATHMANDU 220 KV/ 400 KV TRANSMISSION LINE PROJECT
Revised Barhabise - Kathmandu
400 KV Transmission Line Survey

Submitted By:
NEPAL ELECTRICITY AUTHORITY
ENGINEERING SERVICES DIRECTORATE
PROJECT DEVELOPMENT DEPARTMENT

Submitted To:
NEPAL ELECTRICITY AUTHORITY
TRANSMISSION DIRECTORATE
MAJOR TRANSMISSION LINE PROJECT 220 KV



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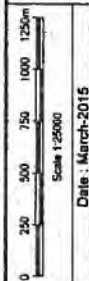
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- FOOTTRACK
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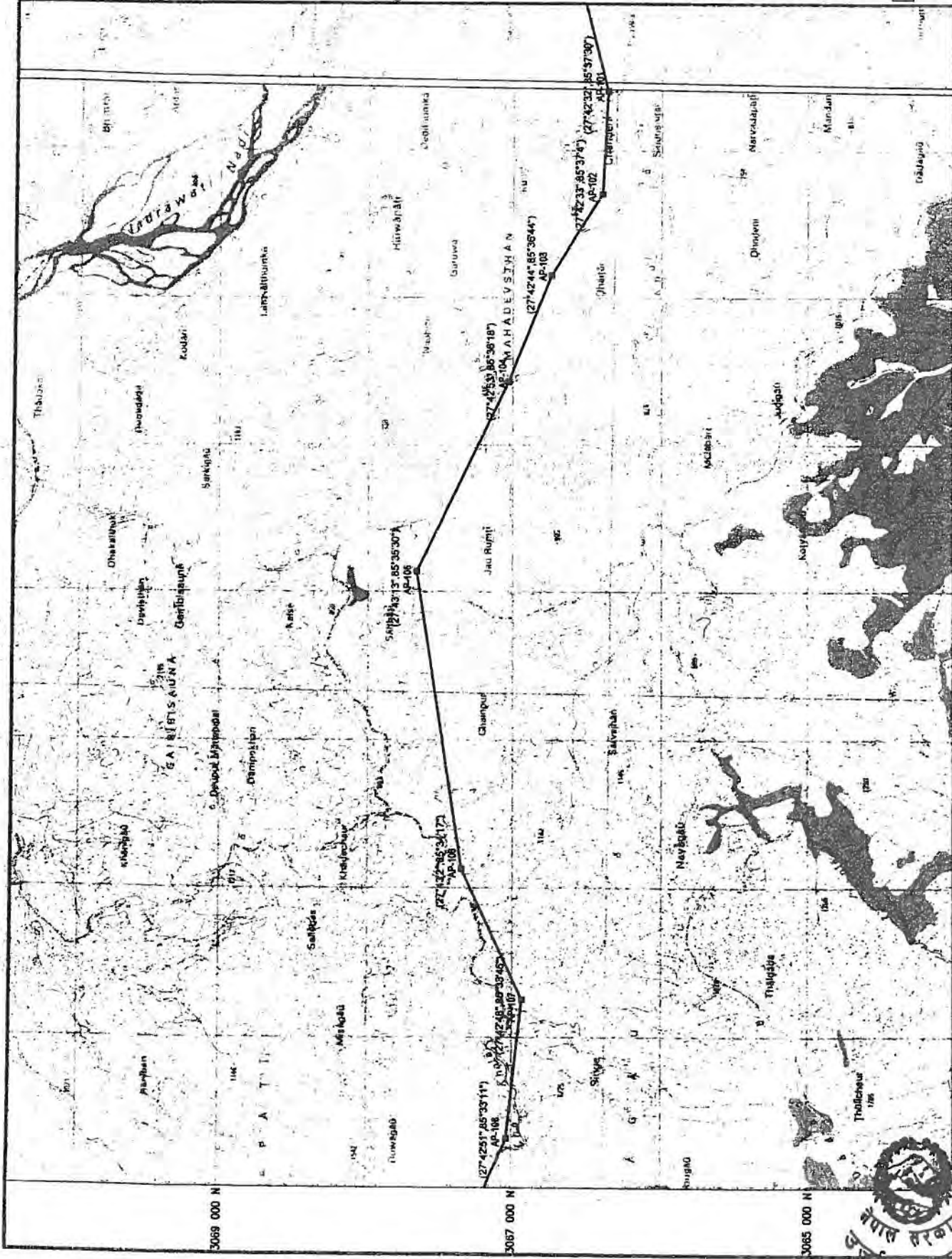
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Route Alignment Map of Detailed Survey



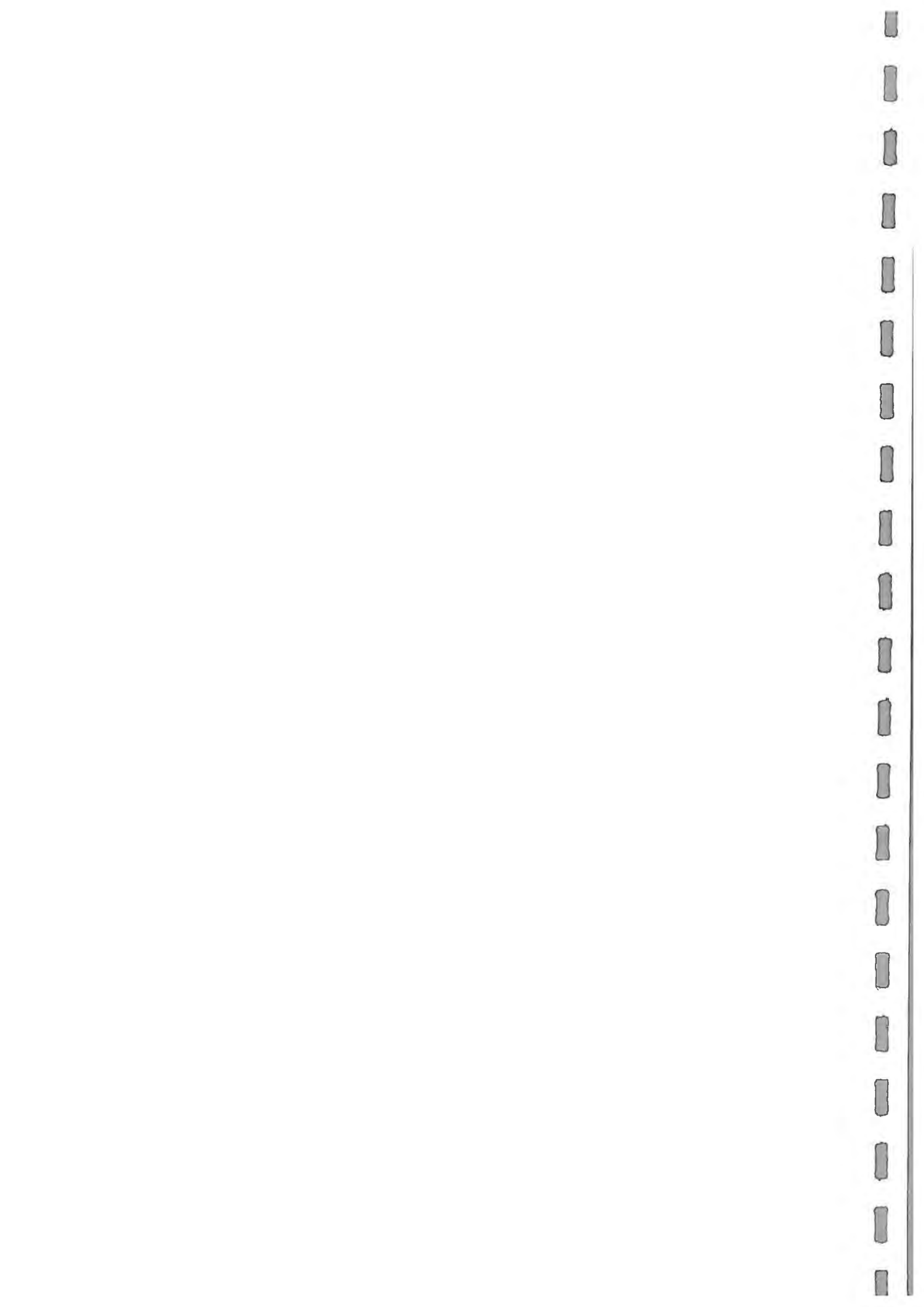
Date: March-2015
TAMAKOSHI(KHIMTI) - KATHMANDU 220 KV/ 400 KV TRANSMISSION LINE PROJECT
Revised Barhabise - Kathmandu
400 KV Transmission Line Survey

Submitted By:
NEPAL ELECTRICITY AUTHORITY
ENGINEERING SERVICES DIRECTORATE
PROJECT DEVELOPMENT DEPARTMENT

Submitted To:
NEPAL ELECTRICITY AUTHORITY
TRANSMISSION DIRECTORATE
MAJOR TRANSMISSION LINE PROJECT 220 KV



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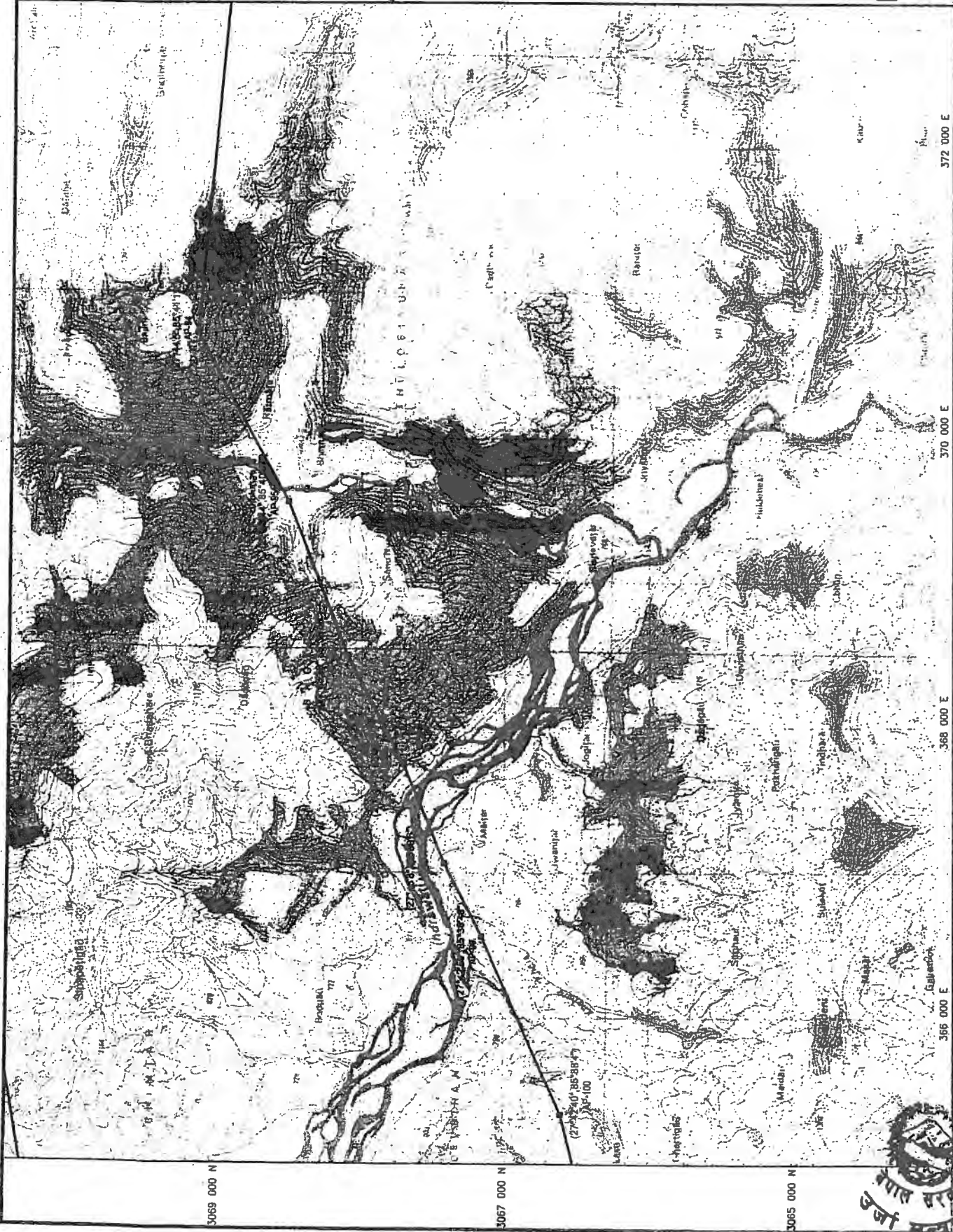
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- ANGLE POINT
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Submitted To:

NEPAL ELECTRICITY AUTHORITY
TRANSMISSION DIRECTORATE
MAJOR TRANSMISSION LINE PROJECT 200 KV

Submitted By:

NEPAL ELECTRICITY AUTHORITY
ENGINEERING SERVICES DIRECTORATE
PROJECT DEVELOPMENT DEPARTMENT

Title

Route Alignment Map of
Detailed Survey

Scale 1:25000

Date: March-2015

372 000 E

370 000 E

368 000 E

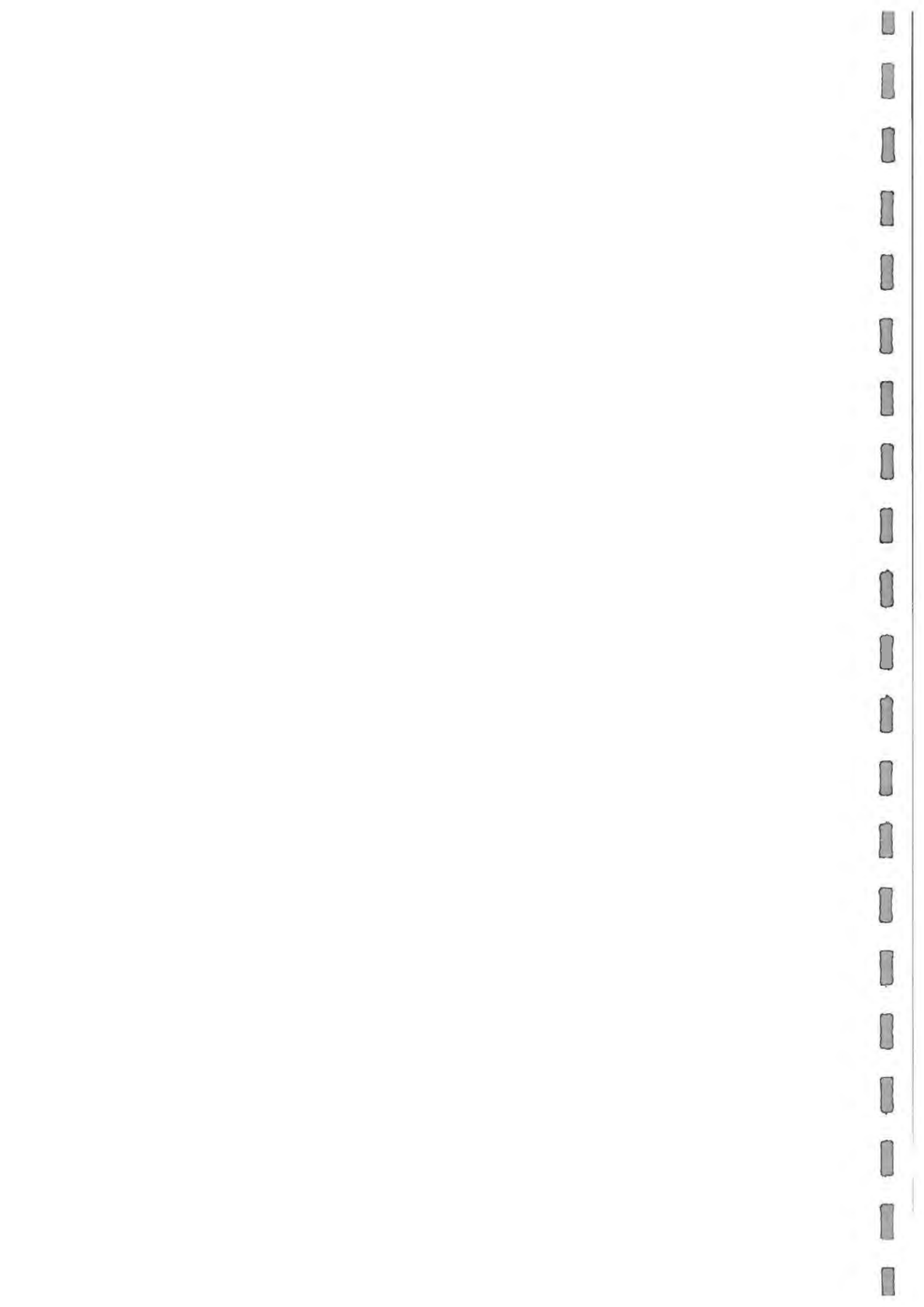
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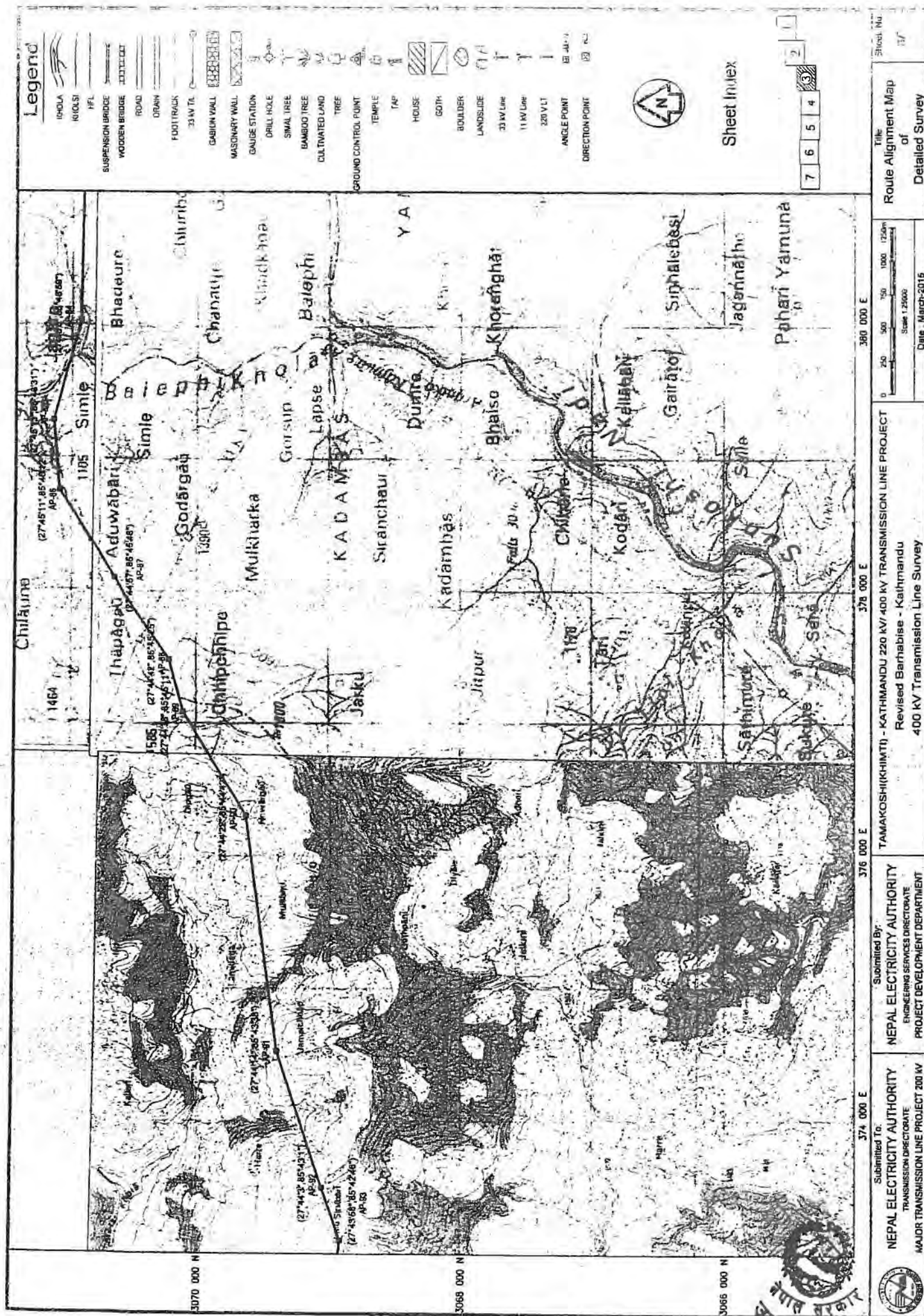
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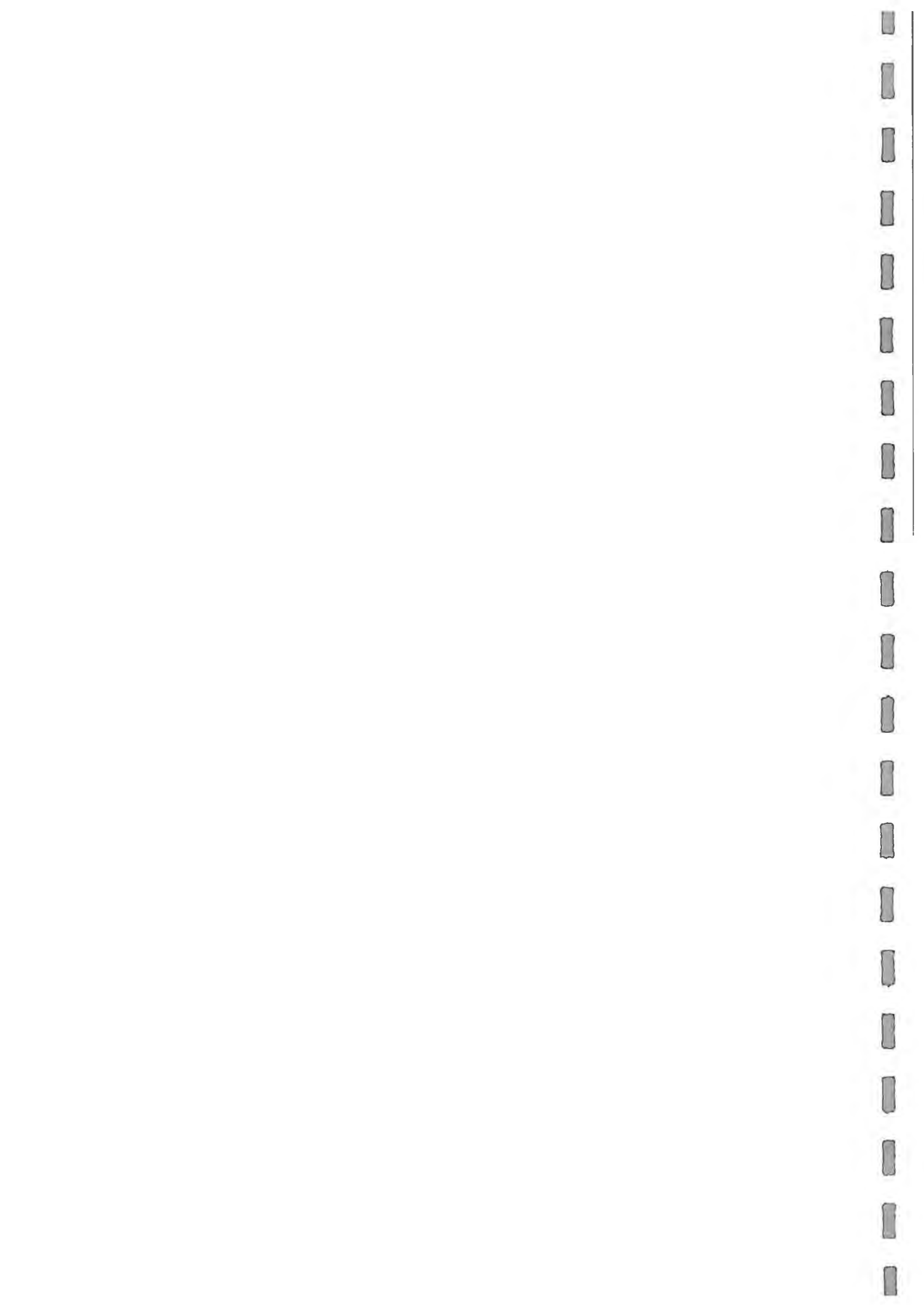
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Legend

- KNOLA
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Scale 1:25000

Date: March-2015

TAMAKOSHI(KHIMTI) - KATHMANDU 220 KV/400 KV TRANSMISSION LINE PROJECT

Revised Barhabise - Kathmandu

400 KV Transmission Line Survey

Submitted By:

NEPAL ELECTRICITY AUTHORITY

ENGINEERING SERVICES DIRECTORATE

Submitted To:

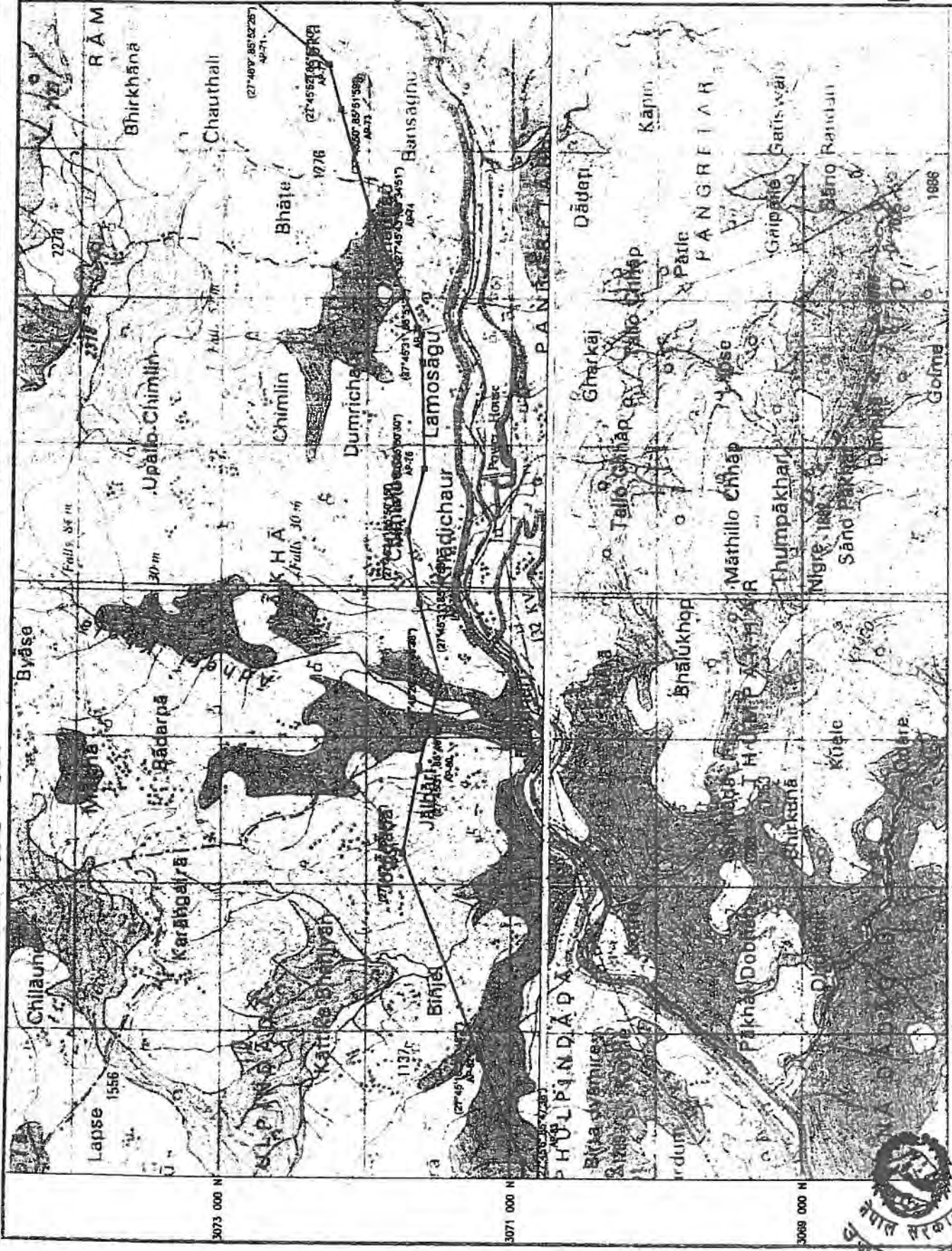
NEPAL ELECTRICITY AUTHORITY

TRANSMISSION DIRECTORATE

MAJOR TRANSMISSION LINE PROJECT 200 KV

PROJECT DEVELOPMENT DEPARTMENT

2068





Legend

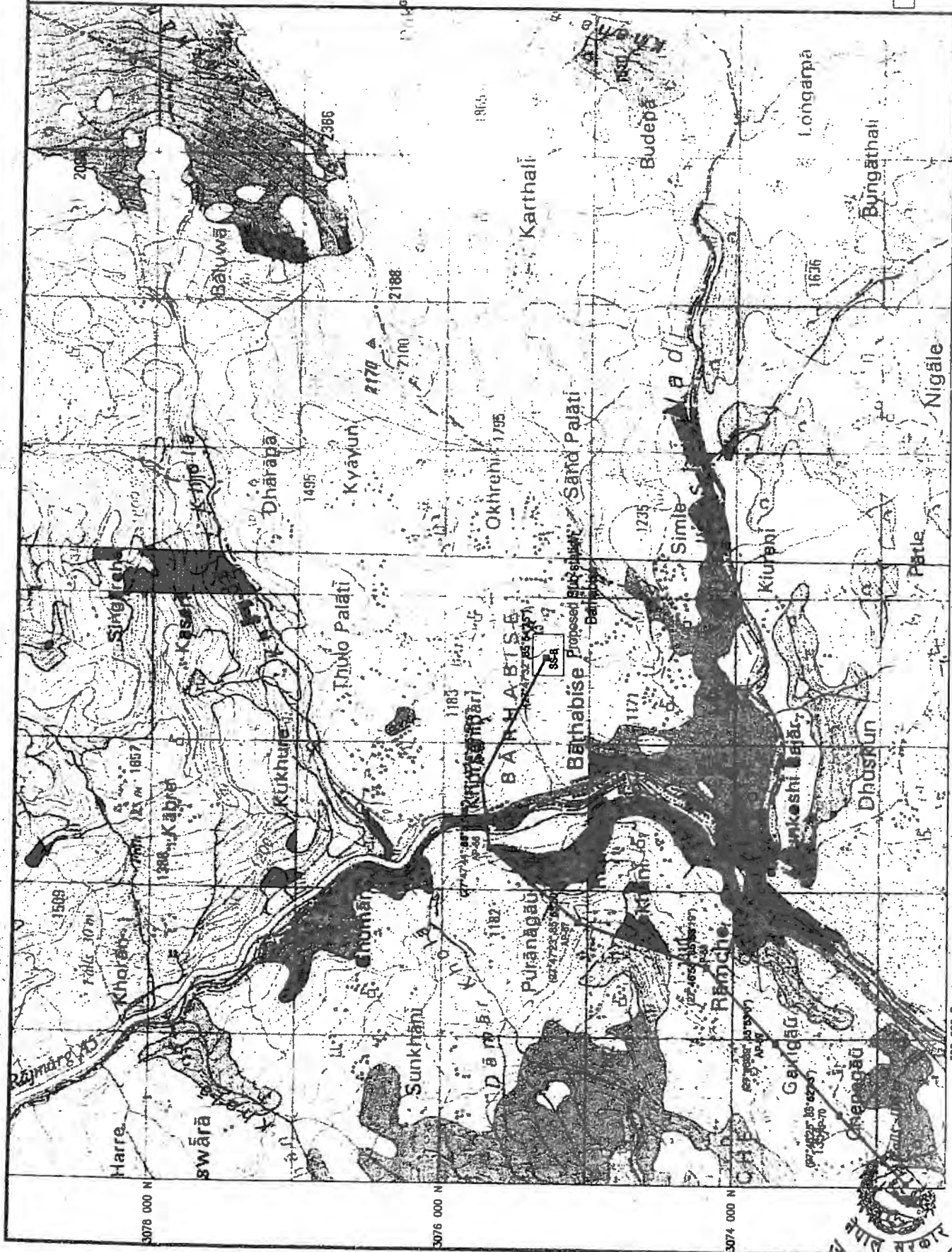
- KHOLA
- KHOLSI
- HFL
- SUSPENSION BRIDGE
- WOODEN BRIDGE
- ROAD
- DRAIN
- FOOTTRACK
- 33 KV TL
- GABION WALL
- MASONRY WALL
- GAUGE STATION
- DRILL HOLE
- SIMAL TREE
- BAMBOO TREE
- CULTIVATED LAND
- TREE
- GROUND CONTROL POINT
- TEMPLE
- TAP
- HOUSE
- GOTH
- BOULDER
- LANDSLIDE
- 33 KV Line
- 11 KV Line
- 220 V LT
- ANGLE POINT
- DIRECTION POINT



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7 6 5 4 3

Sheet No. 1/7
Route Alignment Map of Detailed Survey



Submitted To:
NEPAL ELECTRICITY AUTHORITY
TRANSMISSION DIRECTORATE
MAJOR TRANSMISSION LINE PROJECT 200 KV

Submitted By:
NEPAL ELECTRICITY AUTHORITY
ENGINEERING SERVICES DIRECTORATE
PROJECT DEVELOPMENT DEPARTMENT

TAMAKOSHI(KHIMTI) - KATHMANDU 220 KV/ 400 KV TRANSMISSION LINE PROJECT
Revised Bathabise - Kathmandu
400 KV Transmission Line Survey

3076 000 N

3076 000 N

3074 000 N

390 000 E

392 000 E

394 000 E

396 000 E

0

250

500

750

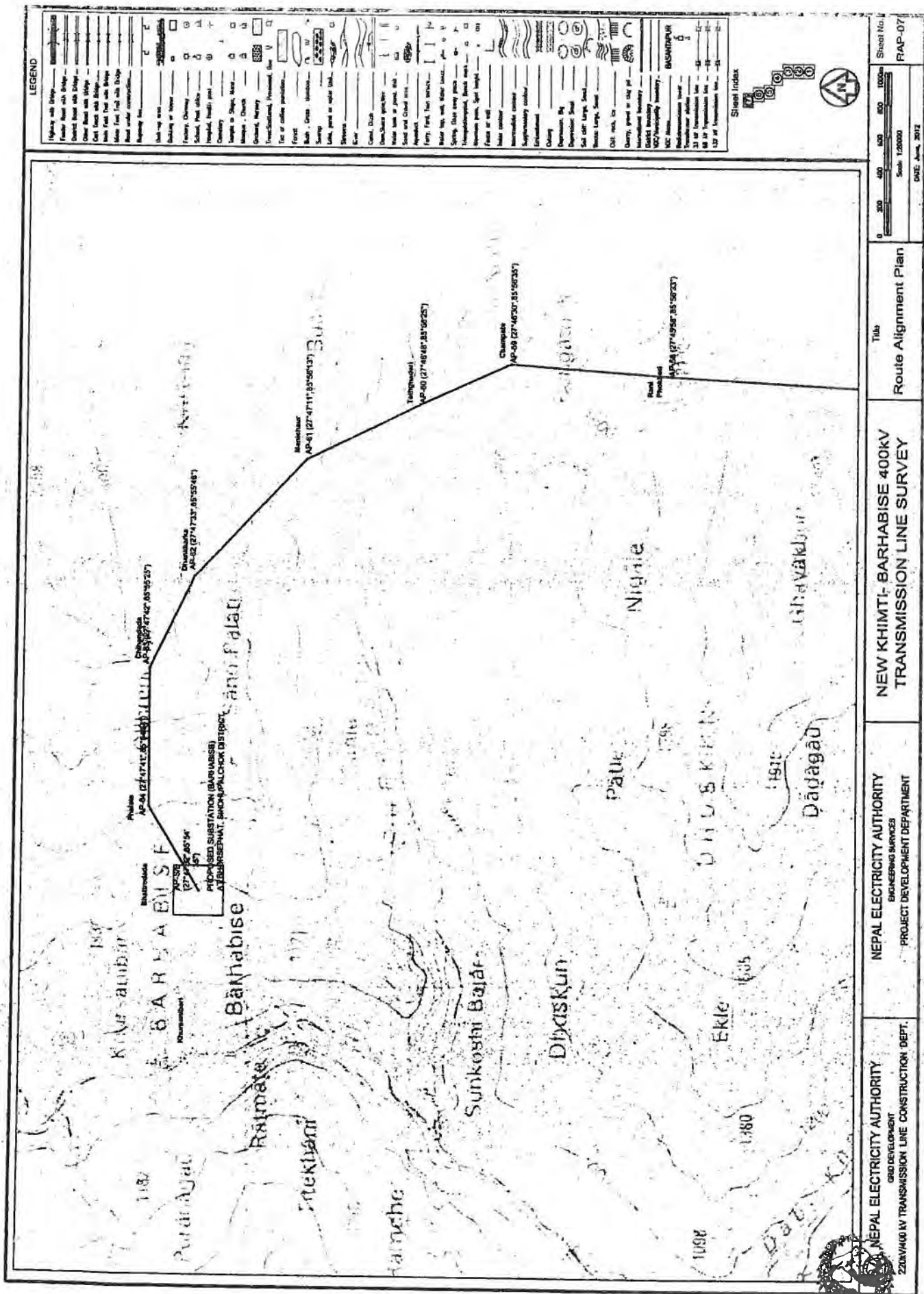
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1250m

Scale 1:25000

Date : March-2015





नेपाल सरकार
उर्जा मन्त्रालय
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NEPAL ELECTRICITY AUTHORITY
GRID DEVELOPMENT
220KV/400 KV TRANSMISSION LINE CONSTRUCTION DEPT.

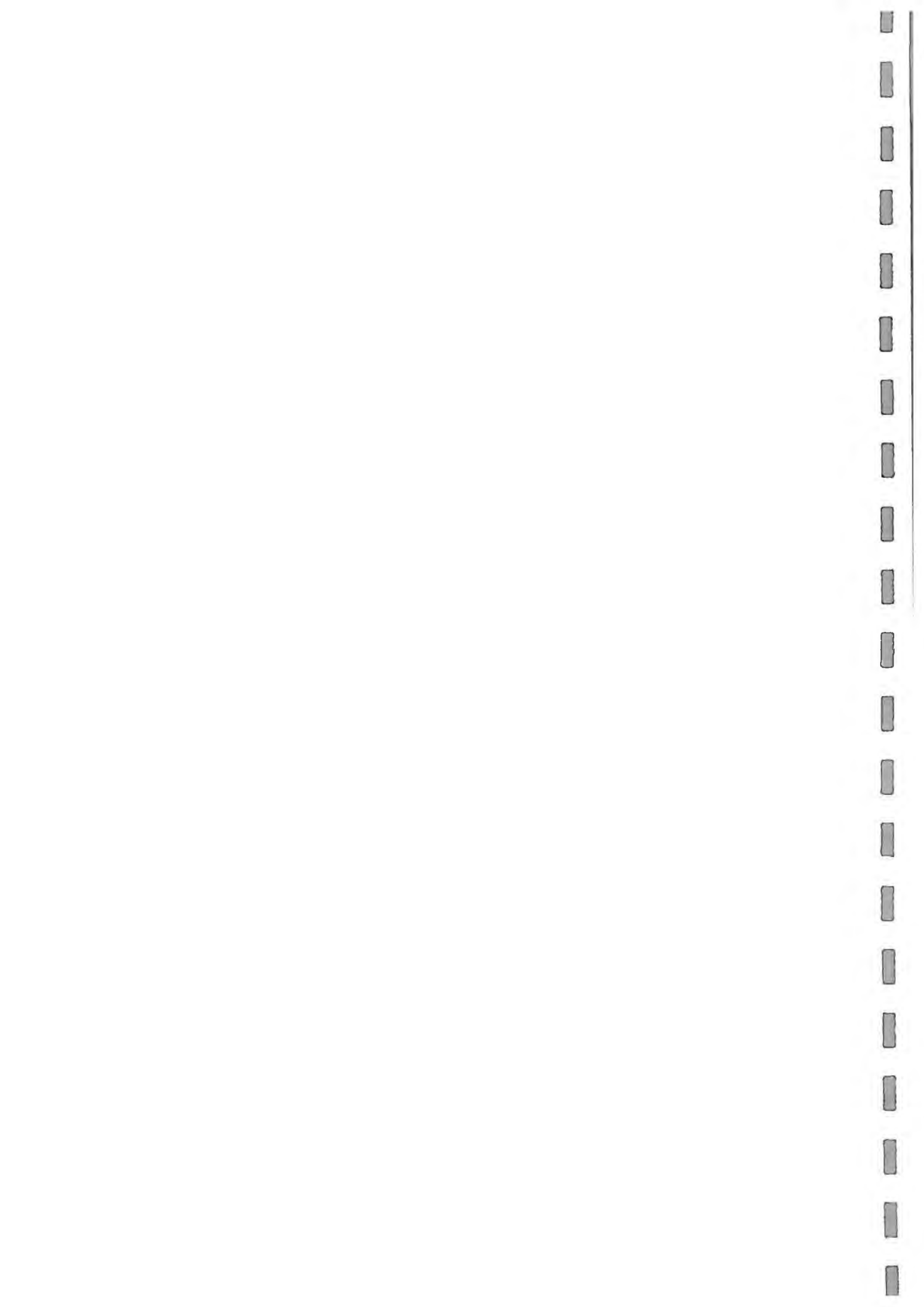
NEPAL ELECTRICITY AUTHORITY
ENGINEERING SERVICES
PROJECT DEVELOPMENT DEPARTMENT

NEW KHIMTI-BARHABISE 400KV
TRANSMISSION LINE SURVEY

Route Alignment Plan

Scale 1:20000
Date June, 2012

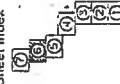
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RIAP-07



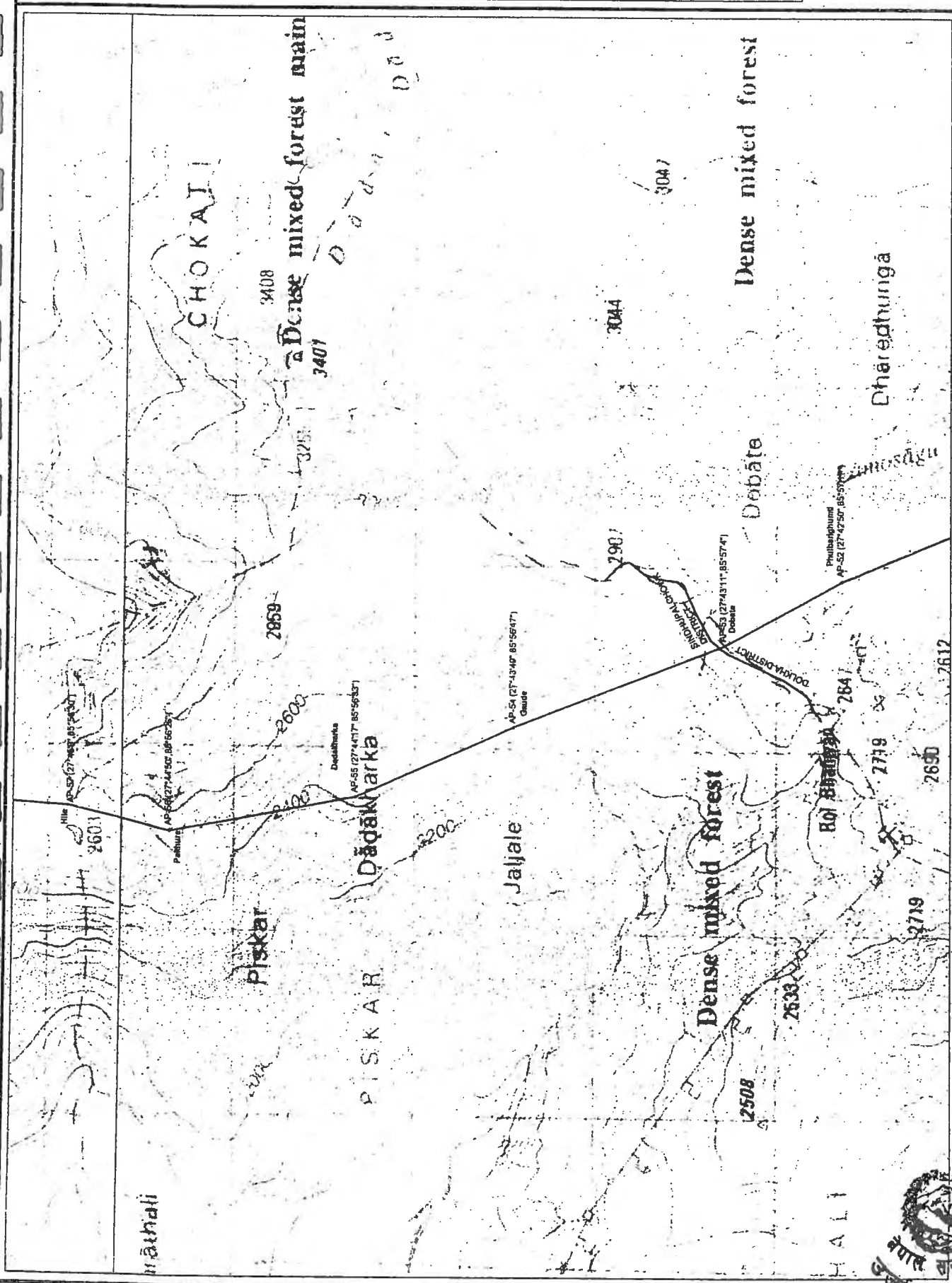
LEGEND

Highway with bridge	—	—
Feeder Road with bridge	—	—
District Road with bridge	—	—
Other Road with bridge	—	—
Cart Track with bridge	—	—
Main Road with bridge	—	—
Minor Road with bridge	—	—
Road under construction	—	—
Regulatory line	—	—
Set-back line	—	—
Building or house	—	—
Factory, chimney	—	—
School, Post office	—	—
Hospital, health post	—	—
Cemetery	—	—
Temple or Sthupa, stupa	—	—
Mosque, Chorten	—	—
Graveyard, Mastaba	—	—
Tree or coffee plantation	—	—
Forest	—	—
Barren, Grass, Barren	—	—
Swamp	—	—
Lake, pond or water tank	—	—
Stream	—	—
River	—	—
Canal, ditch	—	—
Dam, sluice gate, weir	—	—
Water tank or pond, well	—	—
Sand and gravel area	—	—
Archaeological	—	—
Ferry, Ferry, Ferry	—	—
Water up, well, Water tank	—	—
Spring, Ditch, any place	—	—
Topographical, Bench mark	—	—
Mountain peak, Spot height	—	—
Fence or wall	—	—
Water channel	—	—
Intermittent, colour	—	—
Supplementary contour	—	—
Contour	—	—
Contour	—	—
Depression, Bay	—	—
Depression, Sand	—	—
Set-off, Large, Small	—	—
Roads, Large, Small	—	—
Cart, road, line	—	—
Quarry, gravel or clay pit	—	—
International boundary	—	—
District boundary	—	—
VC/Municipality boundary	—	—
VC Name	—	—
Reduction, station	—	—
Transmission line	—	—
33 kV Transmission line	—	—
66 kV Transmission line	—	—
132 kV Transmission line	—	—

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Scale	1:20000
DATE	June, 2012



Title
Route Alignment Plan

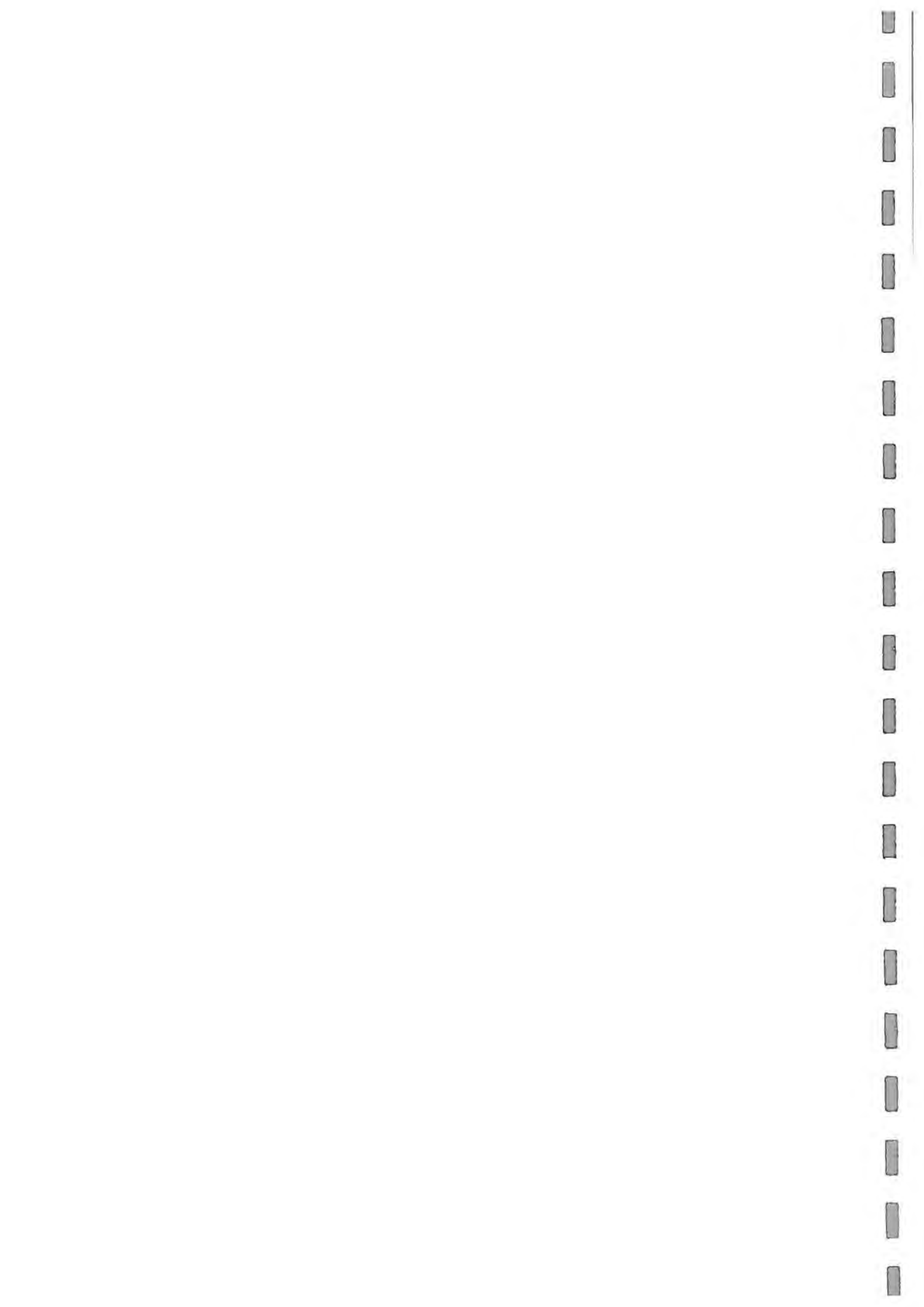
NEW KHIMTI BARHABISE 400KV
TRANSMISSION LINE SURVEY

NEPAL ELECTRICITY AUTHORITY
ENGINEERING SERVICES
PROJECT DEVELOPMENT DEPARTMENT

NEPAL ELECTRICITY AUTHORITY
GRID DEVELOPMENT
220KV/400 KV TRANSMISSION LINE CONSTRUCTION DEPT.



2066



LEGEND

Highway with Bridge	AP-10 (27°41'30" N, 85°57'47" E)
Feeder Road with Bridge	AP-11 (27°40'12" N, 85°56'58" E)
District Road with Bridge	AP-12 (27°40'12" N, 85°56'58" E)
Other Road with Bridge	AP-13 (27°40'12" N, 85°56'58" E)
Cart Track with Bridge	AP-14 (27°40'12" N, 85°56'58" E)
Motor Foot Road with Bridge	AP-15 (27°40'12" N, 85°56'58" E)
Motor Foot Road with Bridge	AP-16 (27°40'12" N, 85°56'58" E)
Road under construction	AP-17 (27°40'12" N, 85°56'58" E)
Highway line	AP-18 (27°40'12" N, 85°56'58" E)
Ball-up area	AP-19 (27°40'12" N, 85°56'58" E)
Building or house	AP-20 (27°40'12" N, 85°56'58" E)
Feeder, chimney	AP-21 (27°40'12" N, 85°56'58" E)
School, Post office	AP-22 (27°40'12" N, 85°56'58" E)
Hospital, Health post	AP-23 (27°40'12" N, 85°56'58" E)
Cemetery	AP-24 (27°40'12" N, 85°56'58" E)
Temple or Shiva, etc.	AP-25 (27°40'12" N, 85°56'58" E)
Monastery	AP-26 (27°40'12" N, 85°56'58" E)
Monastery	AP-27 (27°40'12" N, 85°56'58" E)
Transshipment, Petroleum, etc.	AP-28 (27°40'12" N, 85°56'58" E)
Tee or cattle junction	AP-29 (27°40'12" N, 85°56'58" E)
Forest	AP-30 (27°40'12" N, 85°56'58" E)
Burnt, Grass, etc.	AP-31 (27°40'12" N, 85°56'58" E)
Swampy	AP-32 (27°40'12" N, 85°56'58" E)
Lake, pond or water tank	AP-33 (27°40'12" N, 85°56'58" E)
Shrine	AP-34 (27°40'12" N, 85°56'58" E)
River	AP-35 (27°40'12" N, 85°56'58" E)
Cave, Ditch	AP-36 (27°40'12" N, 85°56'58" E)
Dam, Shute, etc.	AP-37 (27°40'12" N, 85°56'58" E)
Water tank or well, etc.	AP-38 (27°40'12" N, 85°56'58" E)
Stone and other area	AP-39 (27°40'12" N, 85°56'58" E)
Archeological	AP-40 (27°40'12" N, 85°56'58" E)
Ferry, foot, etc.	AP-41 (27°40'12" N, 85°56'58" E)
Water tank, well, water tank	AP-42 (27°40'12" N, 85°56'58" E)
Spring, Dam, etc.	AP-43 (27°40'12" N, 85°56'58" E)
Transshipment, etc.	AP-44 (27°40'12" N, 85°56'58" E)
Boundary post, Spot height	AP-45 (27°40'12" N, 85°56'58" E)
Force or wall	AP-46 (27°40'12" N, 85°56'58" E)
Water canal	AP-47 (27°40'12" N, 85°56'58" E)
Intermediate culture	AP-48 (27°40'12" N, 85°56'58" E)
Supplementary contour	AP-49 (27°40'12" N, 85°56'58" E)
Contour	AP-50 (27°40'12" N, 85°56'58" E)
Depression by	AP-51 (27°40'12" N, 85°56'58" E)
Depression by	AP-52 (27°40'12" N, 85°56'58" E)
Salt (L), Large, Small	AP-53 (27°40'12" N, 85°56'58" E)
Rocky, Large, Small	AP-54 (27°40'12" N, 85°56'58" E)
Cut, rock, etc.	AP-55 (27°40'12" N, 85°56'58" E)
Quarry, gravel or clay pit	AP-56 (27°40'12" N, 85°56'58" E)
International boundary	AP-57 (27°40'12" N, 85°56'58" E)
National boundary	AP-58 (27°40'12" N, 85°56'58" E)
Village boundary	AP-59 (27°40'12" N, 85°56'58" E)
Village boundary	AP-60 (27°40'12" N, 85°56'58" E)
Village boundary	AP-61 (27°40'12" N, 85°56'58" E)
Village boundary	AP-62 (27°40'12" N, 85°56'58" E)
Village boundary	AP-63 (27°40'12" N, 85°56'58" E)
Village boundary	AP-64 (27°40'12" N, 85°56'58" E)
Village boundary	AP-65 (27°40'12" N, 85°56'58" E)
Village boundary	AP-66 (27°40'12" N, 85°56'58" E)
Village boundary	AP-67 (27°40'12" N, 85°56'58" E)
Village boundary	AP-68 (27°40'12" N, 85°56'58" E)
Village boundary	AP-69 (27°40'12" N, 85°56'58" E)
Village boundary	AP-70 (27°40'12" N, 85°56'58" E)
Village boundary	AP-71 (27°40'12" N, 85°56'58" E)
Village boundary	AP-72 (27°40'12" N, 85°56'58" E)
Village boundary	AP-73 (27°40'12" N, 85°56'58" E)
Village boundary	AP-74 (27°40'12" N, 85°56'58" E)
Village boundary	AP-75 (27°40'12" N, 85°56'58" E)
Village boundary	AP-76 (27°40'12" N, 85°56'58" E)
Village boundary	AP-77 (27°40'12" N, 85°56'58" E)
Village boundary	AP-78 (27°40'12" N, 85°56'58" E)
Village boundary	AP-79 (27°40'12" N, 85°56'58" E)
Village boundary	AP-80 (27°40'12" N, 85°56'58" E)
Village boundary	AP-81 (27°40'12" N, 85°56'58" E)
Village boundary	AP-82 (27°40'12" N, 85°56'58" E)
Village boundary	AP-83 (27°40'12" N, 85°56'58" E)
Village boundary	AP-84 (27°40'12" N, 85°56'58" E)
Village boundary	AP-85 (27°40'12" N, 85°56'58" E)
Village boundary	AP-86 (27°40'12" N, 85°56'58" E)
Village boundary	AP-87 (27°40'12" N, 85°56'58" E)
Village boundary	AP-88 (27°40'12" N, 85°56'58" E)
Village boundary	AP-89 (27°40'12" N, 85°56'58" E)
Village boundary	AP-90 (27°40'12" N, 85°56'58" E)
Village boundary	AP-91 (27°40'12" N, 85°56'58" E)
Village boundary	AP-92 (27°40'12" N, 85°56'58" E)
Village boundary	AP-93 (27°40'12" N, 85°56'58" E)
Village boundary	AP-94 (27°40'12" N, 85°56'58" E)
Village boundary	AP-95 (27°40'12" N, 85°56'58" E)
Village boundary	AP-96 (27°40'12" N, 85°56'58" E)
Village boundary	AP-97 (27°40'12" N, 85°56'58" E)
Village boundary	AP-98 (27°40'12" N, 85°56'58" E)
Village boundary	AP-99 (27°40'12" N, 85°56'58" E)
Village boundary	AP-100 (27°40'12" N, 85°56'58" E)

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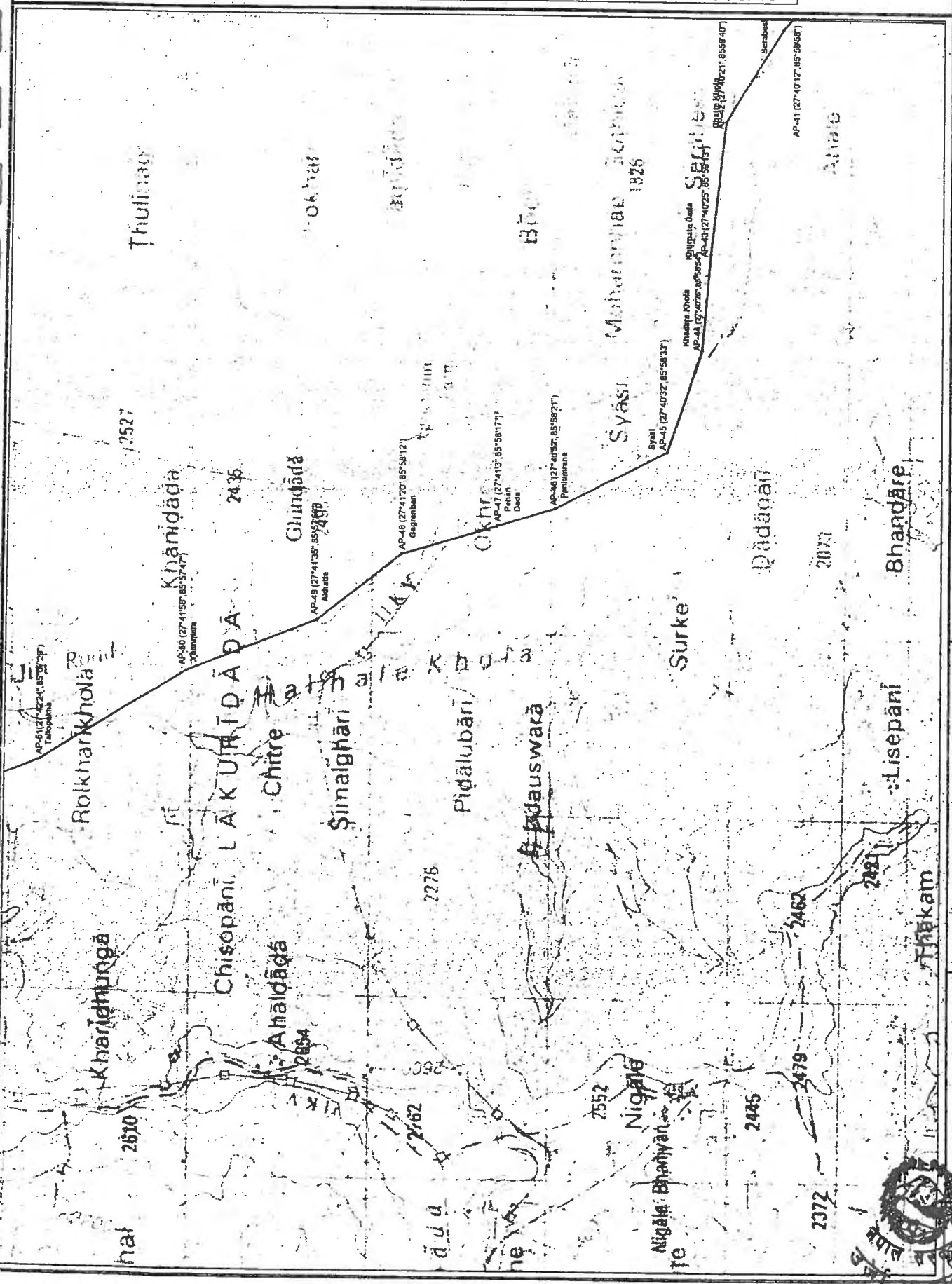
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DATE: June, 2012

Title
Route Alignment Plan

NEW KHIMTI- BARHABISE 400KV
TRANSMISSION LINE SURVEY

NEPAL ELECTRICITY AUTHORITY
ENGINEERING SERVICES
PROJECT DEVELOPMENT DEPARTMENT

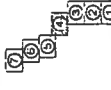
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GRID DEVELOPMENT
220KV/400 KV TRANSMISSION LINE CONSTRUCTION DEPT.



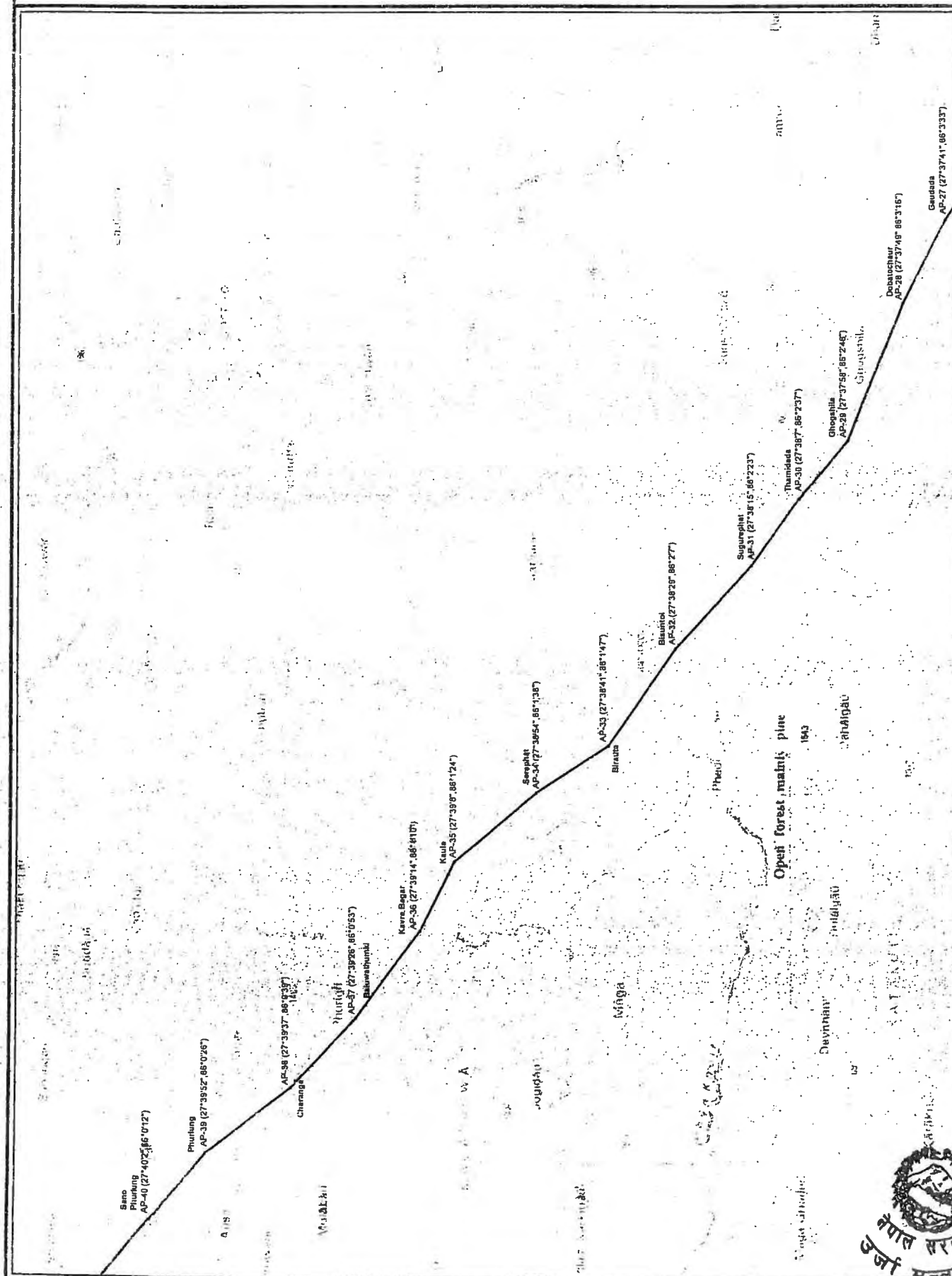


LEGEND	
Highway with Bridge	
Feeder Road with Bridge	
District Road with Bridge	
Other Road with Bridge	
Canal Road with Bridge	
Major Road with Bridge	
Minor Road with Bridge	
Road under construction	
Railway line	
Ball-up area	
Building or house	
Factory, Damery	
State Post office	
Hospital, health post	
Cemetery	
Temple or Shiva, Mah	
Mosque, Church	
Orchard, Nursery	
Uncultivated, wasteland, New	
Tree or coffee plantation	
Forest	
Grass, Grass, Barren	
Swamp	
Clack, pond or water tank	
Stream	
River	
Canal, Ditch	
Dam, Submergence	
Road built up from old	
Sand and gravel area	
Apartment	
Ferry, Taxi, Bus, etc.	
Road up, with, New Road	
Spring, Date any place	
Transportation, Earth road	
Mountain peak, Spot height	
Fence or wall	
new contour	
Intermittent contour	
Supplementary contour	
Embankment	
Celling	
Depression by	
Depression Sand	
Sea cliff, Ledge, Sand	
Rocky Ledge, Small	
Cliff, rock, etc.	
Quarry, gravel or clay pit	
International boundary	
District boundary	
VCZ/Municipality boundary	
MC Name	
Reduction/Increase lower	
Transformation factor	
20 m transformation line	
100 m transformation line	

Sheet Index

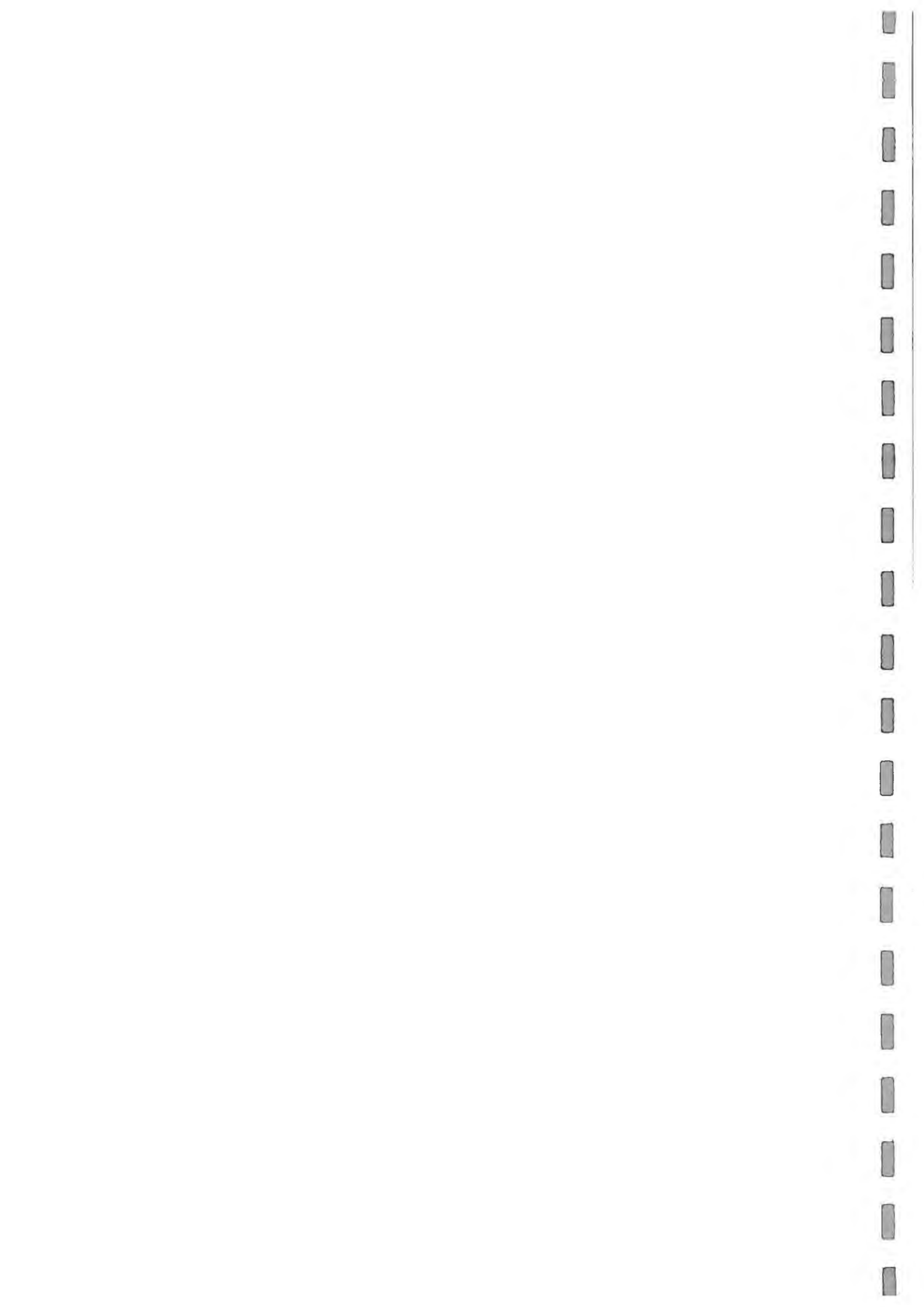


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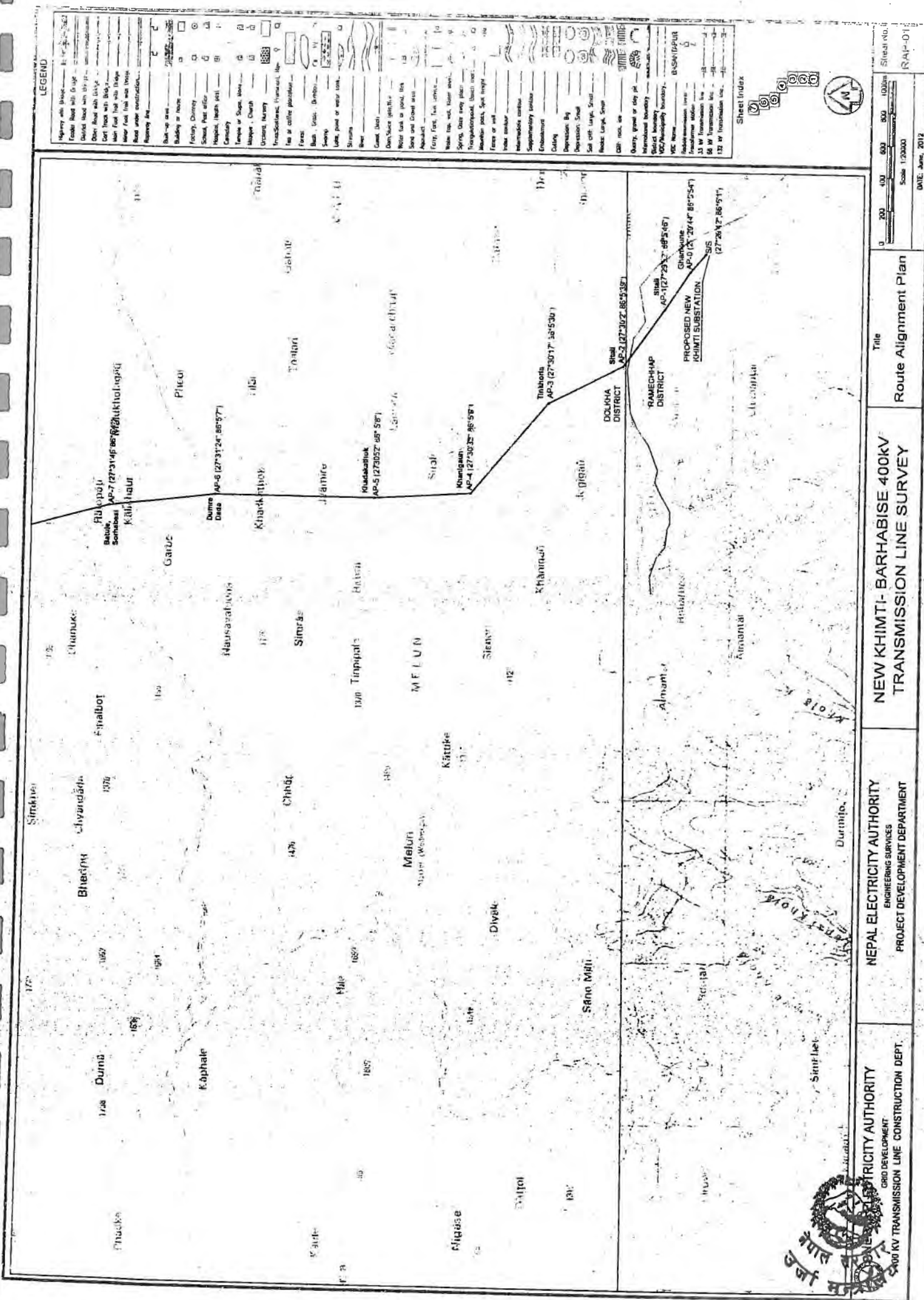
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2.4 Access to the Project

Some sections of the Tanakoshi-Kathmandu 400 kV T/L Project is accessible by Araniko highway, Barhabise highway, Jiri highway, Chautara highway and Manthali highway. The initial stretch of the alignment from proposed Substation site of New Khimti at Ghumaune village, Phulasi VDC of Ramechhap district up to Pawati VDC of Dolakha district is accessible by Manthali highway. Some stretches in between are located at higher altitudes and are not easily accessible. The end stretch of the alignment in Mulpani, Kathmandu is accessible close proximity to existing road Jorpati to Sankhu and then to Nagarkot.

2.5 Project Components

The Project consists of following components:

2.5.1 Sub-stations

Four substations are proposed –i) Mulpani Substation at Mulpani VDC of Kathmandu District, ii) Halade Sub-station at Nanglebhare VDC of Kathmandu District, iii) Barhabise Sub-station at Barhabise VDC of Sindhupalchowk District and iv) Khimti Substation at Phulasi VDC of Ramechhap district. Each of these sub-stations shall acquire approximately 5 ha of land.

2.5.2 Transmission Line Alignment

The proposed transmission line will start from the Khimti substation located at Ghumaune village, Phulasi VDC of Ramechhap district and passes through various VDCs of Dolakha district and terminates at the proposed sub-station at Barhabise Bazaar of Barhabise, Sindhupalchowk district. After Barhabise hub site, the transmission line alignment again passes through several VDCs of Sindhupalchowk, Kavrepalanchok, Bhaktapur and terminate at Halede substation of Kathmandu district and then again crossings VDCs of Bhaktapur and Kathmandu district finally terminates to the proposed Mulpani substation at Mulpani VDC of Kathmandu district. The proposed substation is accessible from the Jorpati and Mulpani. The transmission line route alignment map has been presented in Figure-2.2.

2.6 Delineation of Project Impact Area

The study area is defined as the project area consisting of the alignment as well as the area that will be impacted due to the construction and operation of the project. The project impact area that will be considered during IEE study has been defined as follows:

- **Direct Impact Area (DIA):** This consists of 46 m Right-of-Way (RoW) comprising 23m on each side of the center line of the transmission line alignment of 100 km. Thus, the settlement area, forests or other vegetation and places having built up infrastructures or facilities that fall within the RoW constitute the 'Direct Impact Area' of the project. On the basis of spatial coverage this area is also termed as High Impact Area (HIA).



- **Indirect Impact Area (IIA):** This consists the area within 100m of stretch from the center point of the transmission line. Any built-up community infrastructures and facilities, forests, etc within 100 m of stretch will be studied in this impact area. This area is also termed as Moderate Impact Area (MIA).

2.7 Construction Planning

The implementation of the proposed project comprises construction of a new 400 kV transmission line. It comprised of foundation and erection of transmission towers, wire stringing, testing and commissioning of 400 kV T/L. The estimated years of project completion is 3.5 years. Implementation will consist of a 6 month pre-construction phase and 3 years construction and commissioning phase.

The construction planning does not match with the completion of the Upper Tamakoshi Hydroelectric Project (456MW). The power of Tamakoshi shall be evacuated from Tamakoshi to Khimti by Gongar-Khimti 220 kV T/L which is currently under construction. From Khimti, the power shall be connected to national grid by Khimti-Dhalkebar 220 kV T/L and Khimti-Lamosanghu 132 kV T/L until the Tamakoshi-Kathmandu 220 kV T/L is constructed which directly evacuates power from Khimti to nearest and largest and biggest load centre-Kathmandu.

2.7.1 Construction Method

Due to the linear nature of the construction works, smaller storage facilities shall be built at appropriate locations along the transmission line alignment. These details shall be worked out during the IEE. The linear nature of the transmission line construction suggests that the construction work will be carried out by manually, where possible, for each location in various works such as land clearing, excavation, concreting, transporting tower and other materials.

Logistics support will be provided with the temporary establishment at appropriate location in the vicinity of the existing communities along the transmission line alignment. Since the construction of transmission line towers require clearing and excavation of fairly small areas at tower locations, the construction works will not require spoil dumping sites. The spoils will be filled up and compacted in the tower base area. No permanent access road needs to be constructed to tower site from the existing road head. Only the existing roads and tracks will be used for the construction and maintenance where available. The materials required for civil construction works related to the transmission line and substation will be:

- a. Steel reinforcement
- b. Cement
- c. Coarse aggregate
- d. Fine aggregates (sand)

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

2.7.2 Requirement of Workforce

Local people those are affected by the project implementation will be encouraged for the employment. Local skilled, semi skilled and unskilled labor will be used for the construction and the transportation of the material as far as possible. Altogether about 300 people will be deployed in the construction of the project, which includes 160 unskilled, 90 semi skilled and 50 skilled human resources.

2.7.3 Project Implementation Schedule

The estimated completion period of the project is 42 months which includes 6 months pre construction phase and 36 months construction and commissioning phase.

The construction work of the transmission line will be carried out during the month October to May when ground conditions are essentially conducive to allow easy movement of materials and construction towers. Construction activities during rainy season (June–September) will be restricted to the stringing of conductor. However, construction of the substation can be carried out throughout the year.

Chapter 3

DATA REQUIRED AND METHODOLOGY FOR DATA COLLECTION

3.1 Type of Data

Primary and secondary data shall be acquired on physical, biological, and socio-economic and cultural environment of the project area for IEE study. Primary information shall be obtained by field visit whereas secondary information by consulting the project maps, survey report and other related document. The data of the core project area or direct impact zone shall be site specific and quantitative. Information on project affected VDCs shall also be collected. Following are the types of data to be collected on physical, biological and socio-economic and cultural environment.

3.1.1 Physical Environment**3.1.1.1 Physiography and Topography**

Physiographic zone of the project area, characteristic physiographic features along T/L route alignment, altitudinal variation, topography- mountain, valley, slope etc.

3.1.1.2 Geology and Soil

Characterization of geomorphic zone of the project area, seismicity, surface geology along the T/L alignment, rock type, major soil types, slope stability, erosion and landslides in the project area.

3.1.1.3 Climate

Characterization of climatic zone of the project area, seasonal variation, annual rainfall and precipitation, temperature variation.

3.1.1.4 Watershed and Drainage

Major River crossings and its tributaries, their nature and type, along the proposed alignment.

3.1.1.5 Land Use Pattern

Total land requirement, existing land use with area and percentage, changing trends, particular land use along the proposed route alignment with alternatives.

3.1.1.6 Land stability and Erosion

Land stability, major land slide sites, soil erosion, type of erosion, risk and vulnerable sites in the project area and along proposed T/L alignment.

3.1.1.7 Pollution

Land, water, air and noise pollution in the project area, their sources and degree. Spoil materials: Total volume, type, volume to be used for construction, disposal volume and other.

3.1.2 Biological Environment

Characterization of bio-climatic zone, species and forest type of the project area, forest management practice, forest categories by management- community forest, government forest etc. along the proposed TL alignment, community forest users group (CFUG), estimated number of trees and wood volume along the RoW, other data as per given tables in Annex-II.

3.1.2.1 Flora

Floral diversity of the project area, dominant species, density, non timber forest product (NTFP), ethno-botanical use. The data from forest sampling shall be quantitatively analyzed for frequency, density, basal area, relative dominance, Importance Value Index (IVI) and estimated wood volume. The aforementioned parameters were calculated by using the following formula:

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

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

The basal area is the trunk cross-sectional area. The basal area of each of the forest component was calculated on the basis of DBH.

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

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

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

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

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

$$\text{IVI} = \text{RF} + \text{RD} + \text{Rdom}$$

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

$$\text{Wood volume of standing trees} = 1/2 \times \text{BA} \times \text{Height}$$

3.1.2.2 Fauna

Major wild species of mammals, birds and reptiles in the project area, their habitat, occurrence, migration, illegal hunting.

3.1.2.3 Rare, Endangered and Threatened Species

Rare, endangered and threatened species of plant and animals in the project area, presence of these species along the TL alignment and its immediate surroundings, overall conservation status of wildlife in and around the project area.

3.1.3. Socio-economic and Cultural Environment**3.1.3.1 Demography**

Population, male/female ratio, population- age group wise, life expectancy, no. of household, household size, population growth rate, population density etc.

3.1.3.2 Settlements

Settlement pattern- scattered or aggregated, in uphill or lowland, name of major settlements in vicinity of the proposed alignment, average walking distance between settlements, growing settlements.

3.1.3.3 Ethnicity

Ethnic groups, dominance/minority, ethnic composition, vulnerable community and marginalized group of the project area.

3.1.3.4 Language

Languages in the project area, lingua franca, number of people speaking, script, literature and media of local language.

3.1.3.5 Religion

Religion in the project area, number of religion followers, religious harmony/influence.

3.1.3.6 Festivals

Festivals in the project area, festive seasons, their importance.

3.1.3.7 Archeological, Historical and Religious Sites

Existing such site, their location, distance to the proposed TL alignment/substation, their importance, fame of area- local/regional, conservation status.

3.1.3.8 Migration

Migration pattern- in/out, seasonal/permanent, causes of migration, impact of migration in population dynamics of local area.

3.1.3.9 Gender Aspect

Women's right- property and participation, privilege, violence, disparity, polygamy/polyandry, child marriage, human trafficking, any other social evils.

3.1.3.10 Law and Order Situation

Crime and violence, major incidents, major types of crime, causes and trends of crime and violence, local conflict for resources, honor etc, traditional conflict resolution system, police post, legal access etc.

3.1.3.11 Occupation

Major occupation of local people in the project area, local people in their occupation by numbers/percentage, traditional occupation, local employment opportunities, economically active people by percentage.

3.1.3.12 Agriculture

Available agricultural land, cropping pattern, irrigation facility, productivity, farming trends- traditional/modern, average land holding size, food security, market access for agro-products, live stock, support to farmers etc.

3.1.3.13 Trade and Industries

Market centers in the project area, trading commodities, trading routes, exports to local/regional/foreign market, local craftsmanship, cottage industries, potential sector/products/resources identified in the project area, tourism and other service sector etc.

3.1.3.14 Income Level

Average income level of local people, sources of income, poverty level (in percentage) in District/VDCs, poverty by ethnic group wise.

3.1.3.15 Education and Literacy

Educational institutions in the project area, enrolment rate, dropout rate, literacy- male and female, literacy in ethnic/group wise, non formal education program etc.

3.1.3.16 Health and Sanitation

Health institutions in the project area, health facilities, common disease, child/mother mortality rate, malnutrition, drinking water supply, use of latrine, general cleanliness, hygiene awareness etc.

3.1.3.17 Road and Transportation

Road network in the project area, public transportation, road access to surrounding project area, means of transportation, transportation cost, impact of road construction in rural setting etc.

3.1.3.18 Energy

Electrification in the project area, means of electrification, fuel sources for household use, access to fuel wood, local price of fuel (firewood, kerosene) etc.

3.1.3.19 Communication and Other Facilities

Telephone (landline/wireless) network in the project area, accessibility to internet and other means of modern communication (television, radio, newspaper).

3.1.3.20 Development Initiative/Activities in the Project Area

Development projects of local level (district/VDC), regional and national level in the project area, nature and size of the projects, its future impact in the project area, development issues/ initiatives / activities in the local area.

3.2 Data Collection Method

The following approaches will be adopted in order to collect data mentioned above:

3.2.1 Desk study and Literature Review

Available secondary information and literature in the form of reports and maps will be collected and reviewed. Some of the important literatures to be reviewed include:

- District and VDC profile;
- Census data published by the Central Bureau of Statistics, GON;
- Technical report of the proposed Tamakoshi-Kathmandu 400 T/L Project;
- Environmental study reports of similar kind of high voltage T/L project;
- Topographic map of the project area;

These required data and information will be collected from District Development Committee (DDC), VDC offices and other line agencies. Internet will be also used for retrieving the data and information during the IEE study of this proposed project whenever required.



3.2.2 Field Study

The ESSD team consisting of IEE expert/team leader, Environmentalist, Statistician, Sociologist and support staffs will carry out detailed field study after the approval of the ToR. During such detail field study, data and information on physical, biological, socio-economic and cultural environments will be collected and documented so as to create a reliable baseline database for impact assessment. Walkover survey will be employed for generating the physical database including interviews with knowledgeable local persons.

The EPR, 1997 and other environmental provisions govern the methodology of the IEE study. For the biological database, vegetation surveys will be carried out and plant species in the impact area shall be identified. Unidentified plant specimens shall be collected and identified by consulting relevant literature. Ethno-botanical information shall be compiled using both primary and secondary sources. The forest type and management practices along the proposed T/L route shall be studied and identified. Forest sampling shall be done by making suitable quadrat in the forests through which the proposed alignment passes. Forest loss along the T/L alignment shall be estimated. The wildlife in the area shall be identified mainly by field observations, discussions and literature review, indirect evidences and key informant surveys.

Information on socio-economic and cultural environment will be collected through observations, group discussions, public consultation and key informants. Sampling household's questionnaire (Annex III) and VDC level checklist will be used to collect primary data from the affected households and the VDC offices (Annex III). Besides application of accepted tools of impact assessment, suggestions and knowledge of the local people will also be taken into consideration for impact evaluation, proposing mitigation and monitoring plans.

3.2.3 Data Synthesis

Primary and secondary information shall be analyzed qualitatively and quantitatively. Differences detected by the analysis, field observation and circumstantial evidences shall form the basis for recommending and designing environmental enhancement and mitigation measures, monitoring and evaluation schemes and management plan. Accordingly, implementing institutions shall be identified and coordination shall be arranged where required.

3.3 Data Analysis

For estimating the basal area, wood volume and biomass of the pole size and timber size tress along the T/L alignment, the trees shall be individually enumerated, identified, with their local names and botanical nomenclatures and then their circumference at the breast height will be taken. The height of the few sample trees shall be taken with the help of measuring tape of



50m length. Similarly, the "Volume of forest trees of Nepal" shall be referred to estimate the volume up to 10 cm top diameter with bark. Similarly, the fallen trees without their branches and foliage the quarter-girth formula shall be used relating to Rules 17 and 18 of the Forest Act, 2049.

Wood volume, basal area and biomass calculation of trees to be cut will be calculated by using some standard formula. The total basal area of the trees to be cleared will be calculated. Then the average density of the basal area per hectare shall be calculated as total basal area (m^2) divided by total area of land (ha). For determining the wood volume, basal area x height formula will be used. The green weighty biomass will be calculated by referring the "Green weight Biomass and Volume Table".

The total biomass will be obtained by adding the green weight of stem, foliage and branch for each tree of individual species corresponding to their diameter at breast height. The valuation of standing biomass will be calculated as per the Forest Act, 2049. Moreover, the loss of forest species, its type, volume and number of trees to be cut, etc shall be identified and calculated.

Appropriate computer software will be used for the analysis of socio-economic data to be collected during households' survey at the project affected site.

3.4 Identification, Evaluation and Prediction of Impact

The main basis for the identification of the impacts will be the baseline information, which will be carefully collected. Simple checklists, questionnaires, matrices and expert judgment will be used to identify the impact. The Primary and secondary data will be analyzed qualitatively and quantitatively. Qualitative data analysis will employ the checklist (tabulation, cross-checking, circumstantial evidences, case studies and inferences) and matrix methods for impact predication.

The emphasis of the analysis will be to establish relationships between environmental changes (issues and alternatives) with or without the proposed project. The differences detected by the analysis, field observation and circumstantial evidences will form the basis for recommending and designing the environmental enhancement and mitigation measures, monitoring and evaluation schemes, and management plan. Consequently, the implementing institutions will be identified and amongst them will be arranged wherever necessary.

The impact prediction will be done using the GIS Maps, expert judgment and other field experimental methods. Econometric Models will be used if possible while assessing and predicting the impacts. The impacts will be predicted over a specified period and within defined

area and to collect their views. The impacts will be predicted in terms of Magnitude, Extent and Duration. Magnitude will be further classified in terms of high (H), medium (M) and low (L). Extent will be classified in terms of site specific (SS), local (L) and regional (R). Duration will be classified in terms of long term (LT), medium term (MT) and short term (ST).

3.5 Public Involvement

A team of experts visited the project site for field investigation during BS.2070/09/02 to BS.2070/09/16 and BS. 2071/01/19 to BS.2071/01/26 to collect the baseline information of the project area and to identify the potential environmental impact areas and the pertinent issues.

During the field visit the team met the local stakeholders and discussed with some key persons. Meetings were mainly focused on issues likely to arise due to implementation of the project, existing environment of the project area and views/concerns of stakeholders. The views, opinions, suggestions and information received from the participants were documented for incorporation in the ToR. The list of participants during the public meeting has been attached in Annex-IV. Besides, consultation with stakeholders, project affected families, government officials, etc. have been done to obtain the valuable suggestions. The list of contacted persons is presented in Annex-V.

During IEE study, public consultation will be carried out to involve the public in all the activities to be carried out in the project area. The study shall document public issues and make public participation during the IEE process. Local and district level government institutions/bodies, local user groups, local NGOs and CBOs, etc. shall be consulted during IEE report preparation. The public consultation shall mainly focus on the findings of the IEE, building up the awareness about the project plans and programs, building up the mutual consensus on the implementation of the project, identification of key issues and consideration of these issues in the IEE report and in the project design.

Public views, options and relevant issues raised during the consultation will be recorded. In addition to the aforementioned plan, the IEE team perform other public consultation according to the requirements, situations and demands of the stakeholders. The study will also be analysed the possible alternatives of project as per EPR, 1997.

The draft IEE report will be made available to stakeholders in corresponding VDCs and DDCs to take feedback and suggestions regarding the procedure adopted and implemented in the project. The comments and suggestions from stakeholders will be incorporated while preparing the IEE report.

3.5.1 Consultation of the Concerned Agencies

The following organizations will be consulted during the preparation of the IEE report.

Central Level Agency: Ministry of Energy, Ministry of Forest and Soil Conservation (MoFSC), Department of Electricity Development (DoED), and Department of Forest.

District Level Agency: District Development Committee, District Administrative Office, District Agriculture Office, District Health Office, District Soil Conservation Office, District Forest Office, and other concerned district level agencies.

Local Level Agency: Village Development Committees, Community Forest Offices, Health/sub-health posts, non-governmental organizations, Community Based Organization, etc.

3.5.2 Public Notice

As per EPR, 1997, local people and stakeholders will be notified by publishing a public notice in national daily newspaper. Fifteen days notice will be given to local people to raise concerns or issues regarding the IEE report in written form. Deed of Public Inquiry ("Muchulka") will be collected from local concerning bodies. The comments raised by local people/stakeholders/institutions will be incorporated in the IEE report. The public notice will be published after the approval of ToR from Ministry of Energy and preparation of draft IEE report as well. A copy of the notice will be pasted at the DDCs office, VDCs offices, local schools, clubs, health posts, local NGOs, etc. If the project requires land from government forest/community forest or trees are needed to be cut down from government/community forests, then comments and suggestions from them will be attached in the IEE report along with their recommendation letters.

Chapter 4

EXISTING ENVIRONMENTAL CONDITION

The 100-km long proposed Tamakoshi-Kathmandu 400 kV T/L Project is located in the mountain and chure area of the Ramechhap, Dolakha, Sindhupalchok, KavrePalanchok, Bhaktapur and Kathmandu districts of Central Development Region of Nepal. The existing environment of the project area with regard to physical, biological and socio-economic & cultural aspects are presented in subsequent sub-chapters.

4.1 Physical Environment

4.1.1 Topography and Land use

The proposed line traverses an undulated landscape that is dominated by terraced cultivated land and forest of the Lesser Himalayan Region. The altitude of the alignment varies from approximately 638m to 2593m for the first section of the transmission line between New Khimti substation and Barhabise substation (figure 4.1).

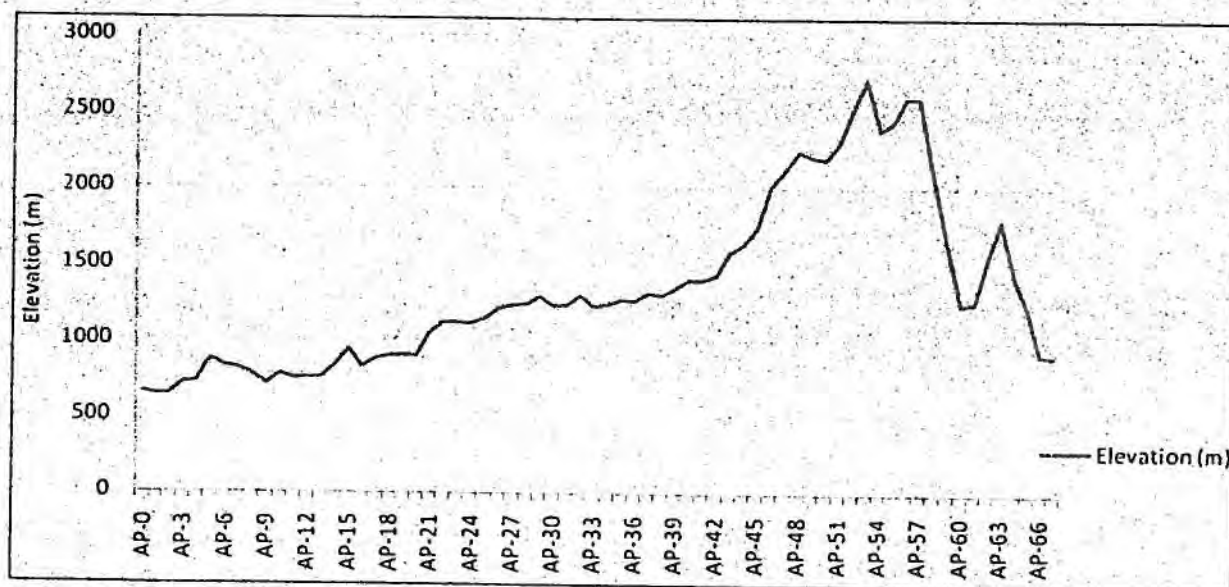


Figure 4.1: Elevation Profile of the first section of the T/L Alignment

For the transmission line of 400 kV capacity, the right of way (RoW) is defined as 23m on either side from the central line. This means that a total of 455.5 ha of land will be acquired by the project as RoW. Since the tower pads are also constructed Land to be acquired under RoW including area of tower pads.

Out of the total land to be acquired for RoW, majority of the land is cultivation land 298.3 ha (65.5%) followed by forest land 145.3 ha (31.9%) which includes forest, bush and grassland and remaining as others 11.9 ha including sand, water-body, cliff, etc (Table 4.1).

Table 4.1: Land requirement for RoW of the T/L Project

S. No.	Landuse	Area (ha)	Percentage
1.	Cultivation	298.3	65.5
2.	Bush	44.9	9.9
3.	Forest	82.6	18.1
4.	Grass	17.8	3.9
5.	Sand	8.1	1.8
6.	Water-body	3.7	0.8
Total		455.5	100.0

Source: GIS analysis

4.1.2 Geology and Soil

Physiographically, the whole stretch of the proposed project lies in the Lesser Himalayan Region. Geologically, the alignment runs through schist and gneiss rock types. The soil types encountered along the alignment are alluvium deposits, loose soil with gravel mixed and soft rocks.

4.1.3 Erosion and Land Stability

The site observation of the corridor revealed that the line traverses through undulated topography. No major unstable areas were observed along the alignment. The Angle Points have been located on stable ground.

4.1.4 Climate

The transmission line corridor lies in the Sub-tropical Climatic Zone. Table 4.2 shows the annual maximum and minimum temperature and rainfall recorded for the project affected districts.

Table 4.2 Precipitation and Temperature of Project Affected Districts

S. No.	District	Av. Annual Temperature (°C)		Rainfall (mm) (Average)
		Maximum	Minimum	
1	Ramechhap	21	11	2055
2	Dolakha	19	8	2043.5
3	Sindhupalchowk	32.5	5	1615
4	Kavrepalanchowk	21.8	12.2	1391
5	Bhaktapur	32	-2	1385
6	Kathmandu	25.9	13.1	1318

Source: District profile of respective district.

4.1.5 Watershed and Drainage

The watershed of the project area is drained mainly by the snow-fed river Tamakoshi, Sunkoshi and Bhotekoshi Rivers and rain-fed rivers like Milti khola, Ladke Khola, Mahadev Khola,

Charnawati Khola and Manohara Khola. There are also other tributaries which crosses the T/L corridor. The monsoon influences the hydrology of the rivers and streams of the area.

4.1.6 Air and Water Quality and Noise levels

The proposed T/L traverses mainly through rural settings. As the area passes through rural settings, the status of air quality is satisfactory. In the urban setting like Barhabishe and Mulpani sections where the line traverses gravel roads and foot trail, dust particles were observed due to the movement of public vehicles.

4.1.7 Major Crossings

The major river crossing of proposed T/L includes Bhotekoshi River, Sunkoshi River, Tamakoshi River, Chandrawati Khola, Kothe Khola, Ghette Khola, Chandane Khola, Baluwa Khola, Ahdheri Kholsi, Simpani Khola, Phadke Khola, Okhle Khola, Indrawati River and Mahanhara Khola.

This line also crosses the Upper Chaku A 132 kV T/L which lies in the Phulpingkatti, Marming, Ramche, Dhuskun, Mankha to connect to Lamosanghu substation.

In order to ensure that the project does not affect the aviation route, an application has been send to Civil Aviation Authority of Nepal to receive "No Objection Letter". A Copy of such request made by ESSD is attached in Annex VI.

4.2 Biological Environment

The ecological zonation of the proposed 100 km long T/L project area covers tropical, sub-tropical and some patches of temperate vegetation zone in Central Nepal. The districtwise total land area, total forest area and number of community forests (CFs) along the T/L alignment in these districts are as follows:

Table 4.3: Forest Status of Project Affected Districts

S. No.	District	Total Land Area (ha)	Forest Area (ha)	Forest Area (%)	Total No. of CFs	CFs along T/L Alignment
1.	Ramechhap	156,432	78,836	50.39	418	2
2.	Dolakha	214,287	101,500	47.37	412	35
3.	Sindhupalchowk	248,827	101,608	40.83	519	45
4.	Kavrepalanchowk	140,486	73,801	52.53	529	20
5.	Bhaktapur	11,900	2,134.8	17.9	61	10
6.	Kathmandu	39,500				4

(Source: DFO of respective districts; Field Data)

4.2.1 Vegetation and Forest Resources

The natural vegetation and forest ecosystem in the project area consist of mainly Pine and Sal mixed forest and sub-topical mixed hardwood forests. The Sal Forest is dominant in the lower slope especially in the project area of Dolakha, Sindhupalchowk and Kavre districts. Most of the transmission line passes through ridges. The major tree species found in the project area are Sal (*Shorea robusta*), Chilaune (*Schima wallichii*), Khotasalla (*Pinus roxburghii*), Mauwa (*Engelhardia spicata*), Saj (*Terminalia alata*), Simal (*Bombax ceiba*), Kutmero (*Litsea monopelata*), Bot Dhayero (*Lagerstroemia pariflora*), Chatiwon (*Alstomia* sp.), Amala (*Phyllanthus emblica*), Gogan (*Saurauia nepaulensis*), Siris (*Albizia* sp.), etc. Bhalayo (*Semecarpus anacardium*), Dhayero (*Woodfordia fruticosa*), Dhursul (*Coleobrookea oppositifolia*) etc. are the major shrub species in the project area.

4.2.2 Community Forest

The preliminary field visit and study has estimated that a total of 116 community forests (CFs) will be affected by the project. These 116 CFs have a total area of about 6296.47 ha out of which only 145.3 ha will be acquired by the project. Among total of 116 CFs falling under right of way (RoW) along the entire alignment of the transmission line, 2 number of community forests are in Ramechhap district, 35 CFs are in Dolakha, 45 CFs are in Sindhupalchowk, 20 CFs are in Kavrepalanchowk, 10 in Bhaktapur and remaining 4 in Kathmandu district. It is estimated that about 145.3 ha of forest land (including 82.6 ha of forest and 44.9 ha of bush-land) will be acquired by the project at Right of Way (RoW). No part of the proposed alignment falls in

National Park, Environmentally Sensitive Area, Protected Area, Buffer Zone and Conservation Area: The following table shows the list of potentially affected CFs.

Table 4.4 Project Affected CFs

District	VDC	Ward	Name of CF	Total area (ha)
Ramechhap	Phulsi	1	Seradevi	105.60
			Sideshwori	130.00
Dolakha	Melung	5	Karna Kali	3.10
		3,4	Rumti Ramche	39.00
		1	Sitalidevi	13.15
	Ghang Sukathokor	2	Paleke Sahukhoria	82.24
	Pawoti	8	Khahare Bhadaure	71.04
		8	Kalinagsthan Simakopatal	4.59
		3	Hatti Dhunga	60.00
		2,3,8	Baluwa Bhumethan	91.81
		6	Mulpani	61.25
		1	Bhakure Dhokebhir	110.36
	Fasku	1	Charnawoti	102.00
	Bhimeshwor Municipality	9	Gahate Bagkhor	4.90
		11,12	Bhir Muni Devithan	6.42
		11	Amale Kharka	7.31
		11	Kuprisalleri	45.45
		9	Mahankal Sahale	35.00
		6	Buda Bhimsen	68.27
		6	Simpani Khahare	128.39
		8	Kamala mai	57.4
		8	Simsagure Birekhorea	31.00
		9	Mathani	39.06
		8	Barshedandapari	32.48
		8	Bichaur	56.00
		8	Sundarimai	10.8
		11	Dhade	19.97
	Magapauwa	5	Bhakare	101.20
		3,4,6	Pokhari	20.37
		2,3,7,9	Pauwa	44.32
		4,6	Ramite	8.02
	Boch	7,8	Dhade Singhadevi	346.25
		6,7	Chhitakunda	30.75
		6	Chitreshwor	2.28
	Lakuridada	1	Napke Yanmara	160.88
		2	Timbure Teensalle	133.25
		9	Setidevi Dadar	368.56
	Dhuskun	3,4,6,8	Aangechaur Chilune Ghari	69.75

Sindhu-Palchowk		2,8	Ratochaurhile	190.93
	Chokati	7	Tunibote Kalleri	85
	Karthali	6	Uneu Danda	16.50
		8,9	Dewali Ban	19.48
		6	Dware Khalde Ban	64.43
	Barhabise	5	Sewashe Okhreni	8.56
		6,7,8,9	Sunkoshi Ban	50.00
		6	Sun Khani Ban	5.93
		6	Bete Chaur Mahila	1.88
		4,5	Dharpa Chyan Danda	11.50
	Ramche	8	Sisneri Ban	38.68
		7	Jogi Khoriya Ban	34.31
		1	Nagi	41.33
		1,2,3,5	Salghari Panighat	25.18
		2,3,6	Ramche Bhiri Ban	45.50
		5	Kabhre Salghari Ban	26.12
	Mankha	6	Sisnedhansar Ban	15.69
		6	Chimling Besi Ban	17.84
		9	Devistan Ban	62.50
		6	Kulain Devi Mahila	0.60
		6	Uteseni Ghare	2.61
		1	Salghari	15.90
		9	Jurethumki	39.34
		2	Phurkesalla	74.11
	Phulpingdanda	6,7,9	Phalante Kalika	50.00
		5	Chanpbote Binjel Ban	30.00
	Kadambas	1,4,6,7,9	Lampate Sal Bisauna	250.00
		6,9	Setidevi Ban	35.82
	Irkhu	1,8,9	Banjhe Kapashe	38.00
		1,2	Rani Pokhari Ban	33.33
		5	Banjh Bisauna	78.22
		3	Sansari Danda Ban	91.68
		1,4,9	Deurali Chyan Danda	39.08
	Thulosirubari	6	Jhyali Khola	7.00
		4,5	Dhappakha	4.04
		4,5	Rolpakha Ban	142.25
		6	Srichhap Deurali	124.64
		1,6	Bhedigoth Dhad Pakha	55.89
		3	Tamakhani	105.83
		4	Deurali Thulochaur	5.45
	Bhotsipa	5,8	Thulitar/ Thulo Ban	123.00
		2,3	Golmadevi	66.85
		3	Rani Odar	10.12

		9	Tinpakhe Dabi Ban	105.00
Kavrepalan chowk	Chandeni (Mandan)	1,3	Mandan Bhir Khoriya Karttike Ban	33.25
	Mahadevsthan (Mandan)	9	Baguwa Pakha	30.00
		9	Ratomate Dablynga Pakhero	10.25
		9	Ratomate Jhagadpur	20.30
		9	Ratomate Naubise	18.75
		2	Daitar Dude Pakho	25.80
		2	Bokse Ban	111.30
		3	Salleni Baguwa Pakha	65.50
		4,5	Juke Pani Ban	10.25
		3	Baguwa Pakha	15.25
		3	Mahadevsthan Ban	6.55
		9	Jamune Pakha	7.55
	Nayagau (Deupur)	1	Jiri Khimti Darapani Pakha	8.25
		1	Naulo Danda	6.25
		1	Neupane Danda	4.71
		9	Gairi Dara Pakha	14
		8,9	Thuli Chaur Ban	51.33
	(Naldum) Baluwapati	6	Rani Ban	81.75
		5	Batase Ban	43.24
		8	Chisapani Ban	19.67
Bhaktapur	Nagarkot	1,2,3	Yena Danda	34.00
		7,8	Kusum	112.00
		7,8	Lakhane	3.96
	Changunarayan	4	Mane Dada	2.48
		1,2,3,4,5,6	Nayacho Pauwa	2.03
		1,2,6,7,9	Changu Narayan	47.00
	Chhaling	9	Shree Ban	22.04
		9	Jalpa Devi	34.64
		1,2,3,4	Ganga Rani	81.00
		9 & suntol (1-7)	Itali Devi	33.26
Kathmandu	Suntol	9	Bishamvanarayan	107.75
		9	Lambodanda	68.66
		9	Kusum	170.00
	Danchhi	3	Baghdhara	1.36
Total			116	6296.47

4.2.3 Wildlife

4.2.3.1 Mammals

The project area and its surroundings have distinct altitudinal, ecological and vegetation changes between the high hills to the terrain hills, with a great diversity in natural and wildlife

habitats. In the project area only a few species of mammals common Leopard (*Panthera pardus*), Porcupine (*Hystrix indica*), Fox (*Vulpes vulpes*), Rhesus Monkey (*Macaca mullata*), Common langur (*Presbytes entellus*), Shyal (*Canis aureus*), Barking Deer (*Muntiacus muntjack*) etc. were reported during the checklist survey.

4.2.3.2 Birds

Forests, bamboo grooves, agricultural fields, villages, rivers and streams in the project vicinity provide a variety of habitats for different species of birds. However, like the mammals, most birds of the project area are migratory and are not confined to the project area only. The locals informed that the Crow (*Corvus splendens*), House Sparrow (*Passer domesticus*), Kalij (*Lophura leucomelana*), Baj (*Buteo spp.*), Baudai (*Falco tinnunculus*), Ban Kukhura, Cuckoo (*Plantative cuckoo*), Kalij Pheasant (*Lophura leucomelanos*), Suga (*Psittacula cyanocephala*), Dhukur (*Streptopelia chinensis*), Koili (*Surniculus lugubris*), Jureli (*Pycnonotus cafer*), Titra (*Francolinus spp.*), Kalchaudo (*Myophonus caeruleus*), Bakulla (*Bubulcus ibis*), Pani Hans (*Podiceps cristatus*), Lampuchchhre (*Cissa erythrorhyncha*), Haleso (*Treron spp.*), Chibe (*Dicrurus adsimilis*) are the common bird species found in the project area.

4.2.4 Ethno Botany/ Plant Resource Use Pattern

Plants like Sal (*Shorea robusta*) and Saj (*Terminalia alata*) are extensively being used for timber. Almost all the plant species are used for firewood. Leaves of Khanayo (*Ficus sp.*), Ratmati (*Litsea monopelata*), Siris (*Albizia sp.*) Tanki (*Bauhinia spp.*), Tama Bans (*Bambusa sp.*), Bakhre Ghans (*Dendrocalamus sp.*) are used as fodder. Kurilo (*Asparagus officinalis*), Amala (*Phyllanthus emblica*), Titepati (*Artemisia indica*), etc are commonly observed from the higher regions of the project area for marketing. Fruits of Kaphal (*Myrica esculenta*), Ainselu (*Rubus ellipticus*), Amaro (*Spondias pinnata*) and Amala (*Phyllanthus emblica*) are edible fruits reported in the project area. Tree species like Sal (*Shorea robusta*) and Simal (*Bombax ceiba*), are listed as protected species by the Government of Nepal and are found in the project area.

4.3 Socio-economic and Cultural Environment

4.3.1 Settlement Patterns

Settlement patterns are characterized by scattered small villages. Along the transmission line route, settlements are clustered in market centres and growth centres along the roadside. The major settlements falls along the transmission line alignment within the project area are Ghumaune, Sitali, Tinkhoriya, Ratopati, Lose, Dhulebeshi, Gurung gaun Dihi, Kiratechhap, Ghogshila, Serabeshi, Yanmara, Dobate, Bungthali, Unichoor, Khursanibari, Bhorsepha, Chepegaun, Topka, Paharigaun, Dumrichaur, Chimling Besi, Chihandada, Dandaghar, Dulalgaun, Kotdada, Majhigau, Bhaintar, Khantitar, Archale, Duudepakha, Thulichaur, Chaturedada, Naldun, Daksandada, Besitol, Phedi, Chhayabasti, Nayaldada, Manahaphat and Mulpaniphat.

4.3.2 General Introduction of Project Districts

The proposed 400 kV T/L Project is located in six districts namely Ramechhap of Janakpur Zone and Dolakha, Sindhupalchok, Kavrepalanchok, Bhaktapur and Kathmandu of Bagmati zone of Nepal. The total area of these districts is 14,651 sq.km. According to the data of CBS 2011, the total population of the six districts is 31,07,829 with 15,69,561 male and 15,38,268 female which occupies 11.73% of the total population of the country (2,64,94,504). The average population density of six districts is 1263 (persons/km²). There are 7,41,986 households and the average household size of the six districts is 4.37. Similarly, the average literacy rate of the six districts is 70%. The economically active population of Ramechhap, Dolakha, Sindhupalchok, Kavre-palanchok, Bhaktapur and Kathmandu districts are 54.15, 54.75, 56.11, 59.48, 67.72 and 70.19 respectively. The average urban population of six districts is 36% although there is no any municipality in Ramechhap and Sindhupalchok districts (0 urban populations). The demographic Characteristics of the project affected districts are given in Table 4.5.

Table 4.5: Demographic Characteristics of the project affected districts

District	Rame-chhap	Dolakha	Sindhu-palchowk	Kavre-palanchok	Bhaktapur	Kathmandu	Total
Total Population	202646	186,557	287798	381937	304651	1744240	3107829
Male	93386	87003	138351	182936	154884	913001	1569561
Female	109260	99554	149447	199001	149767	831239	1538268
Total No. of HHs	43910	45688	66688	80720	68636	436344	741986
Average HH size	4.62	4.08	4.32	4.73	4.44	4.00	4.37
Population Density (person/km ²)	131	85	113	274	2560	4416	1263
Sex Ratio (Male per 100 Females)	85.5	87.5	92.60	91.9	103.4	109.8	95
Urban Population (%)	—	12.08	—	17.39	54.09	59.69	36
Population below 5 years (%)	7.91	8.44	8.17	7.33	6.51	6.40	7
Elderly Population 75+Years (%)	3.03	3.05	2.73	2.42	1.91	1.51	2
% of Economically active population (15-60 yrs)	54.15	54.75	56.11	59.48	67.72	70.19	60
% of Literacy Rate (6 years & above)	62.24	62.78	59.59	69.8	81.68	86.25	70
Total Area of the Districts (Sq. km)	1546	2191	2542	1396	2560	4416	14651
% of District Population compared with Country's	0.76	0.70	1.09	1.44	1.15	6.58	11.73

Source: CBS 2011.

4.3.3 Population Characteristics of the Project Area

42 VDCs and one Municipality of six districts fall in the transmission line corridor. The total population of the project affected VDCs is 2,27,957 with 1,21,947 males and 1,20,204 females. Similarly, there are 53,441 households in the project affected VDCs. The population and households of the project affected VDCs cover 7.33% and 7.20% of the six districts' population and households respectively. Similarly, the average family size of the project area is 4.27, which is slightly lower than the district household size of 4.37. The table 4.6 shows the demographic characteristics of the project area.

Table: 4.6 Demographic characteristics of the project area

District	VDCs	Population			Total Households (HHs)	Pop. Density (person/km ²)	Sex Ratio (Males per 100 Females)
		Total	Male	Female			
Ramechhap	Phulase	5,733	2,594	3,139	1,284	246	82.64
Dolakha	Melung	3,566	1,596	1,970	836	319	81.02
	Bhedapu	3,705	1,596	2,109	918	201	75.68
	Pawati	4,573	2,049	2,524	1,109	270	81.18
	Ghyang Sukathokar	4,230	1,942	2,288	1,032	207	84.88
	Fasku	4,338	1,877	2,461	1,117	179	76.27
	Magapauwa	2,950	1,339	1,611	780	188	83.12
	Bocha	2,799	1,182	1,617	775	156	73.1
	Lakuridada	3,713	1,734	1,979	924	134	87.62
	Bhimeshwor	22,537	10,489	12,048	6,076	346	87.06
	Kubhinde	3,009	1,447	1,562	693	379	92.64
Sindhupalchok	Maneshwara	3,393	15,771	1,816	789	176	86.84
	Tauthali	2,762	1,255	1,507	776	152	83.28
	Chokati	2,497	1,163	1,334	627	96	87.18
	Piskar	2,286	1,115	1,171	538	182	95.22
	Dhuskun	2,926	1,336	1,590	759	181	84.03
	Karthali	3,347	1,608	1,739	836	128	92.47
	Barhabise	7,117	3,519	3,598	1,683	678	97.8
	Ramche	4,092	2,028	2,064	999	361	98.26
	Mankha	7,752	3,698	4,054	1,860	501	91.22
	Fulpindada	4,802	2,305	2,497	1,054	256	92.31
	Kadambas	3,372	1,472	1,900	834	243	77.47
	Irkhu	3,443	1,555	1,888	751	277	82.36
	Thulo Sirubari	5,987	2,632	3,355	1,331	268	78.45
	Bhotasipa	4,618	2,084	2,534	994	316	82.24

	Sanu Sirubari	3,274	1,462	1,812	779	296	80.68
	Bhimtar	4,526	2,084	2,442	892	416	85.34
Kavrepalanchok	Chandeni	3,265	1,500	1,765	782	343	84.99
	Mahadevsthan	8,166	3,890	4,276	1,873	369	90.97
	Naya gaun	4,417	1,984	2,433	951	346	81.55
	Baluwapati	6,023	2,943	3,080	1,292	295	95.55
	Gairi Bisauni	5,374	2,497	2,877	1,203	689	86.79
Bhaktapur	Nagarkot	4,571	2,198	2,373	973	485	92.63
	Chhaling	8,129	3,851	4,278	1,817	846	90.02
	Chagunarayan	6,211	2,985	3,226	1,374	916	92.53
	Duwakot	10,461	5,321	5,140	2,412	1658	103.52
Kathmandu	Indrayani	3,361	1,658	1,703	717	1278	97.36
	Lapsipedi	5,629	2,751	2,878	1,209	314	95.59
	Nanglebhare	4,520	2,202	2,318	935	215	95
	Daanchhi	11,246	5,697	5,549	2,593	2254	102.67
	Pukhulachhi	2,676	1,298	1,378	596	1939	94.19
	Suntol	4,819	2,351	2,468	1,021	403	95.26
	Mulpani	11,742	5,889	5,853	2,647	3042	100.62
Total		227,957	121,947	120,204	53,441	524	98.57

Source: CBS 2011

4.3.4 Caste/Ethnicity/Religion

The project area is populated by heterogeneous ethnic communities. The major ethnic groups in the project area are Chhetri (24.49%) followed by Tamang (21.64%), Brahmin Hill (17.10%) and Newar (15.79%). Similarly the other ethnic groups residing in the project affected VDCs are Kami (2.69%), Thami (2.33%), Sarki (1.74%), Danuwar (1.73%), Damai Dholi (1.67%), Sanyasi (1.64%), Magar (1.55%), Gharti Bhujel (1.28%) and others (6.35%). The others include Sherpa, Jirel, Rai, Limbu, Gurung, Majhi, Pahari, Thakuri, Dalit, Kalwar, Sunuwar, Chepang, Dhimal, Tharu and Musalman (CBS 2011). The caste group Danuwar is mainly found in Bhimtar VDC of Sindhupalchowk district and Mahadevsthan VDC of Kavrepalanchowk district. The majority of the people in the project area are Hindu followed by Buddha. Similarly, Christianity is also found in some extent in the project area.

4.3.5 Mother Tongue

Nepali (63.56%) is the major language spoken in the project area. After Nepali, Tamang language (20.62%) is widely spoken language. Besides these, people having mother tongue such as Newari (10.04%), Thami (1.73%) and Danuwar (1.70%) are also residing in the project affected VDCs. The other languages spoken at the project area are Maithili, Bhojpuri, Magar, Gurung, Tharu, Sunuwar, Rai, Sherpa, Majhi and others (CBS 2011).

4.3.6 Education

According to the population census of 2011, the literacy rate of 5 years and above in the project affected VDCs are 65.44% with male literacy rate of 74.79% and female literacy rate of 57.31%. This literacy rate is lower than the district literacy rate (70%).

4.3.7 Occupation and Employment

Agriculture is the major occupation of the people in the project area. The most of the people of project area are engaged in agricultural activities having land, livestock, poultry and fisheries. After agricultural activities, the rest of the people are engaged in business, government service, labor, agro-based industries, livestock and poultry farming, etc. Foreign employment is also common in the project area. People generally go to Gulf country, UK, USA, Australia for foreign employment.

4.3.8 Income Patterns

During the field survey, it was observed that the main sources of household income are agriculture, animal husbandry, and off-farm (non-agricultural) activities. Off-farm activities include professional services, petty trade, business (hotel and restaurant), cottage industry, pensions, wage labor and sale of non timber forest products in the settlements along the proposed 400 kV TL route. Foreign remittance is now one of significant income sources to many households in the project area as in other parts of Nepal. Since the alignment is the touristic route, so tourism is another major income source of the people of project area. Annual income differs by caste/ethnic group and gender of the household head, with Tamang, Gurung, Dalit (socially excluded castes), and female-headed households earning the lowest incomes. Cash expenditure in non food item (education, medicine, festival, purchasing assets and consumption goods) as well as unproductive items (land, house, luxurious things) is higher in recent year.

4.3.9 Agriculture and Livestock

The project area consists of fertile cultivated land, forests, grazing land and barren land. The agricultural products mainly include food crops (paddy, wheat, maize, millets, and potato) and cash crops (oilseeds, fruits and vegetables). The cropping pattern in the project area is paddy-wheat, paddy-wheat-vegetable, paddy-oilseed-vegetable, paddy-pulses, paddy-vegetable, and maize-pulses-oilseed. People are mostly involved in agricultural activities. Livestock and poultry farming are also common in the project affected VDCs.

Livestock including goats, cattle, and buffalos, chickens are sold in the local market for supplementary income. Chemical fertilizers, insecticides and improved seeds for agriculture purposes are normally used in the project area. The main local markets in the project area are Manthali, Jiri, Charikot, Barhabise, Chautara, Dhulikhel and Kathmandu.

4.3.10 Cultivated land

The total area of the project affected districts is calculated to be 818900 ha. Out of which only 33.57 % is cultivated land (Khet/ Bari) remaining other land is barren land, forest, Government land, Grazing land and River, etc.. Dolakha district has low cultivated land (25.87%) whereas Bhaktapur district has higher cultivated land (86.05%) (CBS 2011).

4.3.11 Public Health and Sanitation

The health situation of the Project area is far from satisfactory and water related diseases (diarrhea, dysentery, influenza, cough/cold, typhoid) and common fever, pneumonia, pox, gastric, measles, jaundice, skin diseases, urinary tract infection, chronic bronchitis etc. are still common here. There is a sub-health post in each VDC. The health service in the project area is delivered through the existing sub-health post, which is not satisfactory to the desired level due to lack of sufficiency of medicine as well as health workers. The hospital service is available in Manthali, Ramechhap; Jiri, Dolakha; Dhulikhel, Kavrepalanchok and Kathmandu of Kathmandu district. Traditional healing by Dhami, Jhankri and Lama is also practiced in some place of the project area.

Level of awareness towards improved health and sanitation (particularly towards the safe drinking water, use of toilets, etc.) is gradually increasing in the project area. Use of modern toilets in project area is also being practiced. (Source: DDC Profile.)

4.3.12 Migration

People are migrated from hill to terai and rural to urban area for better opportunity of their life. The outer migration is also common in the project area. The young generations migrating to abroad seeking employment opportunities are common. Malaysia, Qatar, Dubai, UK, USA and in-abroad are the main destination of the migrant in the project affected area. Migration to Kathmandu and other main cities of the country for business, employment, study and medical services is also common in the project area.

4.3.13 Infrastructures

▪ Transportation

The project area is accessible by road and facilitated through market centers, telecommunication, electricity and postal services. The project districts have direct road link to Kathmandu and all the affected VDCs have road network to district headquarters through gravel and earthen motorable road and some higher stretch through foot trail. The major roads that link the project area are Arniko highway, Barhabise-Budepa, Barhabise-Dhushkun-Piskar, Balefi-Tembathan, Lamosanghu-Jiri, Mudhe-Melung, Nayapul-Fasku-Pawati, Tamakoshi-Manthali and Jorpati-Mulpani-Sakhu. The bus service to Kathmandu is also available from the nearest city Jiri, Manthali, Chautara, Dhulikhel, Melamchi and Nagarkot.

▪ Communication

Communication services such as mobile, CDMA and landline phone facilities are available in most of the VDCs of the project area. Modern communication facilities like television, cable-network, e-mail, internet and fax are available in the project area. Availability of some of the local and national newspapers and magazine are observed in all parts of project area, District headquarters and major markets. Local FM radio services are available in the project area.

▪ Energy

The project area is electrified through either National Grid or rural electrification. Most of the people in the hilly area of the project area use Kerosene for lighting purpose. Solar power is also used in the project area VDCs. In project affected districts more than 80% households use firewood for cooking purpose. Others use LP gas and kerosene etc.

• Others

Piped water supply, traditional stone spouts, river and stream are the main source of drinking water in the project area. Local irrigation programmes are also on work in project affected areas. Ghyangkholra Irrigation Upper and Lower, Ghyangkholra Bhataghari, Ghyangkholra Khannagi Irrigation, Andheri khola Budhathoki Irrigation Canal, Andherikhola Irrigation Canal, Gairi khola Irrigation Canal, Fadkekhola irrigation project of Melung, Singe-Chainpur Irrigation project and Mahadevsthan Irrigation project are major irrigation project working in the project area.

The local governmental organizations are located in all VDCs. The agriculture, livestock and public health services centers are also located in the project areas. In the field of finance and Banking sector, various micro finance, saving and credit cooperation are working in the project area.

4.3.14 Religious, Historical and Archaeological Sites

There are various religious/ cultural sites spreading over in the project area. They are Shiv mandirs, Devithan, Bhairavthan and Gumbas. Changunarayan temple, that cover the Nepal' old history, is in the project area. The project area or the project district is also the probable touristic place. Bhotekoshi, Sukoshi rafting, South Asia's highest Bunji jumping in Bhotekoshi river are the famous entertaining activities found in the project area. In the same way, Nagarkot is another famous tourist place that lie in the project area. However, there are no archaeological sites of significant importance in the core project area.

The major festivals of the project area are Vijaya Dashami, Tihar, Teej, Maghe Sankranti, Fagu Holī, Ram Nawami, Buddha Jayanti, Uvali-Udhali and Lhosar. Lhosar festival is celebrated by the

Tamang, Gurung and Sherpa and Id for Muslim communities. Various Jattras at different times are also celebrated by Newar communities of project area.

4.3.15 Gender Status

Most of the women in the project area are engaged in the household works as well as in agriculture, business and other sectors. School enrollment is higher in boys as compared with girls. The literacy rate of women in the project area is low (57.13%) in comparison to the male literacy rate (74.79%). Cooking, washing, food processing, household maintenance, hygiene and sanitation activities, bearing, rearing and caring of children and taking care of the sick, elderly and other members of the family are daily activities of the women. The decision making process on economic activities is mostly exercised by the males. Land and property holding is dominated by the males. Early age marriage (below 16 years) and dropout of school is high in case of girl in the project area

4.3.16 Law and Order

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

4.3.17 NGOs and INGOs Activities

Some Non-governmental Organizations (NGOs) and Clubs are working in the field of energy & water supply, health & sanitation, sports, women awareness, infrastructure development, natural disaster and income generating activities in the project area.