ADB

Environmental Assessment Report

Project Number: 45202-NEP
July 2012

Rural Electrification of the Village Development Commitees influced by Tanahu Hydropower Project

Initial Environmental Examination (IEE)

Prepared by Nepal Electricity Authority for the Asian Development Bank.

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ABBRIVIATIONS AND ACRONYMS

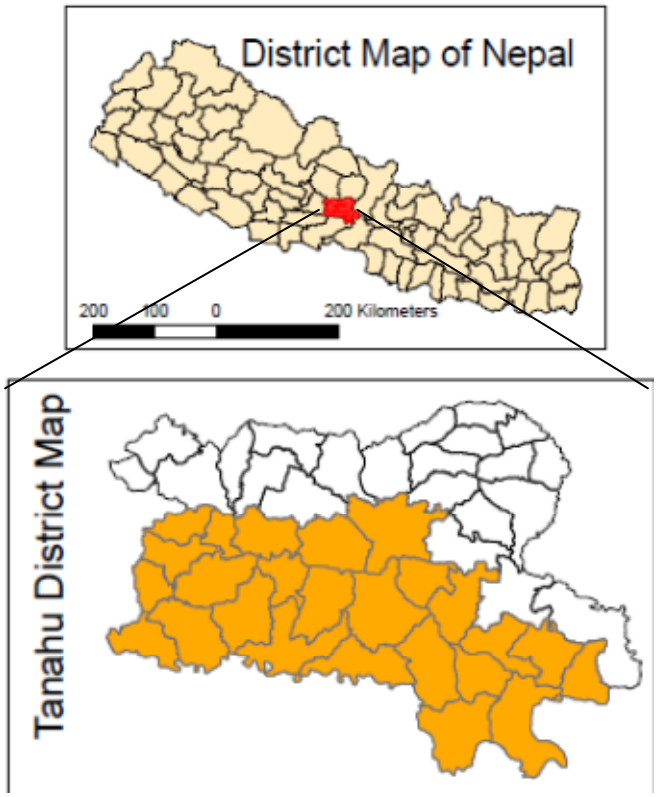
I. INTRODUCTION

The Government of Nepal (GON) is planning for the development of the Tanahu Hydropower Project[1] and has requested the Asian Development Bank (ADB) to provide financing for the project. This is one of the sub-projects identified for implementation under the Project Preparation Technical Assistance (PPTA) No. 45202-NEP. The Executing Agency (EA) for the PPTA is the Nepal Electricity Authority (NEA) while the Implementing Agency (IA) will be Tanahu Hydropower Ltd, a NEA subsidery. The NEA is a government corporation that is responsible for the generation and distribution of electricity throughout Nepal.

This Initial Environmental Examination presents the environmental assessment of the Rural Electrification sub-project that provides rural electrification to the Tanhahu Hydropower Project influence area and is located in the Tanahu District in the the Western Development Region of Nepal. The IEE has been carried out in compliance with the *Asian Development Bank Safeguard Policy Statement, June 2009.*

The main purpose of the IEE is to environmentally assess the location, construction and operation of the rural electrification which is shown in Figures 1 and 2. The IEE has been prepared for Tanahu Hydropower Ltd. to be submitted to the ADB.

Figure 1: Location Map of the Project



[1] Initially the project was named as Upper Seti Hydropower Project. Recently to avoid confusion with the West Seti Hydropower Project in the Far Western Nepal, the name has been changed to Tanahu Hydropwer Project.

Figure 2: Google Image of the Project Site

1.1 Background

Approximately 85% of the population of Tanahu district live in highly dispersed and culturally diverse rural settlements that are isolated from each other by rugged topography. Only a section of the population of the Tanahu district is connected by the National Electricity Grid. While one of the priority development demands of the communities of the Tanahu district is rural electrification, the government has not been able to cater the community demand due to shortage of power, and financial constraints to establish rural electrification networks to cover the rural areas of scattered population with low population densities across the rugged topographic terrain. Electricity grids that do exist are isolated and clustered around the main population centers located along the Prithibi Highway. Most of the rural people rely on kerosene for light energy, while a part of population use the subsidised solar photovoltaic cell. The increasing cost of battery and low skill in battery maintainace at the community level with poor outreach of maintainance support services is a bottleneck to mainain the clean energy source at the rural areas.

In the public consultation meetings covering the surrounding village Development Committee of the Tanhau Hydropower Poroject in 2001, 2006, and 2012, the coomunities putforth the rural electrification at least in the surrounding VDCs of the project development area as one of the priority conditions of public approval for the project devlopment. It is at this juncture, the Tanahu Hydropower Ltd. planned the rural electrification of the Village Development Committees surrounding the project development site as a part of the Social Development Program of the project. To fullfill the development commitment, the sub-project relating to rural electrification is planned covering 17 VDCs surrounding the project site in late June 2012.

1.2 Objectives and Scope of the IEE

The objectives of the IEE are to:

- Assess the existing environmental conditions in the project area including the identification of environmentally sensitive areas;
- Assess the proposed location, design, construction and operation activities to identify and evaluate their potential impacts, and determine their significance; and
- Propose appropriate mitigation and monitoring measures that can be incorporated into an Environmental Management Plan that will avoid or minimize adverse impacts so that residual impacts are reduced to acceptable levels.

1.3 Methodology Adopted For Study

The IEE is based primarily on the information collected for the environmental assessment study of the Tanahu hydropower project as it also covers the same geographical areas. Apart from this additional information is supplemented by field studies on vegetation, wildlife , land use, sociology and culture along the distribution line routes. Design details have been provided by the engineering consultants. As the sub-project is the outcome of the public consultation meeting of the Tanhahu Hydropower Project in 2001, 2006, and 2012, further extenssive consultation on the

sub-project is not considered essential, however, site specific consultation with the local communities along distribution line corridor was made during the field study as part of the IEE process to further validate community attitudes to the possible development.

1.4 Report Structure

The report structure follows the format outlined in Annex to Appendix 1 of the *Asian Development Bank Safeguard Policy Statement, June 2009.* The IEE consists of twelve sections: (A) Executive Summary, B Introduction; C Policy, Legal and Administrative Framework; D Description of the Project; E Description of the Environment; F Analysis of Alternatives; G Screening of Environmental Impacts and Mitigation Measures; H Public Consultation and Information Disclosure: I Grievance Redress Mechanism; J Environmental Management Plan; K Finding and Recommendations, L Conclusions

II. POLICY AND LEGAL ADMINISTATIVE FRAMEWORK

2.1 ADB Policy

The project does not involve activities that have significant adverse impact. As per the ADB s new Safeguard Policy Statement of 2009 guidelines, the environmental classification for the project component is Category B, and requires IEE to determine the extent of impact stipulated in the ADB's safeguard policy statement 2009. The IEE report conforms to the ADB Operations Manual F1/BP and F1/OP (2010), Environment Policy, and Environmental Assessment Guidelines (2003)[2] and the new ADB Safeguard Policy Statement 2009.

2.2 Government of Nepal Requirements

The environmental assessment requirements for GoN pertaining to the projects is stipulated in the Environmental Protection Regulation (EPR), 1997[3] framed under the Environment Protection Act (EPA), 1997. As per the EPR (1997[4], as amended), the proposed Rural Electrification line voltage including the new sub-station and substation extention falls under the category not needing environmental assessment as per the latest amendments.

2.3 Other Government of Nepal Policy and Legislations

Though the environmental assessment is not a legally required procedures for the proposed project components and sub-components, a number of government policy statements and legislations, however, are linked with the implementation of the project's mitigation measures corresponding to the environmental concerns. The major policies, acts and regulations and guidelines related to the sub-projects are discussed below:

2.3.1 Interim Constitution of Nepal, 2007[5]

Article (63) of the interim constitution of Nepal required the state to give priority to the protection of the environment and also to the prevention to its further damage due to physical development activities by increasing the awareness of the general public about the environmental cleanliness. The state shall also make arrangements for the special protection of the environment and the rare wildlife. Provision shall be made for the protection of the forest, vegetation and biodiversity, its sustainable use and for equitable distribution of the things derived from it. Hence, to prevent such damage the application of this article requires the study of environmental resources in all development works and assesses their impacts so that the measures could be taken up to prevent any harmful effects on the environment. These requirements are well addressed by the mitigation measures proposed in the environmental assessment studies and the best environmental practices to be followed where there the studies are not mandatory.

2.3.2 Hydropower Development Policy, 2001[6]

[2] ADB. 2003. Environment Policy, Environmental Guidelines for Selected Industrial and Power Projects, and Environmental Assessment Guidelines. Manila.
[3] Government of Nepal (GoN) : Environment Protection Rules, 1997
[4] Government of Nepal (GoN) : Environment Protection Act, 1997
[5] Government of Nepal (GoN): Interim Constitution of Nepal , 2007
[6] Government of Nepal (GoN) : Hydropower Development Policy, 2001

The hydropower development Policy 2001 emphasizes the need of implementation of mitigation measures in project affected area. The policy also stated that Resettlement and Rehabilitation works shall be conducted as per approved criteria of GON. The policy clearly stated that hydropower development shall be emphasized with due consideration of environmental conservation. Section 6.3 deals with the provision of investment in generation, transmission and distribution of electricity where as section 6.1.2.3 (a) deals with different kind of license required at different level of project development. This study are in line with the spirit of the this policy.

2.3.3 Nepal Environmental Policy and Action Plan (NEPAP) 1993 and 1998[7]

This was endorsed to further institutionalize environment protection in the development processes. NEPAP recognizes that a growing number of people are exposed to pollution from industrial enterprises. NEPAP emphasized the need for mitigating adverse environmental impacts to address urban and industrial development, air and water pollution and infrastructure development. The action plan for infrastructure development within NEPAP recommends the finalization of draft EIA guidelines for water resources development and the use of EIA when designing hydroelectric projects. Recently, a subsequent document NEPAP II has been finalized including recommendations for implementing environmental programs and action plans. The environmental considerations incorporated in this environmental assessment are in line with the spirit of the NEPAP.

2.3.4 Forest Sector Policy, 2000[8]

Any hydropower project including transmission line attracts the Forest Policy 2000 (revised) that highlights the forest conservation, management and their sustainable use through people's participation. The long term objectives of the policy are; to meet people's basic needs fuel, fodder, timber and other forest products on sustainable yield basis, to protect land against degradation and to conserve the ecosystems and genetic resources. The implementation of the project should not hamper these objectives.

2.3.5 Land Acquisition Act, 1997[9]

It is the major legislation to guide the compulsory acquiring of land in Nepal. Government of Nepal can acquire land at any place in any quantity by giving the compensation pursuant to the Act for the land required for any public purpose or for the operation of any development project initiated by government institution (Section 3 & 4). The powers given under these sections are very broad as Government is empowered to acquire any landing the name of a public work by paying compensation to the owner of the land. The land to be acquired for the construction of towers and substations will be compensated as per this legislation.

2.3.6 Soil and watershed conservation act, 1982[10]

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

[7] Government of Nepal (GoN) : Nepal Environment Policy and Action Plan (NEPAP) 1993 and 1998
[8] Government of Nepal (GoN) : Land Acquisition Act, 1977
[9] Government of Nepal (GoN) : Forest Sector Policy, 2000
[10] Government of Nepal (GoN) : Soil and Watershed Conservation Act, 1982

considered illegal in the area and are suspected for natural disaster. The project components are not within the declared or protected areas, no permission under this act needs to be taken. However, the project activities will comply with the routine provisions related to soil and watershed conservation normally followed during the construction and operation phases.

2.3.7 Water Resources Act, 1992[11]

The act was enacted to make arrangement for the rationale utilization, conservation, management and development of water resources in Nepal. Section 8, subsection 1 of the Act deals with the application procedure for utilization of water resource, section 9 of the act describes the use of water for hydroelectric purpose. Similarly, sections 18, 19 and 20 deals with water quality standards, water pollution and adverse effect on the environment. As per the Act, all the water resources either falling on the alignment of the project components or located near the project components sites must be investigated for the probable impacts on the services provided by them.

2.3.8 Labor Act, 1992[12]

This act classified people below 15 years as child and "Nabalik" for the age group of above 14 years and below 18 years. This has also made provision of department of labor and labor court. This allows time bond contract for the manpower required for development work. This also states that equal opportunity shall be given to women as men. According to this act, wage rates of the employees shall not be less than rate fixed by the concerned offices of GoN. The implementing authority will make sure that the contractor will comply with the provisions of the Act during the construction of the project activities.

2.3.9 Forest Act, 1993[13]

This act recognizes the importance of forests in maintaining a healthy environment. The act requires decision-makers to take account of all forest values, including environment services and biodiversity not just the production of timber and other commodities. The basis of the act's approach to forest and forest products is resource oriented rather than use oriented. As provisioned under the Act, while clearing the forest on the RoW of TL, the implementing authority will co-ordinate with the District Forest Office. Similarly, the compensatory re-plantation will also be carried out under the provision of the Act.

2.3.10 Environment Protection Act, 1997 and Environment Protection Rules, 1997

The environment Protection Rules (EPR) was endorsed as per the rule of Environment Protection Act (EPA) 1997 and amended in April 1999 and 2006 and 2009. The EPR adopts the environmental assessment criteria mentioned in the Environmental Impact Assessment (EIA) guidelines. The EPA and EPR provide a legal basis for the concerned authorities for regulating an EIA and/or Initial Environmental Assessment (IEE). Discussions of the project requirements as per the Act and Rules is provided on section 2.2 above.

2.3.11 Local Self Governance Act, 1999[14]

[11] Government of Nepal (GoN): Water Resources Act, 1992
[12] Government of Nepal (GoN) : Labour Act, 1992
[13] Government of Nepal (GoN) : Forest Act, 1993
[14] Government of Nepal (GoN) : Local Self Governance Act, 1999

This act provides more autonomy to District Development Committees (DDCs), Municipalities, and Village Development Committees (VDCs). Section 23 of the Act provides the functions, rights and duties of the ward committee. Section 25 (e) of the act requires the ward to help for protection of environment through plantation over the bare land, cliff and mountains. Section 28 has mentioned the functions, rights and duties of VDC. As mandated by this Act, concerned DDCs, VDCs and the municipalities must be informed and co-ordinated while implementing the project components.

2.3.12 Electricity Act, 1992[15]

This 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 or from any other sources. Survey, generation, transmission or distribution of electricity with obtaining license is prohibited under Section 3 of the Electricity Act. Section 4, sub-section 1 of the Act, requires any person or corporate body who wants to conduct survey, generation, transmission or distribution of electricity over 1 MW to submit an application to the designated authority along with the economic, technical and environmental study report.

2.3.13 Electricity Regulation, 1993[16]

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

2.3.14 Forest Regulation, 1995[17]

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 cutting and transporting the forest products in a forest area to be used by the approved project should be borne by the proponents of the project. As provisioned under the Regulation, while clearing the forest on the RoW of TL, the implementing authority will co-ordinate with the District Forest Office.

2.3.15 Water Resources Regulation, 1993[18]

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

[15] Government of Nepal (GoN) : Nepal Electricity Act, 1992
[16] Government of Nepal (GoN) : Nepal Electricity Regulation, 1993
[17] Government of Nepal (GoN): Forest Regulation, 1995
[18] Government of Nepal (GoN) : Water Resources Regulation, 199

components or located near the project components sites must be investigated for the probable impacts on the services provided by them.

2.3.16 Local Self Governance Regulation 2000[19]

This empowers the local bodies to coordinate and implement development program and for rationale utilization of local natural resources. Article 7 (68) empowers the VDCs for monitoring and supervision of development work implemented in the VDC. Article 7 (210) focus on environmental studies and due consideration while implementing the project like sand quarry, stone quarry and coal mine etc. As mandated by this Regulation, concerned DDCs, VDCs and the municipalities must be informed and co-ordinated while implementing the project components.

2.3.17 National EIA Guidelines, 1993[20]

This guideline provides criteria for project screening and Initial Environmental Examination (IEE/EIA). This includes preparation of Scoping Document and terms of reference for EIA, preparation of Terms of Reference for IEE, preparation methods of IEE/EIA report, impact identification and prediction, impact mitigation measures, impact monitoring, evaluation of impact studies, community participation, schedules and annexes. The guideline requires the proponent to consider alternatives to the proposed project. The proponent must consider the alternatives of scale, technology, location, fuel, raw materials, design, time schedule and economic aspects. As this project does not require legal procedures for IEE/EIA, however, have followed the stipulated guideline while preparing this report.

2.3.18 Forestry Sector EIA Guidelines, 1995[21]

The forestry sector EIA guidelines aim to facilitate the sustainable use of forest resource for the socio-economic development and to meet the basic needs of the communities for forest products. The positive and negative impacts of any development projects in the forest area are to be identified and plans must be developed to minimize environmental damage, conserving genetic resources and bio-diversity. As provisioned under the Guideline, while clearing the forest on the distribution alignment of the rural electrification, the implementing authority will co-ordinate with the District Forest Office.

2.3.19 Forest Product Collection and Sale / Distribution Guideline, 1998[22]

The clauses 3 to 10 of the guidelines have specified various procedure and formats for getting approvals for vegetation clearance, delineation of lands for vegetation clearance, evaluation of the wood volume etc. and government offices and officials are responsible for the approval. These provisions have a direct relevance to the development of the project and need compliance to these provisions. The trees and the other resources which will be collected during the clearance of the forest in the rural electrification line placement on the forested land will be disposed as per the Guideline.

2.3.20 Community Forest Guideline, 2001[23]

[19] Government of Nepal (GoN) : Local Self Governance Regulation, 2000
[20] Government of Nepal (GoN) and IUCN: National EIA Guideline 1993
[21] Government of Nepal (GoN): Forestry Sector EIA Guidelines, 1995
[22] Government of Nepal (GoN) : Forest Product Collection and Sale / Distribution Guideline, 1998

The guideline has been prepared by including amendments of acts, rules by officials of government of Nepal and related experts. Through these guidelines persons involved in the development of community forest like facilitators, user groups and others will get help to understand about the process and stages of development of community forest. Forest user group, forest officials, NGOs and INGOs are getting benefit by this guideline. As provisioned under the Guideline, while clearing the forest on the alignment of the rural electrification, the implementing authority will co-ordinate with the Community Forestry User Groups. Similarly, these groups will also be compulsorily co-ordinated while carrying out the compensatory re-plantation.

2.3.21 Community Forest Inventory Guideline, 2005[24]

The guideline for inventory of community forests advises to classify the forests into timber, trees, pole size trees and regeneration on the basis of diameter. Plants having dbh (diameter at breast height, i.e. 1.3m above the ground) greater than 30 cm is considered as trees. Trees having dbh between 10 to 29.9cm are categorized as poles and plants having less than 10 cm dbh belong to regeneration species. The Guideline will be used while carrying out the field investigation to estimate the number of trees to be removed from the rural electrification line placement.

2.3.22 Working Procedures for Forest related with the Use of Forest Land for other Purposes, 2006[25]

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

- The proponent has to afforest the area equal to the forest area lost at the minimum, if the forest area occupied by the project is a barren land. The land area for afforestation will have to decide based on the discussion with the district forest office. Or the proponent could deposit the required amount as per forest norm to the district forest office.
- The proponent should plant 25 trees for every lost tree of above 10cm DBH in areas designated by the district forest office and look after the plantation for 5 years to ensure their protection and growth of every planted tree. Or the proponent eposite the required amount for plantation and protection for five years to the district forest office.
- The proponent will have to compensate the lost forest land for 30 years. The compensation amount for the forest land per ha will be as per the provisions of leasehold forest.

[23] Government of Nepal (GoN) : Community Forestry Guideline, 2001
[24] Government of Nepal (GoN) : Community Forest Inventory Guideline, 2005
[25] Government of Nepal (GoN) : Working Procedures for Forest related with the use of Forest Land for other Purposes

III DESCRIPTION OF THE PROJECT

3.1 The Project

The project area of Tanahun Hydropower Project including transmission line is still not electrified or partially electrified in some places. Tanahun Hydropower Project intends to electrify the nearby villages which will be affected by the project. This schemes includes the construction of 33 kV sub-transmission lines, bay extension work at existing substation, construction of two completely new 33/11 kV substations, extension of 11 kV switchyard at one sub-station, construction of 11 kV distribution feeders and low voltage (400/230 V) distributors.

The project is breakdown into three packages to make the project easy for implementation. Each package contains the following schemes:

3.1.1 Package: 1

Construction of Jaruwa -Dharampani 33 kV sub-transmission line and Damauli-Maghkot 33kV sub-transmission line. Tentative length of each of these lines is 25 km. Actual length can vary after detail survey of the transmission line. One 33 kV sub-transmission line will starts from Jaruwa sub-station (proposed sub-station for construction power supply), goes along the downstream of Seti River and ends at Saranghat Phat of Dharampani VDC. Next 33 kV sub-transmission line will starts from existing Damauli sub-station, goes along the Prithivi Highway toward west and crosses the Chang VDC and terminates at Buduwa Phat of Maghkot VDC.

3.1.2 Package: II

This package includes 33 kV bay extension works at Damauli sub-station, 33 kV bay extensions at Jaruwa sub-station and construction of three numbers of 11 kV feeders in Jaruwa sub-station, construction of 33/11 kV, 5 MVA sub-station at Dharampani with four 11 kV feeders, construction of 33/11 kV, 7.5 MVA sub-station at Maghkot with four 11 kV feeders.

3.1.3 Package: III

This package includes construction of medium voltage (11 kV) distribution feeders, installation of pole mounted distribution transformer and construction of low voltage distributor line to consumer end. Total length of 11 kV line is 344 km , total length of low voltage ABC cable is 450 km, total number of distribution transformer are one hundred fifty, total number of 11 kV sectionalizer are fourteen.

3.2 Type of Project

The project implementation will lead to commercial operations of the three new substations at Jaruwa (33/11 kV, 3.3 MVA), Dharampani (33/11 kV, 5 MVA) and Maghkot (33/11 kV, 7.5 MVA) to connect to 132 /33 kV substation existing at Damauli linked to the 132kV national grid. The Jaruwa substation is also required for the project construction and will be constructed by THP as a component of the project. For rural electrification, the Jaruwa substation bay will be extended under this sub-component. Similar bay extension is proposed at Damauli under this project. A total of 12.76 MW will be transferred to the new substations when the project is completed for rural electrification.

3.3 Need for the Project

As discussed in section 1.1, the rural electrification is a priority development demand of the communties living in the surrounding VDCs of the THP development area. THL at various consultation meetings and public hearing meetings have made a commitment with the local communities of the surrounding areas for the rural electrification as a part of the community development plan. Apart from this the hydropower policy of the GON stipulates rural electrification of the hydropower project development area as one of the policies of the hydropower development. To meet the above policy objective, one percent of the hydropower revenue has been committed to the surrounding Village Development Committees affected by the project.

3.4 Location

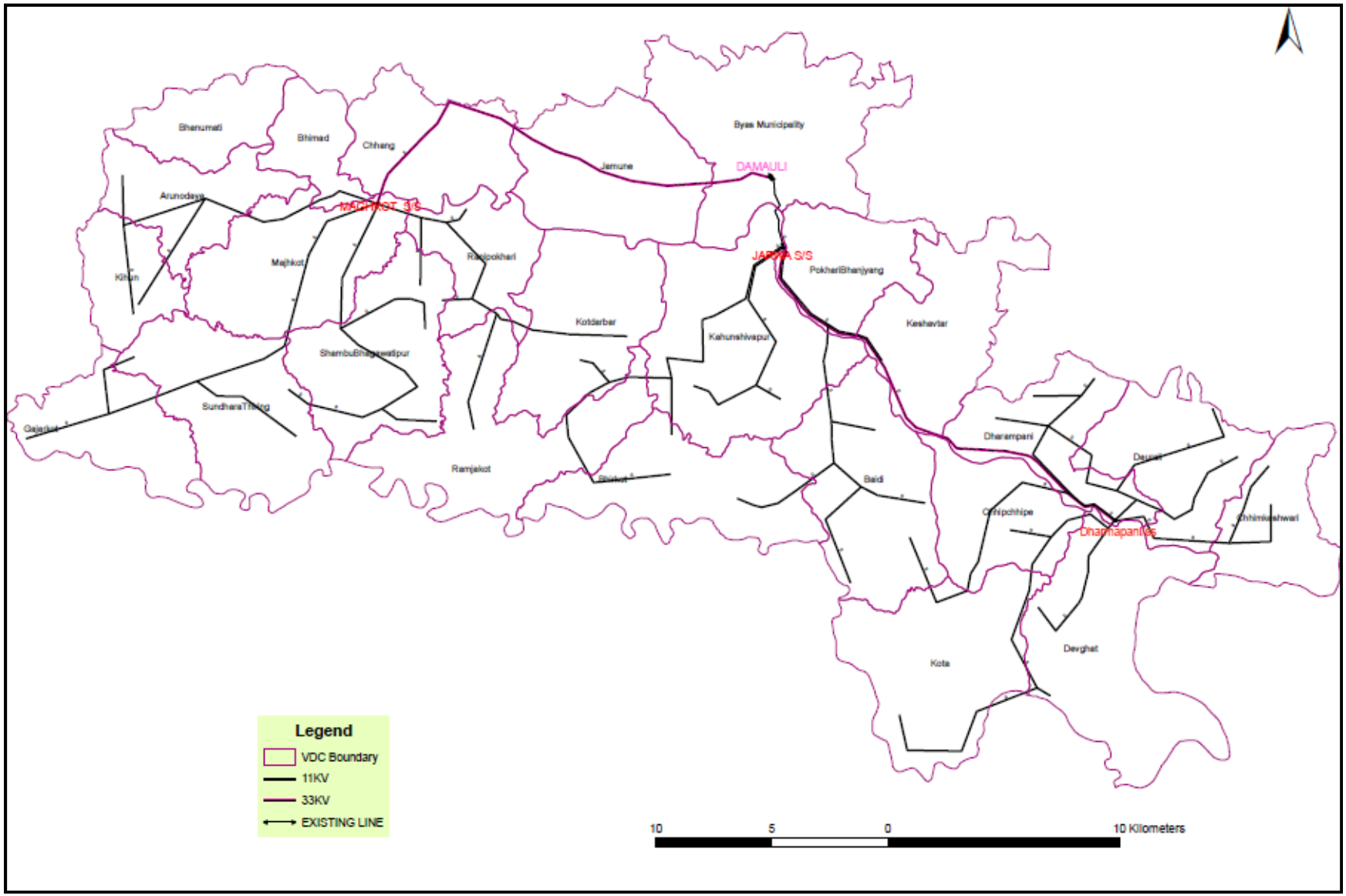
The proposed project is located in the southern and western parts of the Tanahu District of the Western Development Region of Nepal (Figure 1). The area is represented by hilly topography characterized by deeply entrenched major river valleys and abruptly elevating east-west trending major ridge systems with steep valley slopes, relatively gentler middle hill slopes and steep upper mountain crest slopes. The administrative areas covered by the project include the non-electrified households of the 18 village Development Committees[26] (Table 1, Figure 3).

Table 1: Administrative Areas Covered by the Project

S.N.	Name of VDC	Number of house holds	Physiography
1	Baidi	2541	Hill
2	Virkot	1073	Hill
3	Chipchipe	377	Hill
4	Kota	658	Hill
5	Ramjakot	906	Hill
6	Chimkeshwori	379	Hill
7	Deurali	517	Hill
8	Dharampani	730	Hill
9	Gajarkot	1310	Hill
10	Ghiring Sundhara	1404	Hill
11	Maghkot	1179	Hill
12	Kihu	847	Hill
13	Arunodaya	986	Hill
14	Kahu-Shivpur	1254	Hill
15	Kot Durbar	1145	Hill
16	Savung Bhagwatipur	1398	Hill
17	Rising Ranipokhari	922	Hill
18	Devghat		Hill

[26] Village Development Committee is the bottom most administrative/political unit. The Village Development Committee is divided into 9 sub units named Ward.

Figure 3: Village Development Committee covered by the Rural Electrification

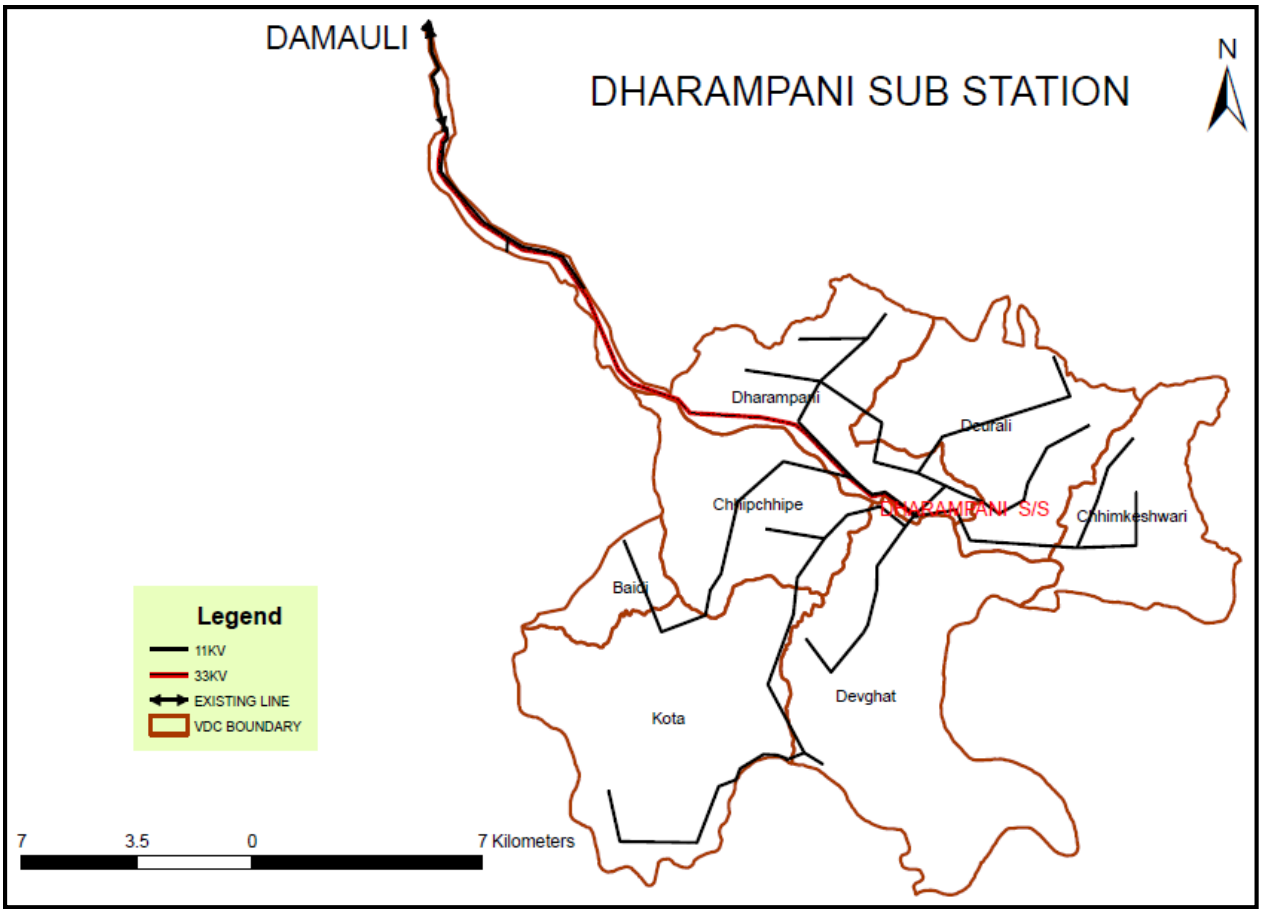


The above non-electrified Village Development Committee surrounding the THP have been covered by the 3 new 33/11 kV substations feed by the existing Damauli 132/33kV substation through 33 kV transmission lines as under:

3.4.1 Coverage of Dharampani Sub-station

This substation located at Saranghat Phat of Dharampani VDC will cover the VDCs of Dharampani, Deurali, Chimkeshwori, Baidi, Kota, Devghat and Chipchipe (Figure 4).

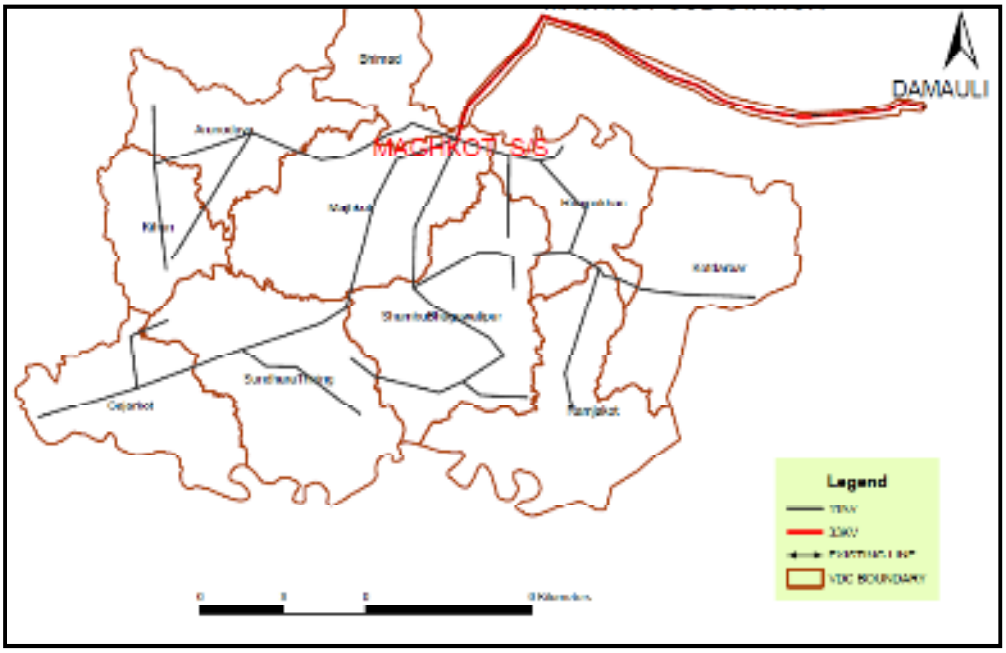
Figure 4: Village Development Committee Covered by Dharmapani Sub-station



3.4.2 Coverage of Maghkot Sub-station

This substation located at Duduwa Phat of Maghkot VDC will cover the part of the THP reservoir surroundings and include the VDCs of Arunodaya, Kihu, Ghiring Sundhara, Gajarkot, Savung Bhagwatipur, Maghkot and Rising Ranipokhari (Figure 5).

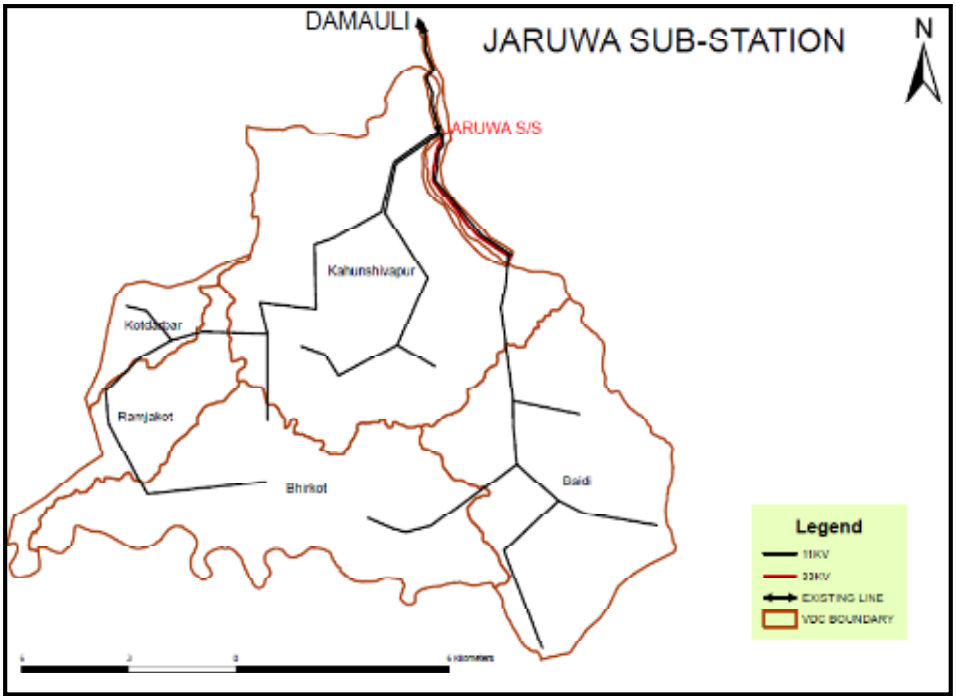
Figure 5: Village Development Committee covered by Maghkot Sub-station



3.4.3 Coverage of Jaruwa Sub-station

Jaruwa sub-station located at Jaruwa of Kahushivpur will supply non-electrified areas of Downstream sections of the THP and include the VDCs of Kahushivpur, Virkot VDC, Kotdurbar VDC and Ramjakot VDC (Figure 6).

Figure 6: Village Development Committee covered by Jaruwa Sub-station



3.5 Size and the Magnitude of the Operation

3.5.1 Dharampani Sub-station

This sub-station is 33/11 kV with 5 MVA power transformer. Four 11 kV feeders will radiate from Dharampani substation. These feeders will supply i. Dharampani VDC, ii. Deurali VDC and Chimkeshwori VDC, iii. Baidi VDC and iv. Kota VDC. Total length of 11 kV feeders will be 118.5km and number of distribution transformer will be fifty seven. The size of distribution transformer will be 25 kVA and 50 kVA, three phase units. The type of conductor used for low voltage distribution will be two core and four core ABC cable having cross section area 25 sq. mm. 50 sq. mm. and 95 sq. mm. and for 11 kV, size of ACSR conductor will be 100 sq. mm and 50 sq. mm.

Detail of length of medium voltage (11 kV) distribution feeders with 100 sq. mm. and 50 sq. mm. ACSR conductor and low voltage distribution feeders with 50 sq. mm. and 30 sq. mm. ABC cable are presented in Table 2.

Table 2: Details of Dharampani Sub-station

S.N.	Feeder Number	Length of 11 kV Distribution Line (km)		Length of Low voltage ABC cable (km)		Number of distribution transformer		Number of sectionalizer switch
		100 sq.mm. ACSR conductor	50 sq.mm.ACSR conductor	4 core 50 sq. mm. ACR Conductor	4 core 30 sq. mm. ACSR conductor	50 kVA 3 Phase	25 kVA 3 Phase	
1	Feeder-1	*14.5*	*14.9*	*42*	*24*	*7*	*4*	*1*
2	Feeder-2	*15.6*	*21.9*	*60*	*24*	*10*	*4*	*1*
3	Feeder-3	*21.6*	*22.7*	*78*	*30*	*13*	*5*	*1*
4	Feeder-4	*11.3*	*17*	*78*	*24*	*13*	*4*	*1*
Total		***63***	***76.5***	***258***	***102***	***43***	***17***	***4***

3.5.2 Maghkot Sub-station

This sub-station is 33/11 kV with 7.5 MVA power transformer. The VDC supplied from this substation are Arunodaya VDC, Kihu VDC, Ghiring Sundhara VDC, Gajarkot VDC, Savung Bhagwatipur VDC, Maghkot VDC and Rising Ranipokhari VDC. Four numbers of 11 kV feeders will be radiate from this sub-station. Total length of 11 kV feeders will be 140 km and number of distribution transformer will be sixty. The size of distribution transformer will be 25 kVA and 50 kVA, three phase units. The type of conductor used for low voltage distribution will be two core and four core ABC cable having cross section area 25 sq. mm., 50 sq. mm. and 95 sq. mm. and for 11 kV, size of ACSR conductor will be 100 sq. mm and 50 sq. mm.

Detail of length of medium voltage (11 kV) distribution feeders with 100 sq. mm. and 50 sq. mm. ACSR conductor and low voltage distribution feeders with 50 sq. mm. and 30 sq. mm. ABC cable are presented in Table 3.

Table 3: Details Maghkot of Sub-station

S.N.	Feeder Number	Length of 11 kV Distribution Line (km)		Length of Low voltage ABC cable (km)		Number of distribution transformer		Number of sectionalizer switch
		100 sq.mm. ACSR conductor	50 sq.mm.ACSR conductor	4 core 50 sq. mm. ACR Conductor	4 core 30 sq. mm. ACSR conductor	50 kVA 3 Phase	25 kVA 3 Phase	
1	Feeder-1	*18.75*	*14.2*	*48*	*36*	*8*	*6*	*2*
2	Feeder-2	*18.5*	*15.5*	*54*	*42*	*9*	*7*	*2*
3	Feeder-3	*9.8*	*8.2*	*24*	*18*	*4*	*3*	*1*
4	Feeder-4	*14.2*	*19.3*	*72*	*48*	*12*	*8*	*2*
Total		***61.25***	***57.2***	***198***	***144***	***33***	***24***	*7*

3.5.3 Jaruwa Sub-station

This sub-station is 33/11 kV with 2 X 5 MVA power transformer. This sub-station will be constructed for construction power of the project and will be used to supply the area nearer to the project. The VDC supplied from this substation are Kahu Shivpur VDC, Virkot VDC, Kotdurbar VDC and Ramjakot VDC. Three numbers of 11 kV feeders will be radiate from this sub-station. Total length of 11 kV feeders will be 85.6 km and number of distribution transformer will be thirty three. The size of distribution transformer will be 25 kVA and 50 kVA, three phase units. The type of conductor used for low voltage distribution will be two core and four core ABC cable having cross section area 25 sq. mm., 50 sq. mm. and 95 sq. mm. and for 11 kV, size of ACSR conductor will be 100 sq. mm and 50 sq. mm.

Detail of length of medium voltage (11 kV) distribution feeders with 100 sq. mm. and 50 sq. mm. ACSR conductor and low voltage distribution feeders with 50 sq. mm. and 30 sq. mm. ABC cable are presented in Table 4.

Table 4: Details Jaruwa of Sub-station

S.N.	Feeder Number	Length of 11 kV Distribution Line (km)		Length of Low voltage ABC cable (km)		Number of distribution transformer		Number of sectionalizer switch
		100 sq.mm. ACSR conductor	50 sq.mm.ACSR conductor	4 core 50 sq. mm. ACR Conductor	4 core 30 sq. mm. ACSR conductor	50 kVA 3 Phase	25 kVA 3 Phase	
1	Feeder-1	*19.35*	*14.85*	*54*	*36*	*9*	*6*	*1*
2	Feeder-2	*11*	*6.95*	*24*	*18*	*4*	*3*	*1*
3	Feeder-3	*16.3*	*17.15*	*42*	*24*	*7*	*4*	*1*
Total		***46.65***	***38.95***	***120***	***78***	***20***	***13***	***3***

3.5.4 Primary Distribution System

Conventional 3-phase, 3-wire system of distribution at 11 kV has been proposed as per the NEA Practice for primary distribution voltage. In the sizing of the MV (11 kV) system, the equipment

capacities are based on the requirement of the 10-year load projection. The conductors (in horizontal configuration) will be supported on 10 m steel tubular poles and steel cross arms. The main feeders will have 100 sq. mm or 50 sq. mm. depending on load and length of the feeders. The three phase laterals will have 50 sq. mm. ACSR conductors.

Selection of conductors, in general is guided by voltage regulations, fault level, economic loading and NEA's standards. Because of the sparse load density, voltage drop consideration is the major limiting factor. Consequently, the main feeder is mostly of 100 sq. mm. Laterals are of 50 sq. mm. ACSR conductors. Pole mounted distribution transformers are envisaged in the all situations.

3.5.5 LV System (400 V)

Three phase, four wire ABC cable has been proposed for low voltage distribution. In some sparsely areas, two core ABC cable will be used. The size of low voltage distribution cable will be 50 sq. mm. and 25 sq. mm.

System layout of the substations existing and after extension of Damauli substation is presented in Figure 7 and 8 whereas system layout of the Dharmapani, Magh kot and Jaruwa substation is depicted in Figures 9, 10, and 11respectively. Similarly system layout of the Switchyards for Dharmapani and Maghkot is presented in Figures 12 and 13 respectively. Figures 14 and 15 present the layout of the control buildings of Dharmapani and Maghkot substations respectively.

Schematic layout of the distribution networks from the substation Dharmapani, are presented in Figures 16, 17, 18 and 19 for feeder 1, 2, 3, and 4 respectively. Figures 20, 21, 22 and 23 depicts the schematic layout of Maghkot feeder 1, 2, 3 and 4 respectively. Similarly Figures 24, 25 and 26 present the distribution network schematic layout for feeder 1, 2 and 3 of Jaruwa Sub-station.

Figure 7: System Layout Existing Damauli Sub-station

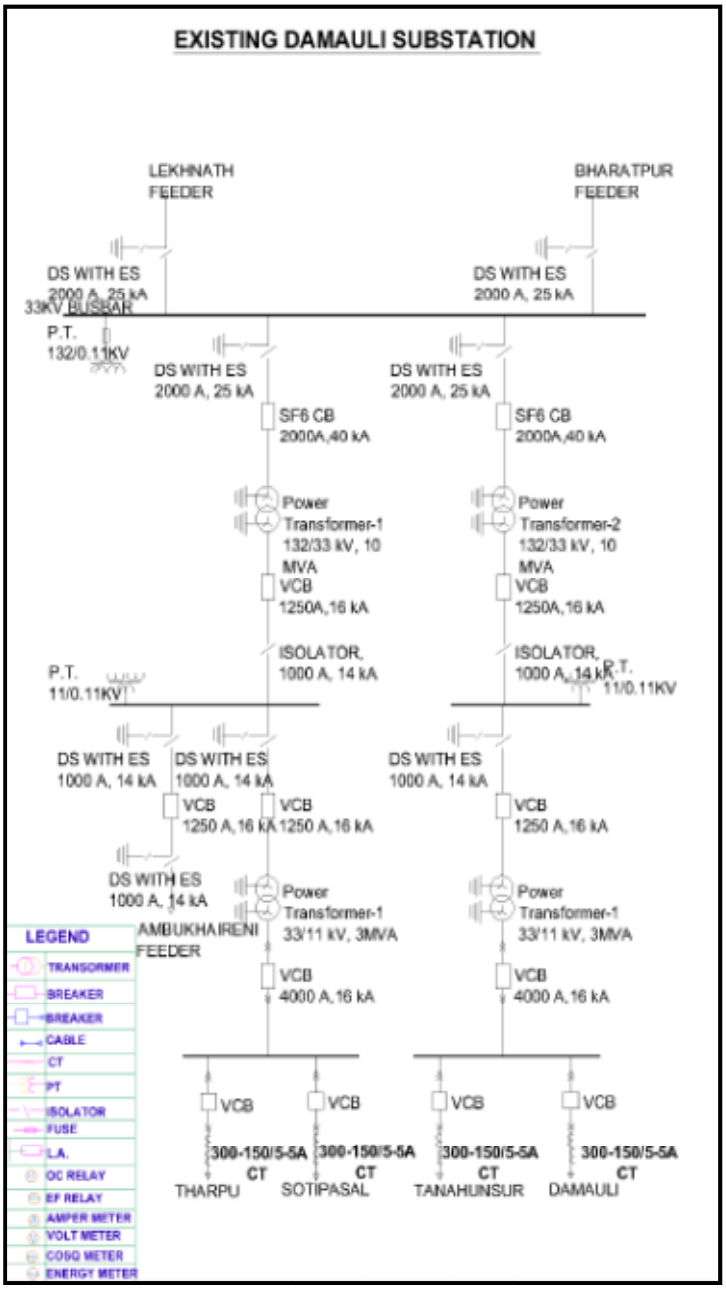


Figure 8: System Layout, Damauli Sub-station after Extension

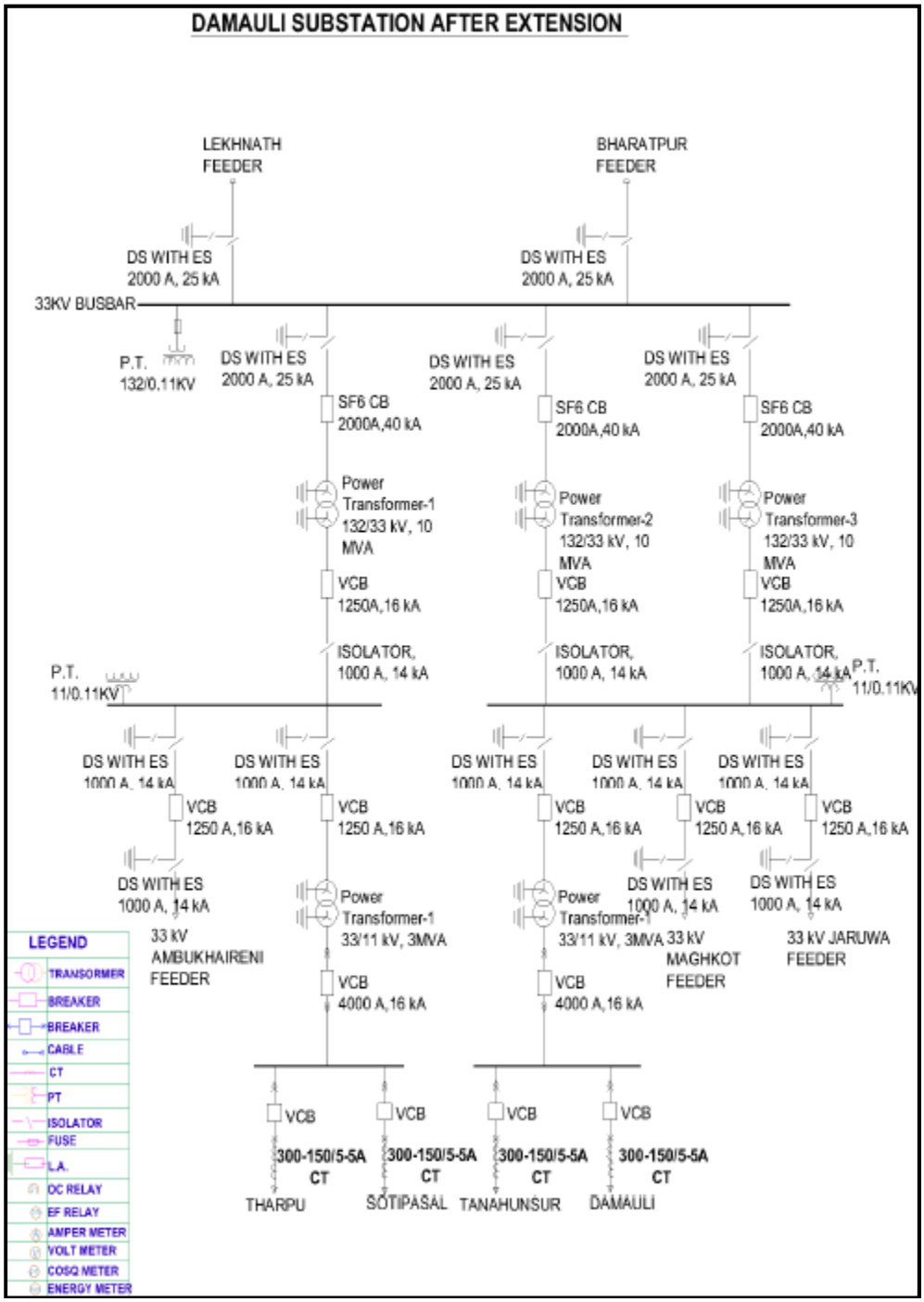


Figure 9: System Layout Dharmapani Sub-station

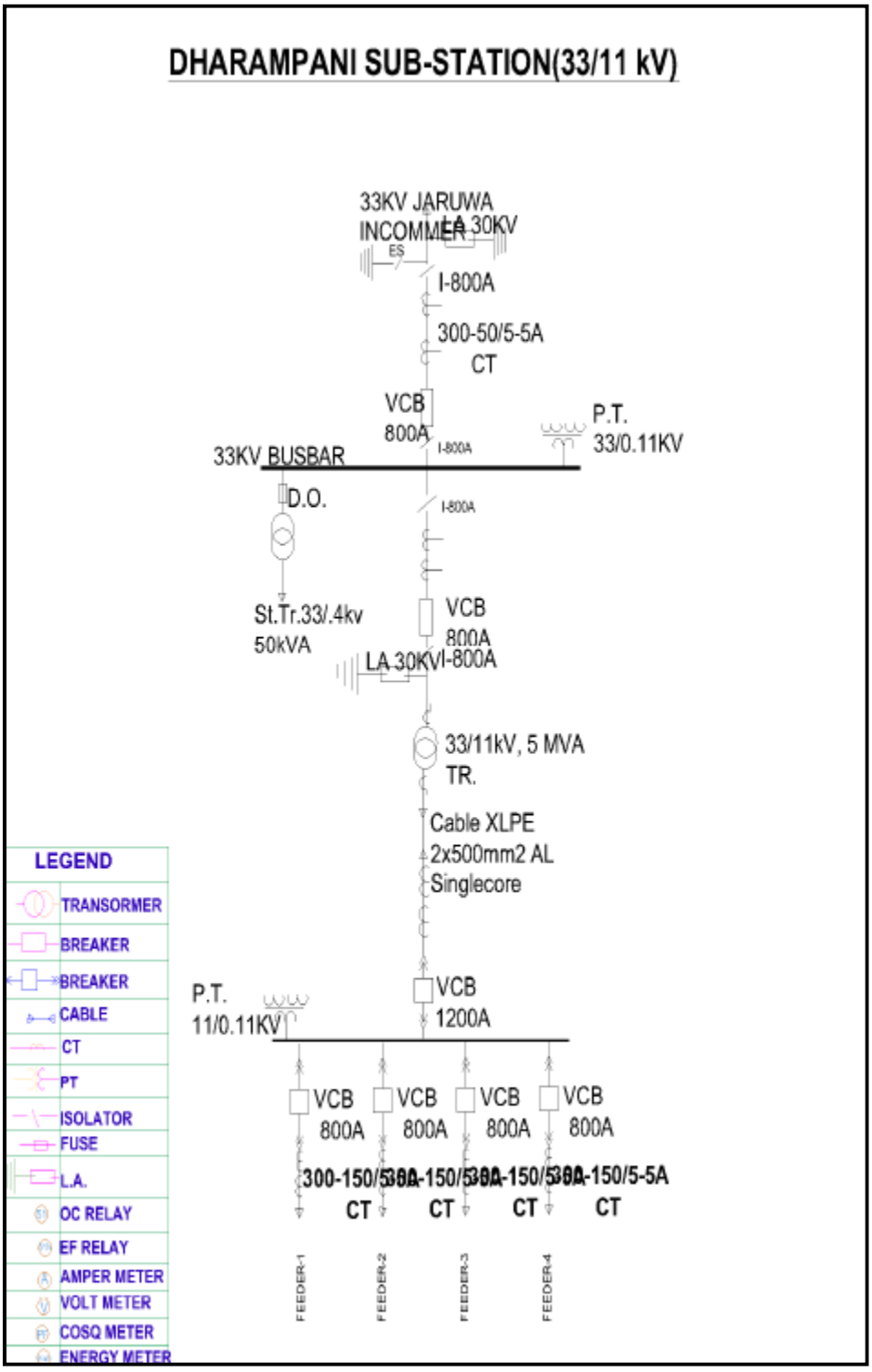


Figure 10: System Layout Maghkot Sub-station

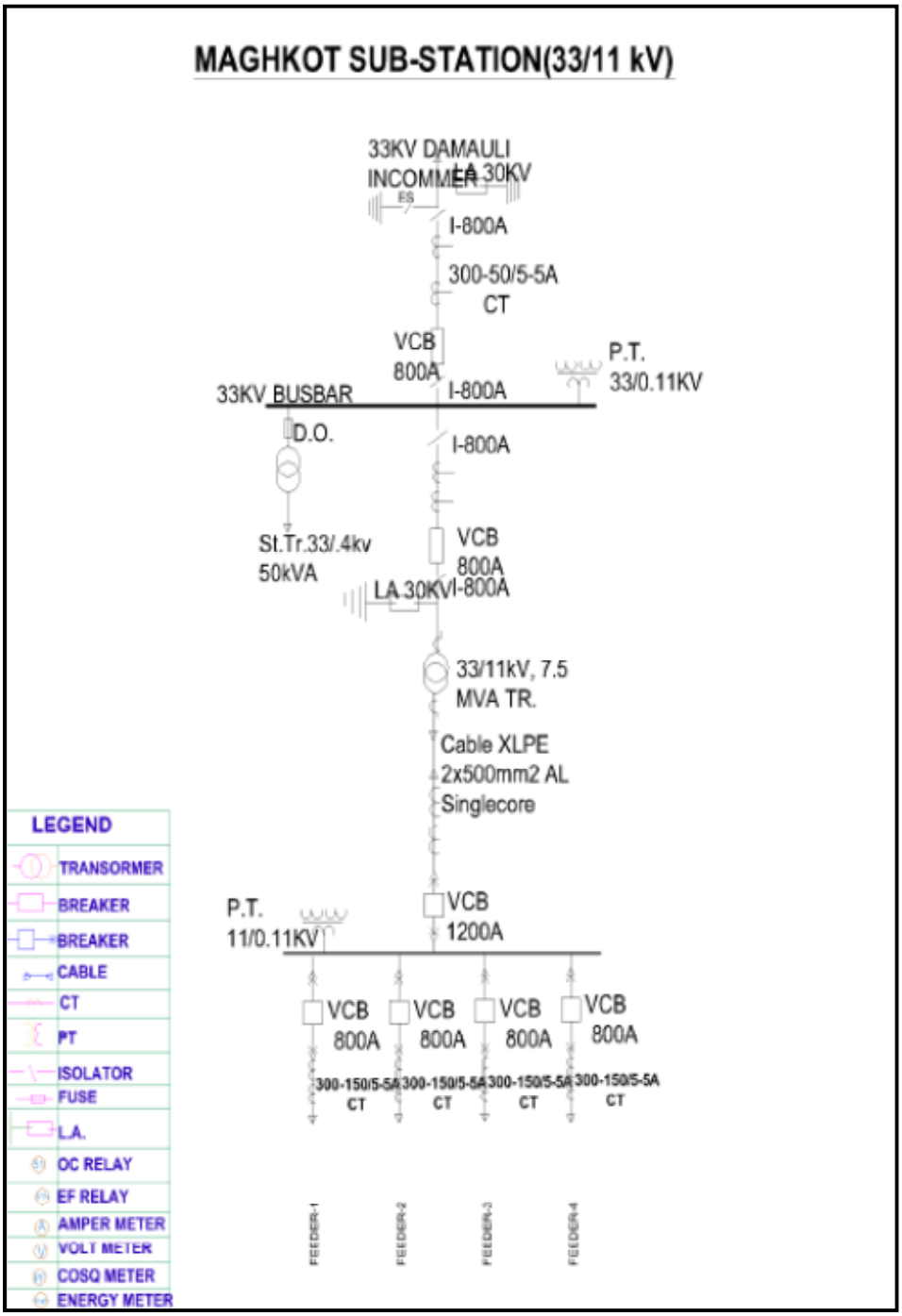


Figure 12: System Layout Jaruwa Sub-station

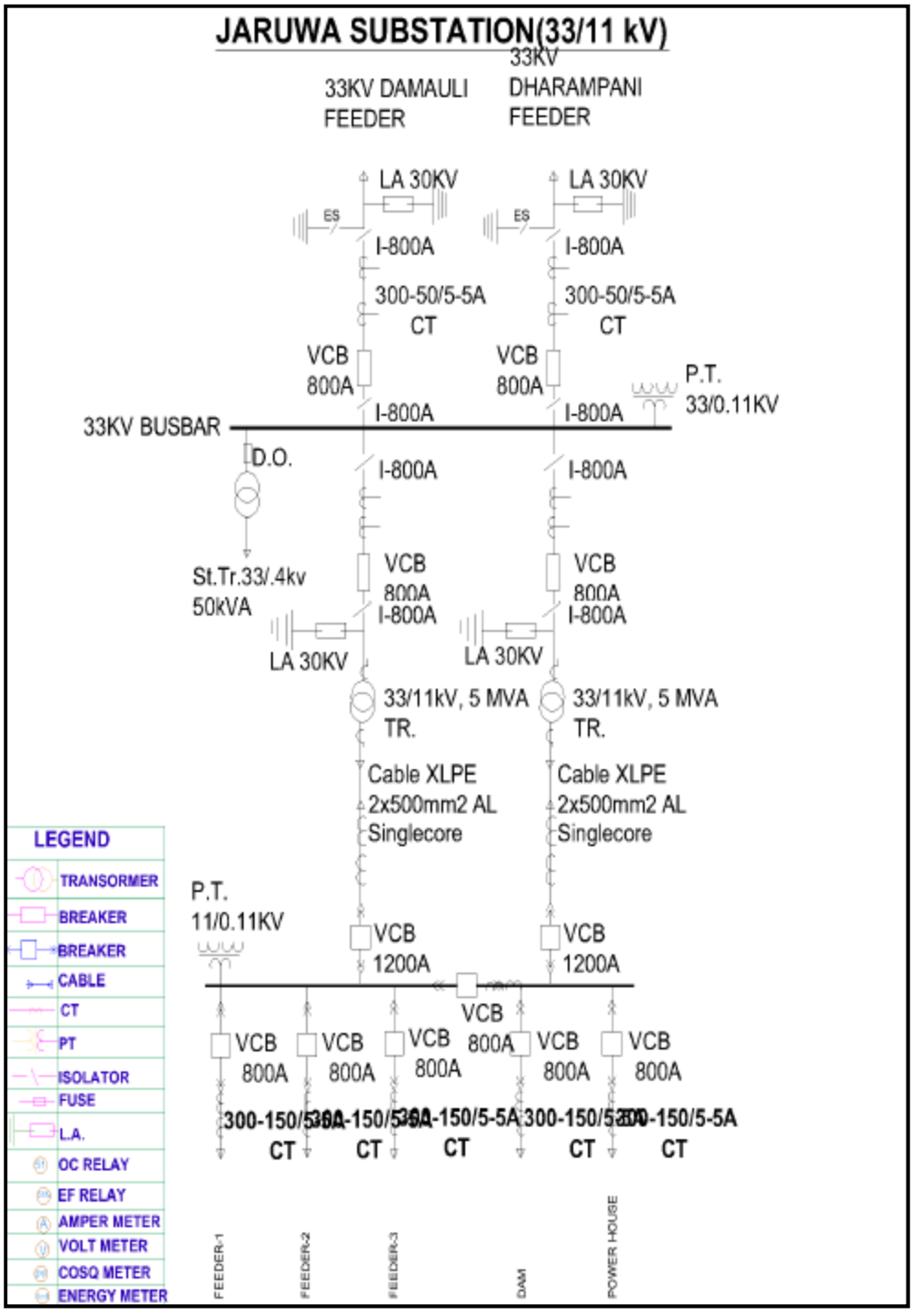


Figure 12

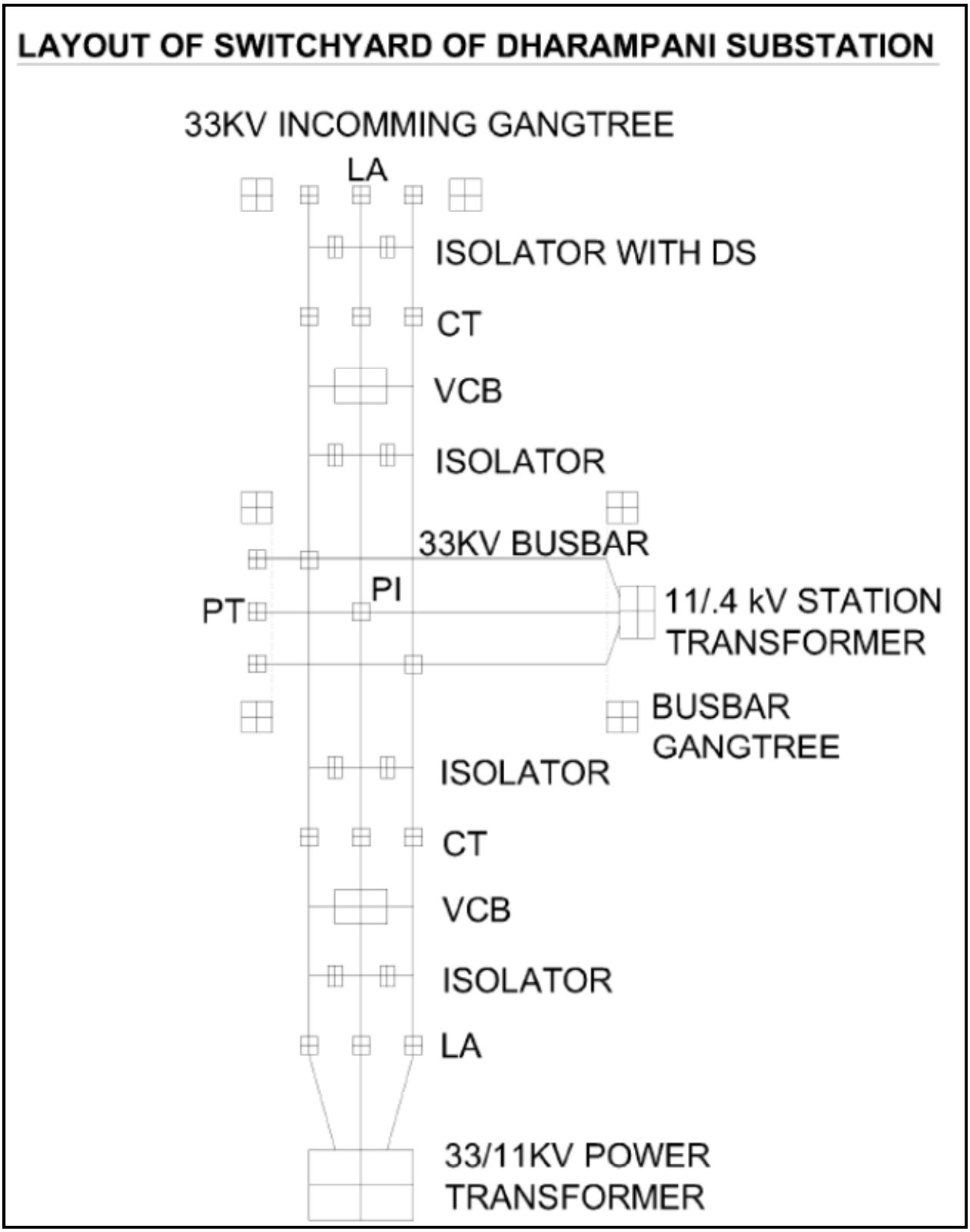

LAYOUT OF SWITCHYARD OF DHARAMPANI SUBSTATION
33KV INCOMMING GANGTREE
LA
ISOLATOR WITH DS
CT
VCB
ISOLATOR
33KV BUSBAR
PT
PI
11/.4 kV STATION TRANSFORMER
BUSBAR GANGTREE
ISOLATOR
CT
VCB
ISOLATOR
LA
33/11KV POWER TRANSFORMER

Figure 13

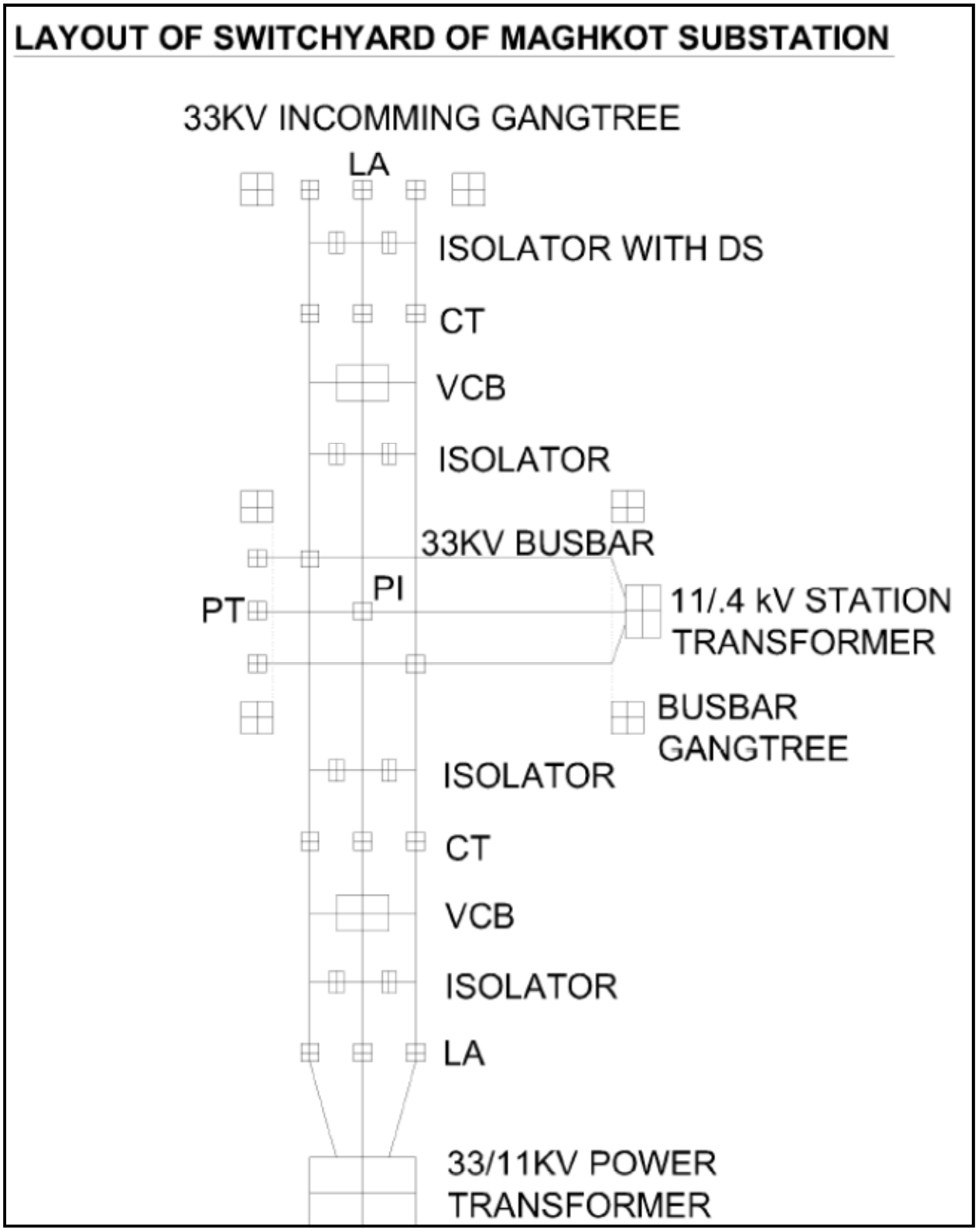

LAYOUT OF SWITCHYARD OF MAGHKOT SUBSTATION
33KV INCOMMING GANGTREE
LA
ISOLATOR WITH DS
CT
VCB
ISOLATOR
33KV BUSBAR
PI
PT
11/.4 kV STATION TRANSFORMER
BUSBAR GANGTREE
ISOLATOR
CT
VCB
ISOLATOR
LA
33/11KV POWER TRANSFORMER

Figure 14

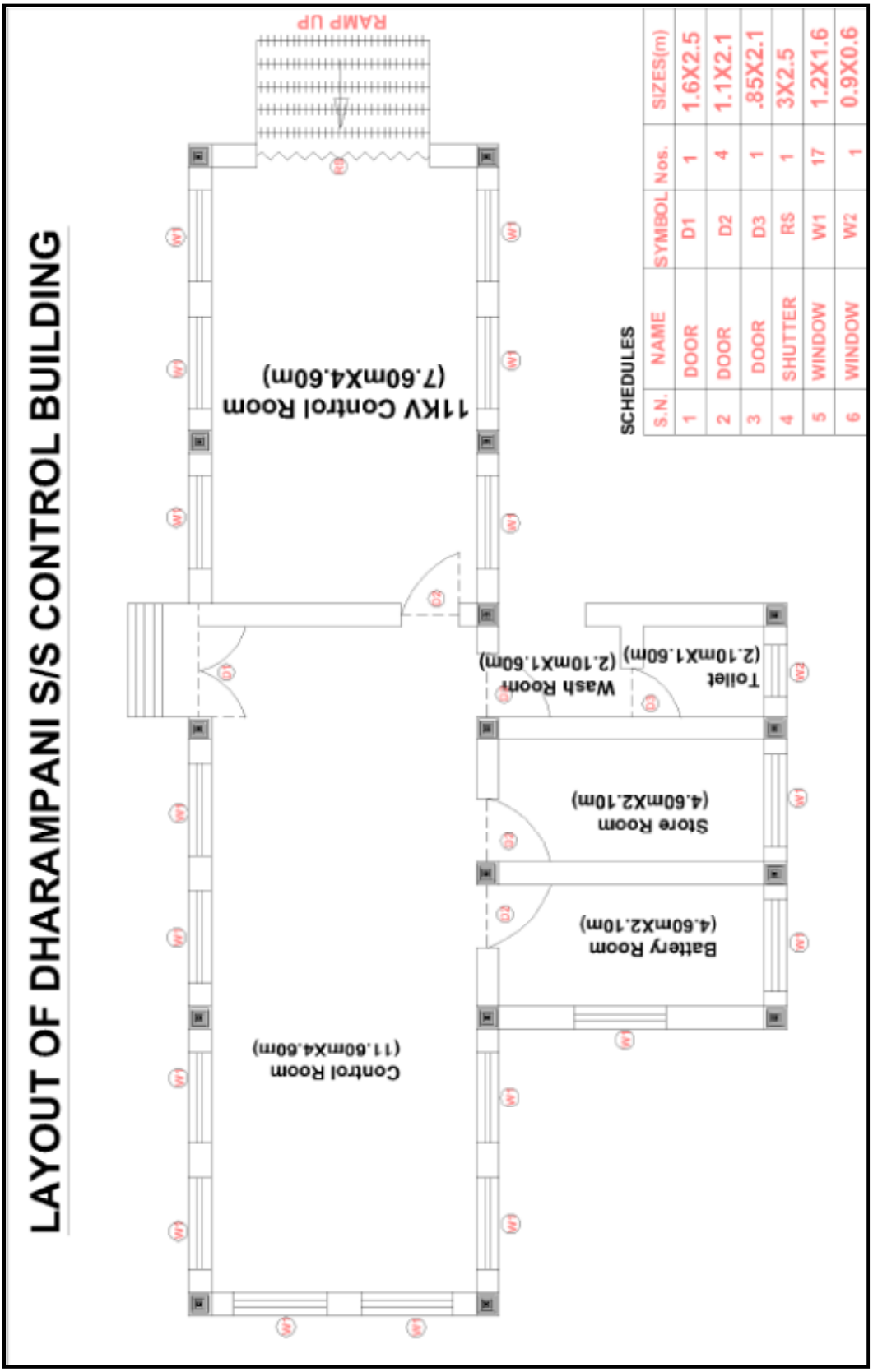

LAYOUT OF DHARAMPANI S/S CONTROL BUILDING
RAMP UP
11KV Control Room
(7.60mX4.60m)
Control Room
(11.60mX4.60m)
Battery Room
(4.60mX2.10m)
Store Room
(4.60mX2.10m)
Wash Room
(2.10mX1.60m)
Toilet
(2.10mX1.60m)
SCHEDULES
S.N. NAME SYMBOL Nos. SIZES(m)
1 DOOR D1 1 1.6X2.5
2 DOOR D2 4 1.1X2.1
3 DOOR D3 1 .85X2.1
4 SHUTTER RS 1 3X2.5
5 WINDOW W1 17 1.2X1.6
6 WINDOW W2 1 0.9X0.6

Figure 15

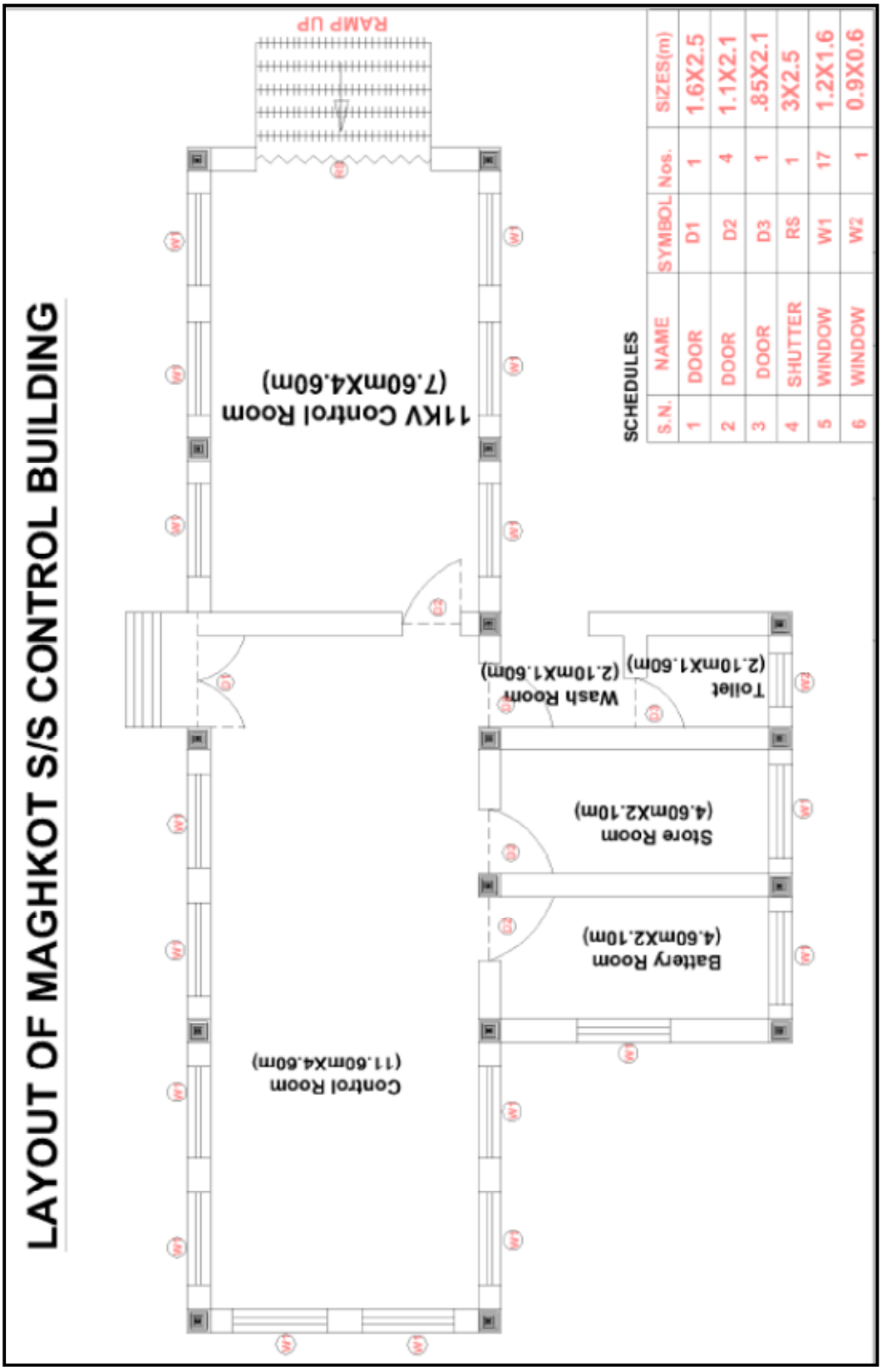

LAYOUT OF MAGHKOT S/S CONTROL BUILDING
RAMP UP
11KV Control Room
(7.60mX4.60m)
Control Room
(11.60mX4.60m)
Wash Room
(2.10mX1.60m)
Toilet
(2.10mX1.60m)
Store Room
(4.60mX2.10m)
Battery Room
(4.60mX2.10m)
SCHEDULES
S.N. NAME SYMBOL Nos. SIZES(m)
1 DOOR D1 1 1.6X2.5
2 DOOR D2 4 1.1X2.1
3 DOOR D3 1 .85X2.1
4 SHUTTER RS 1 3X2.5
5 WINDOW W1 17 1.2X1.6
6 WINDOW W2 1 0.9X0.6

Figure 16: Distribution Network Layout (Dmauli – Dharmapani and Dharmapani Feeder -1)

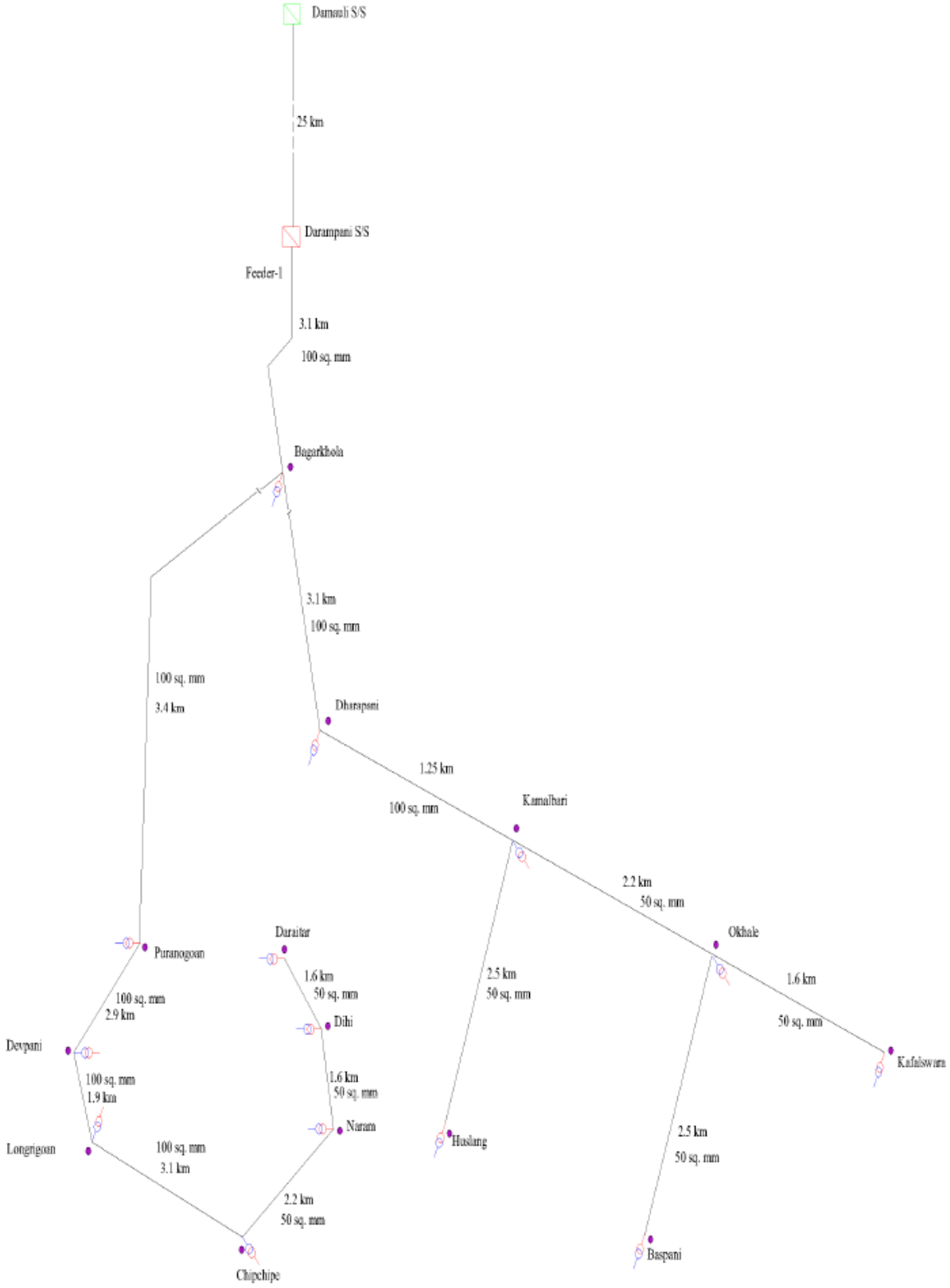


Figure 17: Distribution Network Layout (Dmauli – Dharmapani and Dharmapani Feeder -2)

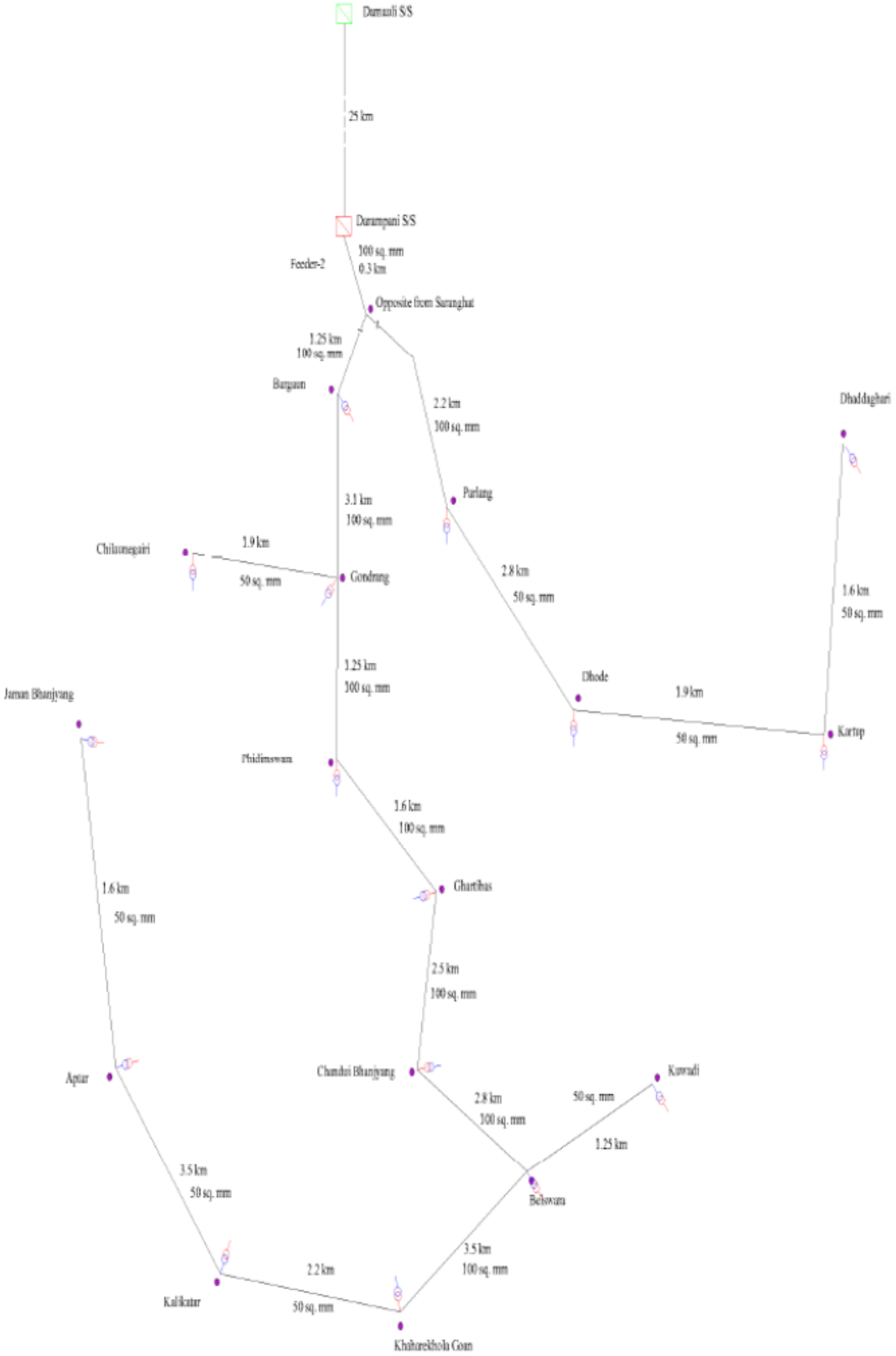


Figure 18: Distribution Network Layout (Dmauli – Dharmapani and Dharmapani Feeder -3)

Figure 19: Distribution Network Layout (Dmauli – Dharmapani and Dharmapani Feeder -4)

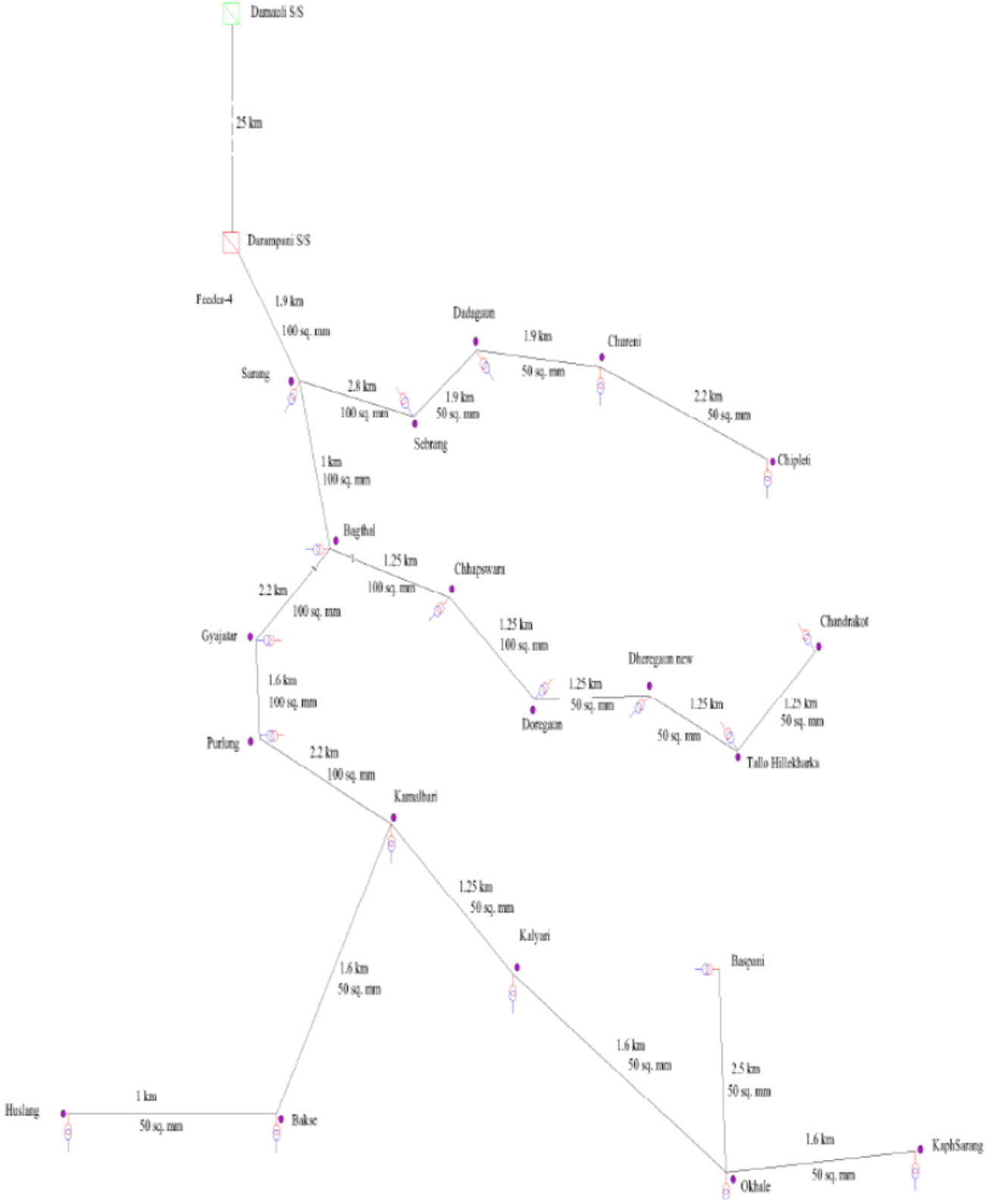


Figure 20: Distribution Network Layout (Dmauli – Maghkot and Maghkot Feeder -1)

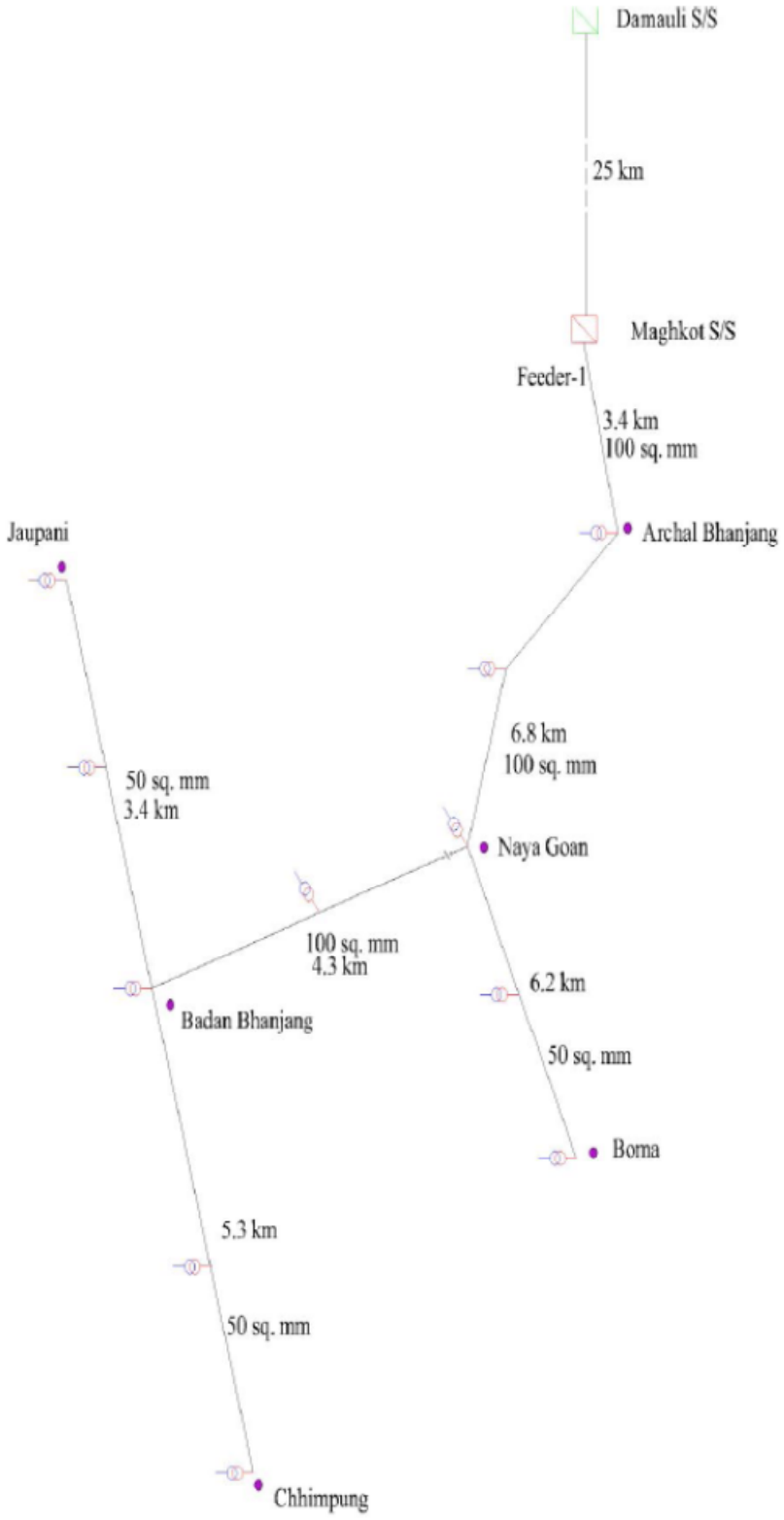


Figure 21: Distribution Network Layout (Dmauli – Maghkot and Maghkot Feeder -2)

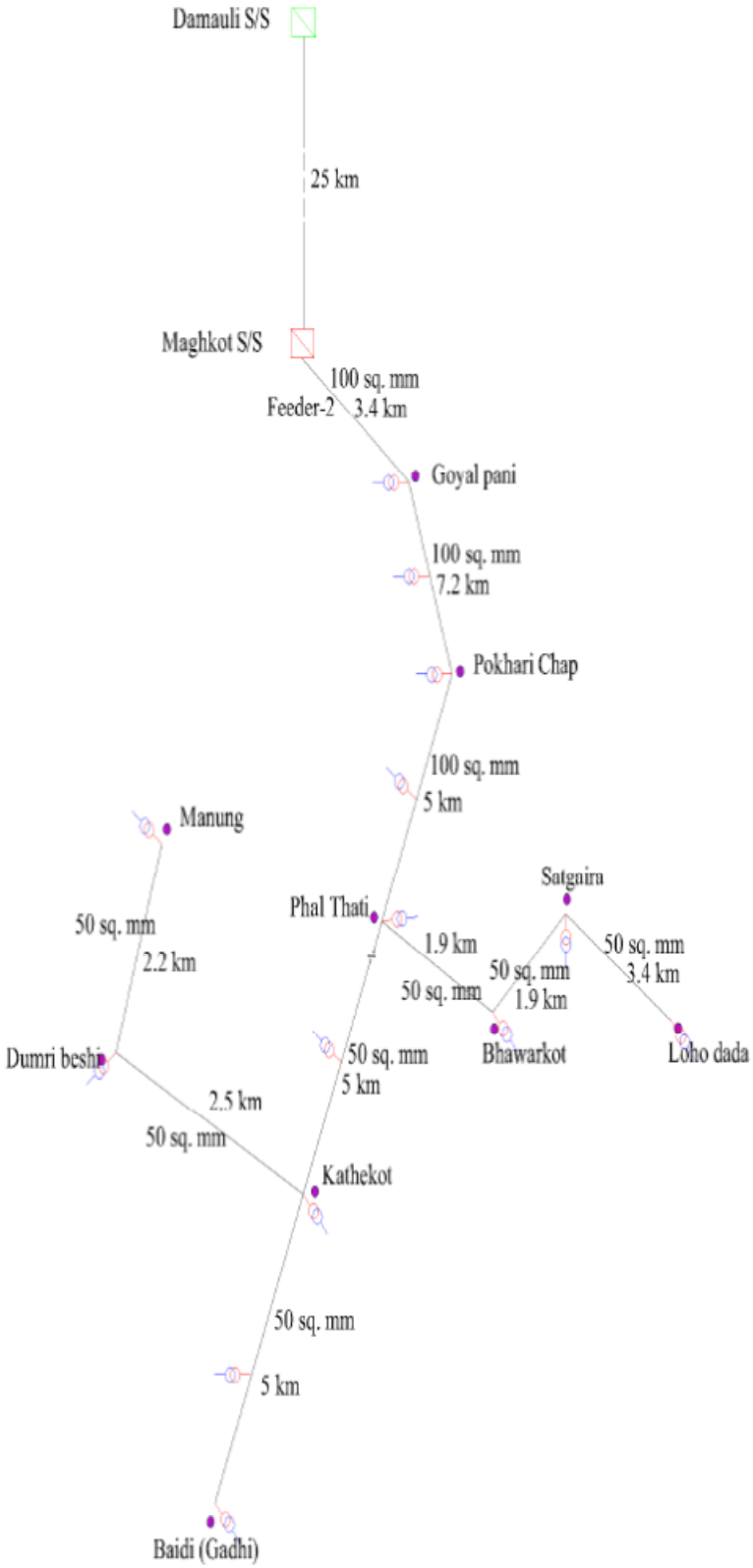


Figure 22: Distribution Network Layout (Dmauli – Maghkot and Maghkot Feeder -3)

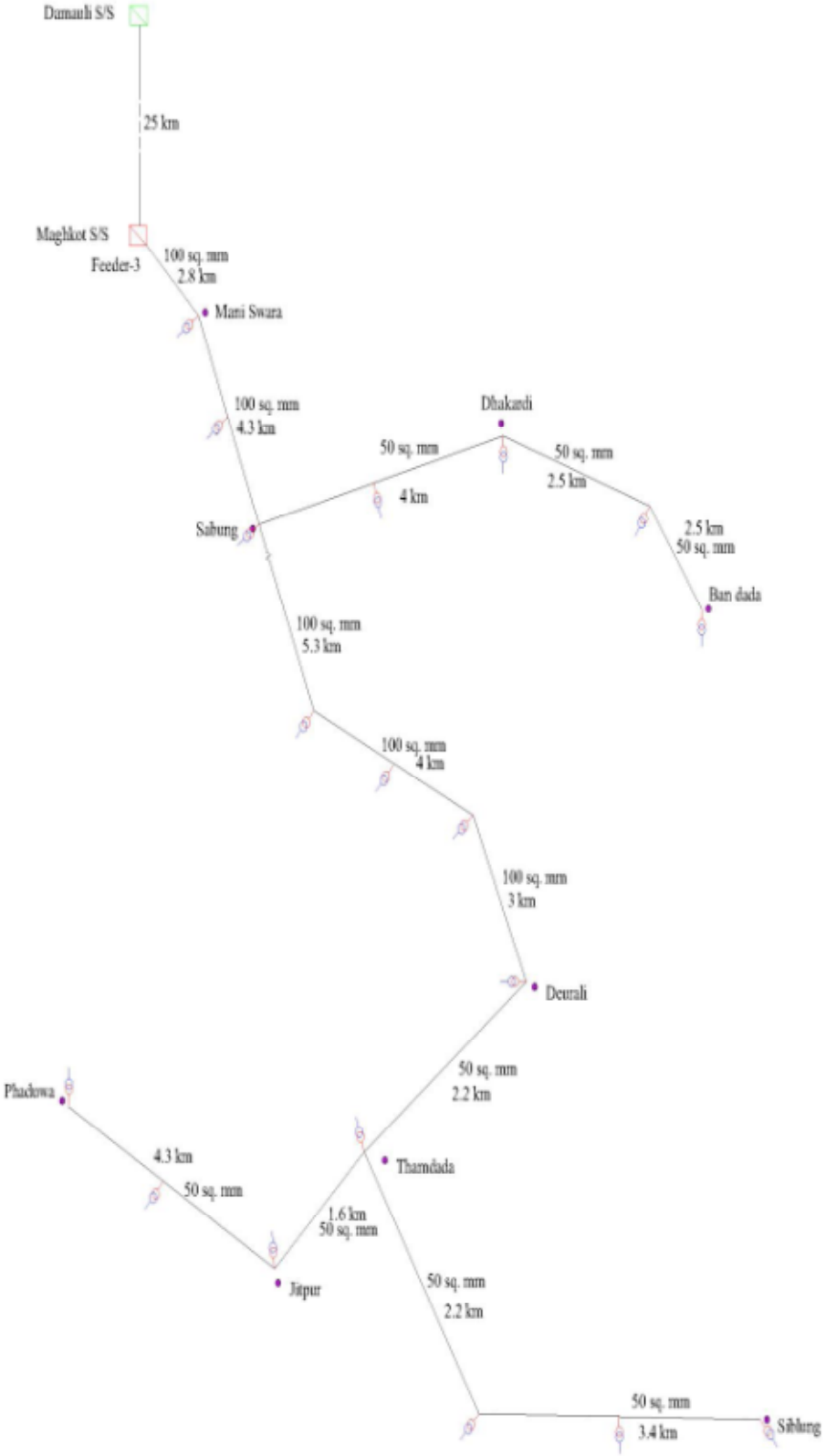


Figure 23: Distribution Network Layout (Dmauli – Maghkot and Maghkot Feeder -4)

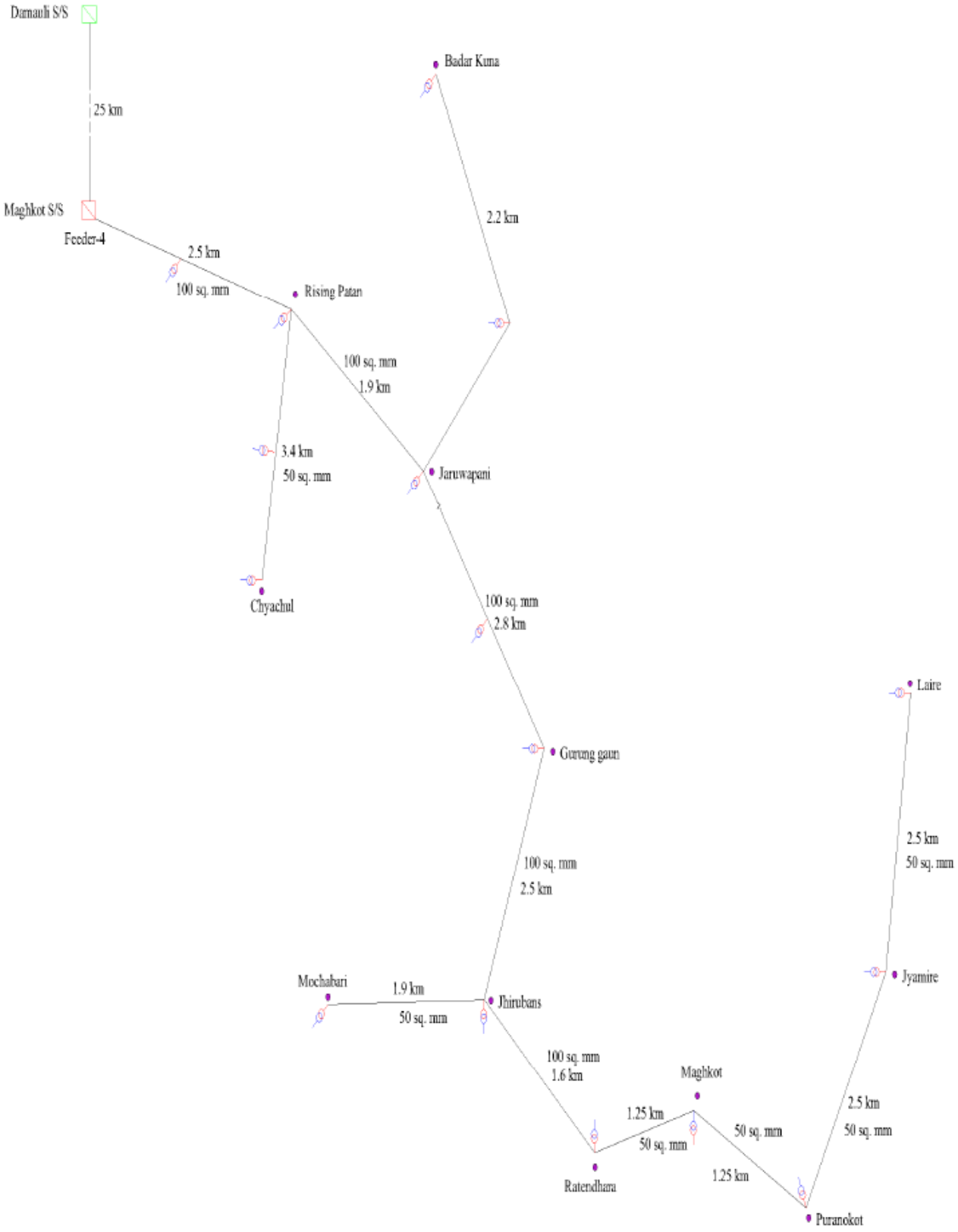


Figure 24: Distribution Network Layout (Dmauli – Jaruwa and Jaruwa Feeder -1)

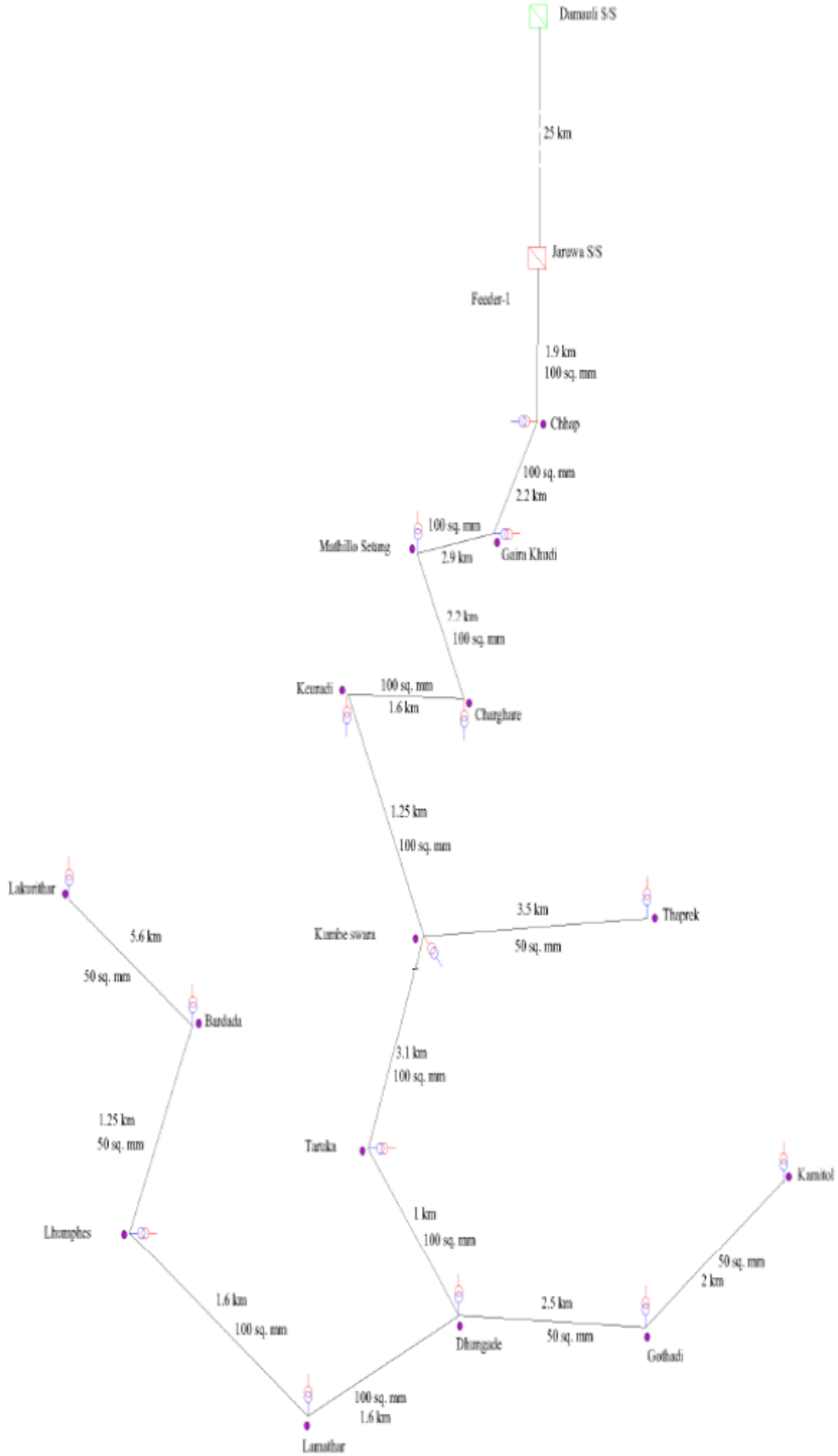


Figure 25: Distribution Network Layout (Dmauli – Jaruwa and Jaruwa Feeder -2)

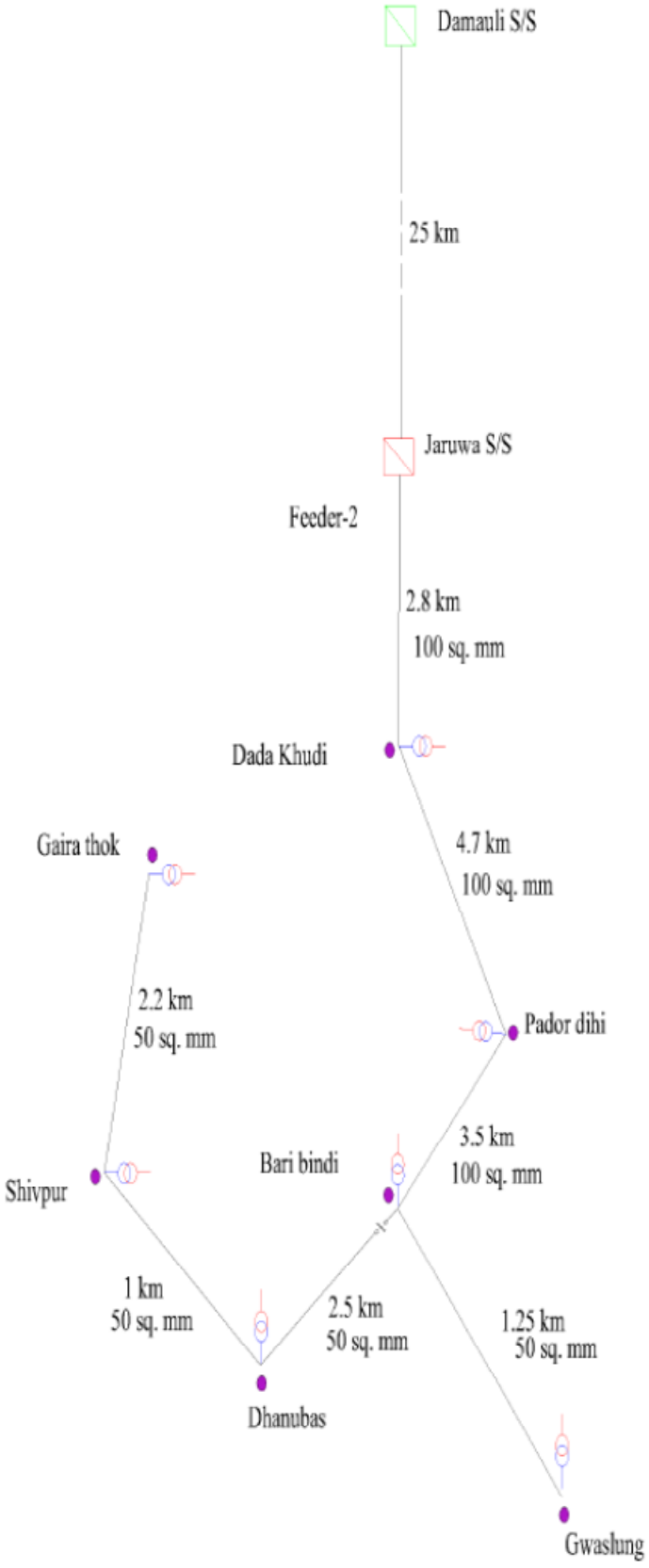
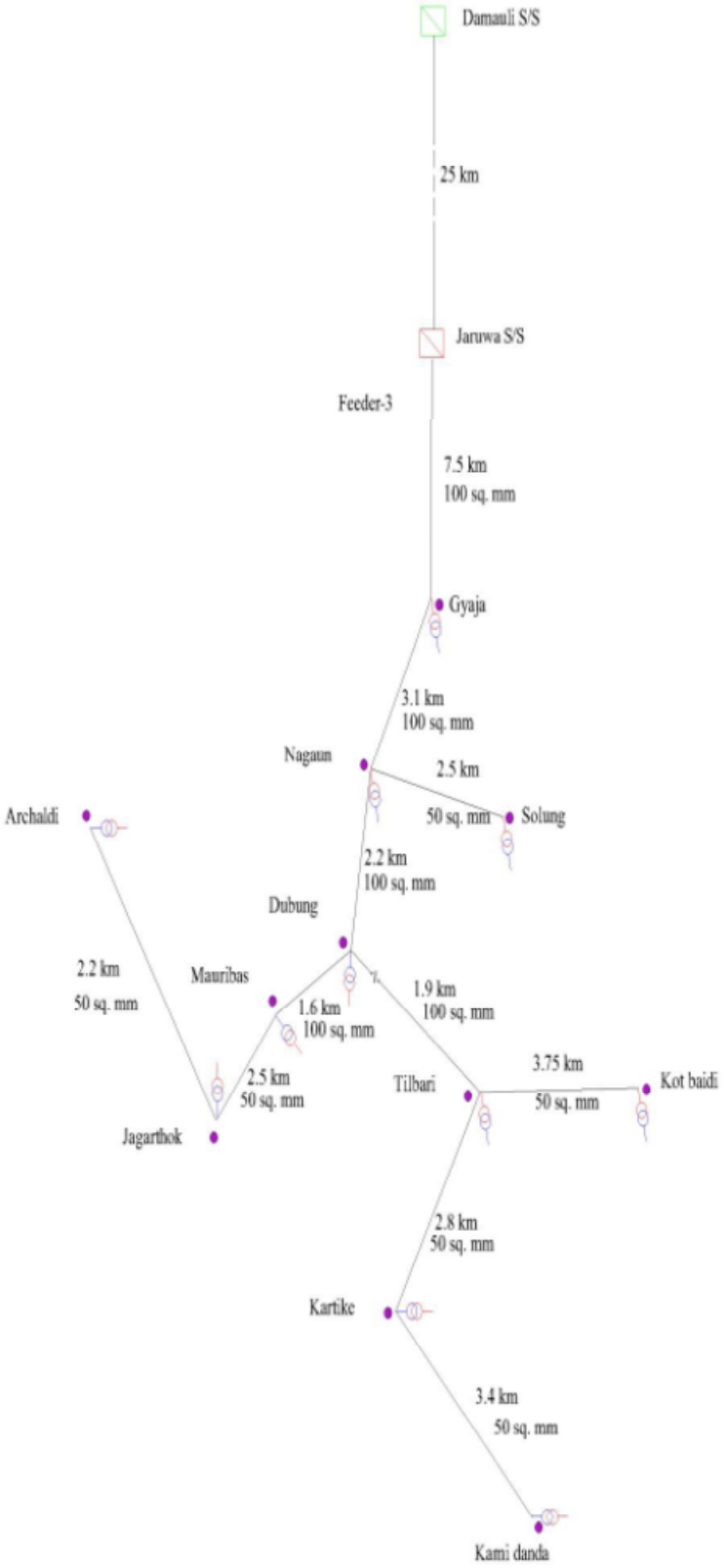


Figure 26: Distribution Network Layout (Dmauli – Jaruwa and Jaruwa Feeder -3)



Sizing of conductor for 33 kV transmission line is primarily based on voltage drop consideration. For this, voltage drop is calculated by computation and also verified in load flow study. A distribution transformer of three phases with capacities of 50 kVA and 25 kVA has been used. The entire distribution transformer are ONAN, pole mounted 3-phase type. Each transformer is protected by a set of dropout fuses (3 numbers) and a set of lightning arrestors (3 numbers).

For the purpose of control and protection of medium size feeders (11 kV feeders), vacuum circuit breakers are provided at the substations having earth fault and over loading protection features. For the long medium size distribution feeders, pole mounted air break type sectionalizing switches are proposed to minimize the outage time. All the laterals are protected with dropout type expulsion fuses.

3.6 Implementation Plan

The access roads to the proposed rural distribution lines are partially aligned to the motorable roads or with the major foot trails. However, major section of LVL passes through the rural areas where even foot trails are lacking. The proposed project involves construction of approximately 1311.55 km of distribution transmission lines (33kV – 50 km, 11 kV 361.55 km, and LVL – 900km). The construction of new sub-station and extension of existing substation involves land acquisition in Dharmapani, Maghkot, Jaruwa and Damauli. In case of construction of distribution transmission line, the project would involve survey work, forest work and clearance, design and engineering of plant equipment, floating tenders for procurement, civil work related to 33 and 11kV and low voltage line and 33 kV/11 kV grid substation testing and commissioning. Total project work costing US$ 10.1 million is expected to complete in ///////// months. The overall project implementation schedule for the project is attached as Table 5.

IV DESCRIPTION OF THE ENVIRONMENT

4.1 Physical Environment

4.1.1 Geomorphology and Topography

Physiographically, the project site is located in the Middle Mounatin Zone (LRMP, 1968)[27]. In the project area, the Middle Mountain Physiographic Zone is represented by a system of mountains and valleys. The general trennds of the major mountain ranges is west -north-west – east-soth-east, whereas the major valley (River Seti) orients due west-north-west- east-south-east and deflects southerly to the east to join River Trishuli. Topographically, the project is highly diverse varying in altitude from less than 200 m to over 2000 m. Geomorphologically, the valley and mountain sytem of the project area is structurally controlled. River Seti forms a deep "V" shaped gorges occasionally flanked by the alluvial terraces at two to three levels. Valley bottom slopes of the flanking mountains are very steep and succeed to the gently slopeing middle mounain slopes and finally culminates into relatively steep uppermountain sloes of the ridge axis. The alluvail teraces at the valley bottom and the gentler middle mountain slopes are the primary area of agriculture and settlment.

4.1.2 Climate

The topographic variation from valley bottom to hill and mountain tops present a unique mixture of climatic conditions within the project area. Climate ranges from tropical at the river valley to temperate in the mountain tops. In the tropical and sub-tropical areas, summers are very hot and humid, with temperatures soaring up to 40^0 C and above occasionally (May – June). In the winters (Dec – February) minimum temperature drops to less than 1^0C and fluctuates between 3^0C to 7^0 C. However, mid day temperatures are quite warm. The temperatures in the Temperate Zones are quite comfortable. Day temperatures in summer vary between 20^0 to 30^0C and in the winters minimum temperatures in the morning drop below 0^0C.

Climate of the project area is influence by the monsoon. Western disturbances brings light rains in the month of January February. Nearly 80% of the precipitation occurs in the monsoon period (June to September). In general, annual total precipitation varies from about 1900mm to 2500mm within the project area. Maximum precipitation in a day in the nearby areas ranges between 182mm (Khirenitar) to 331mm (Lamachaur).

4.1.3 Geology and Soil

The project area falls in the Lesser Himalaya of western Nepal. The Lesser Himalayan Zone in the project area is represented by slates, quartzite, and dolomites of Nawakot Group belonging to Kuncha Formation, Fagfog quartzites, Danadagaon Phyllites, Nourpul Formation, Dhading Dolomites and Benighat Slates. In general the rock formations strike northwest south east and dip moderately to steeply due north east and south west to fold structures. No major fault structures are represented in the prject area.

The soil within the project area could be classified into three broad categories namely, alluvial, colluvial and residual. The alluvial soil are found along the Seti river and are represented by old

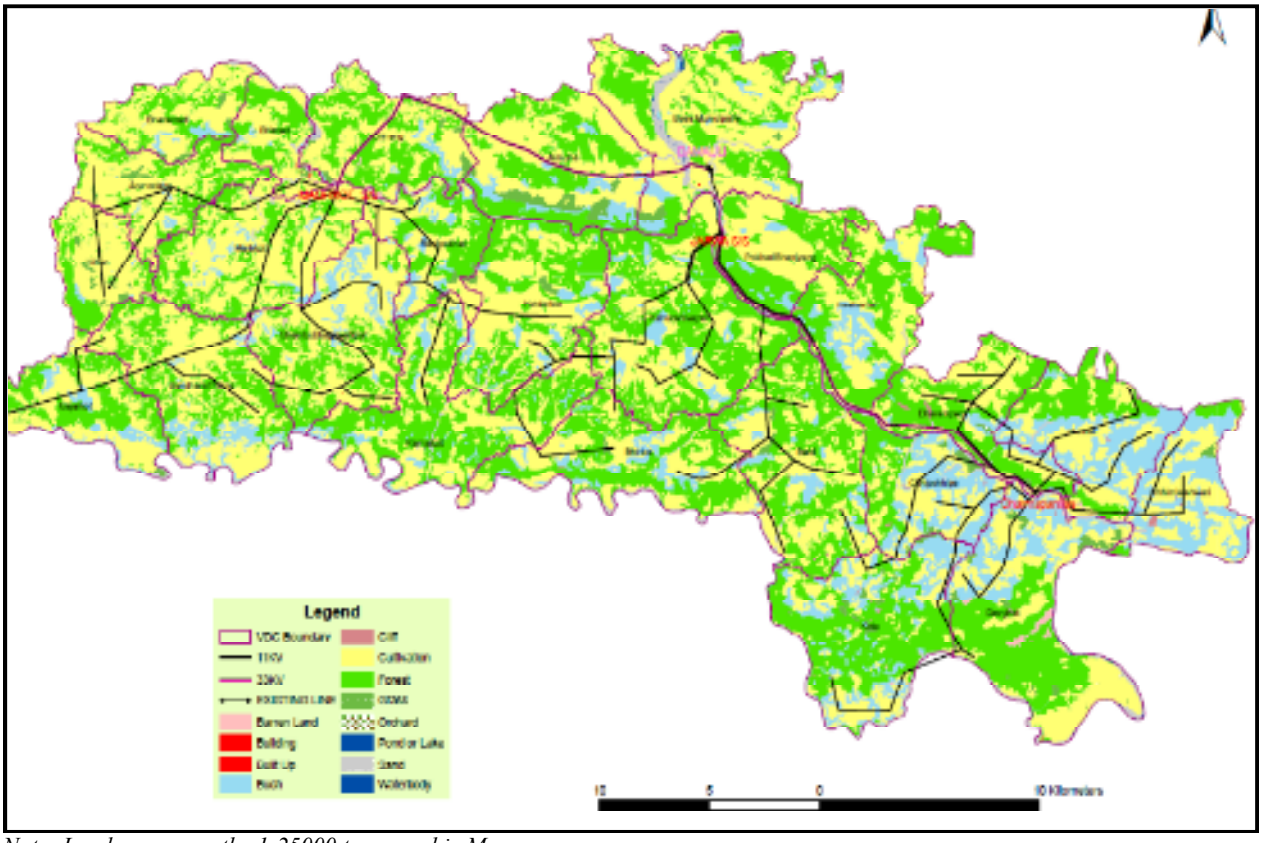
[27] , 1986

alluvial soil and recent alluvial soils. The old alluvial soil forms the extenssive terraces occasionally along th Seti River, while te recent alluvial soils are found mostly along the river channels. The colluvial soil is usually found in gently sloping hills. It varies inthickness from 1 to 3 m thick and rarely exceeds 6 m. The middle mountain slopes and toes of the valley slopes are the typical colluvial soil in the project area. Residual soil are ocasionally deeloped along the ridge summits of the mountain ranges.

4.1.4 Land Use

In terms of land area, forest land use is the dominant landuse in the project area followed by agriculture. The forest area is estimated to comprise nearly 40% of the land and agriculture arround 35 percent. The shrub and grass land comprises nearly 20 percent and rest is made up of the other landuses including riverine area, and barren lands. The general landuse map of the project area is presented in Figure 27.

Figure 27: The Land Use Map of the Project Area showing 33kv/11kV Distribution Lines and Sub-station



Note: Land use as per the 1:25000 topographic Maps.

All the sub-stations are located in the agricultural land use, while the 33/11 kV transmission line pass across the agricultural and forested lands (Table 5).

Table 5: 33/11 kV Line Length (km) passing through the Different Land Use

Sub-station	Distribution line	Cultivated land	Forestland	Bush land	Grassland	Total
Jaruwa	33 kV	3	0	0	0	3
	11 kV	52.56	29.62	2.95	0.47	85.6
Maghkot	33 kV	16.10	5.15	0.75	0	22
	11kV	94.38	19.11	4.96	0	118.45
Dharmapani	33 kV	8.83	16.17	0.00	0.00	25
	11 kV	76.26	36.10	25.55	1.59	139.5
Total		251.13	106.15	34.21	2.06	393.55

Note: Land use as per the 1:25000 topographic Maps.

Nearly 27 percent of the 33/11 kV distribution line passes through the forest land which is a notable issue of the project.

4.1.5 Soil Erosion, Land Instability and Watershed Conditions

The watershed conditions of the distribution line network locations are moderate to fair. The agricultural lands being maintained by the farmers periodically do not pose problems of land erosion and land instability. The forest land and bush grass lands, however, have been under pressure of cattle grazing and are in degraded state. In the recent years with the handover of the forest to the community forest user groups under community forestry, the status of these forests are gradually improving with better undergrowth and forest stock.

Since the rural electrification terrain is hilly landscape with varying degree of slope, the steeper section with thin to moderately thick colluvial soil cover have a potential to failure during heavy monsoon outpour. The old alluvial tars, particularly along the edge of the terrace breaks are also potential to block toppling and debris flow. Similarly, the tributary streams joining the Seti River and Kali Gandaki River in the north and south, have steep longitudinal profiles. These streams have a gully like morphology at the headwaters and are potential to expand laterally and head wards. Proximity of distribution line poles across such streams could be vulnerable to the risk of erosion and land instability.

4.1.6 Water, Air and Noise quality

The area covered by the project represents the rural setting characterized by scattered settlements with intervening forestland and pastures. Spring feed streams and creeks are the main water sources of the area. As the area is not industrialized, the only source of water pollution is the human defecation and waste waters from the household's kitchen and cowsheds. In general the quality of the water is good and fit for human consumption, chances of microbial contamination is high due to common practice of open defecation on the fields and along the creeks and direct discharge of the household wastes in the nearby areas.

Owing to the absence of industrial and vehicular activities in the project area, the ambient air quality is not contaminated by the combustion emissions. Biomass burning for cooking is the non-point source of pollution and contributes very little pollutant to the ambient air. Occasional forest fire in the dry months (March to May), and easterly winds from the desert of Rajasthan in

India engulf the entire area with haze causing low visibility due to high concentration of the suspended particulate matter in the ambient air.

Noise in the area relates to the anthropogenic activities of the rural population such as talking, playing radio, barking of dogs, etc apart from the calls of birds and wild animals and the whispering of winds. In general the noise level in the area is near to the natural state not influenced by the noise of vehicles, industries, and high concentration of population.

4.2 Biological Environment

The forest, bush land, grass land and the riverine water bodies are the primary habitat sites for the project area flora and fauna. The agricultural area and settlements, nevertheless, provide habitats to fauna accustomed with the human settlements only. Most of the floral species in the agricultural lands are exotic species with limited local flora of ethno-botanical and agro-economic values only.

4.2.1 Flora

The proposal area is a part of Central Nepalese Bio-geographic Region (Dobremez, 1976). From altitudinal consideration the area is a part of Upper Tropical Eco-Zone (300 to 1000m) and Subtropical Eco-Zone (1000 – 2000m). Upper tropical Zone below 1000m is characterized by Hill Sal forest, Kahair – sisso forest and Hardwood Open Mixed forest, whereas the subtropical Zone is dominated by the Schima-Castanopsis Forest in the moist area and by Chir Pine Forest and/or Chir Pine-Broad Leaved Forest in the dry areas.

Shorea robusta is dominant tree species of the Hill Sal Forest and is associated with Schima *wallichii* (Chilaune), *Lagerstroemia parviflora* (Botdhyero), *Bauhinia vahlii* (Bhorla) and *Desmodium oojeinense* (sadan) etc. This forest is dominant about 2 to 300m above the river valley floor on the gorge of the Seti River. Hardwood Open Mixed Forest is dominant along the river belt. Representative species differ depending upon the aspect of the hill. *Terminalia alata* (Saj), *Mallotus philippensis* (Sindhure), *Albizia chinensis, Albizia lebbeck, Sapium insigne* (Khirro), *Bamboo spp*., *Lagerstroemia parviflora* (Botdhyero), *Bauhinia vahlii* (Bhorla) and *Desmodium oojeinense* (sadan) are commonly found in this forest. Other associates are *Murraya koenigii*, *Leea macrophylla* and *Dioscorea bulbifera*. This forest is rich with ground vegetation. Khair – Sisso forest, also scattered along the Seti river gorge along the river flood plains and alluvial tars is dominated by *Acacia catechu.* Schima-Castanopsis Forest is best represented by *Schimawallichii, Castanopsisindica, C. tribuloides* and *Englehardtia spicata* which are conspicuously found in the project area. This forest is dominant above 600m in the moist areas of the mountain slopes. The chir-pine forest in the dry slopes is dominated by *Pinus roxburghii.* The 33kV transmission line linking Jaruwa- Dharampani, and Damauli – Maghkot traverses across the Hill Sal forest, whereas most of the 11kV transmission lines in the middle reaches of the mountain pass through the Schima-Castanopsis Forest and Chir-Pine Forest.

Floristic exploration of Tanahu Hydropower Project (THP) area revel 209 flowering plant species[28]. Number of flowering plants indicates that, the area is very rich in plant biodiversity. The THP survey enumerated herbs in highest number (69 spp.) followed by tree (62 spp.), shrubs

[28] Upgrading EIA Study of Upper Seti Hydroelectric Project, 2006

(53 spp.) and climbers (25 spp.). The project area is also equally diverse in wild ferns. A total 18 ferns have been recorded from the area. A total 28 ornamental plants mostly exotic were also recorded from the project area.

4.2.2 Fauna

Though the forest area comprises nearly 40 percent of the total land use, degraded nature of the forest coupled with high degree of fragmentation by the agricultural and settlement land uses, the habitat conditions of the forest is not considered as good to the wild fauna. Though the THP EIA study has reported a large number of mammalian wildlife, presence of many of the wildlife species is considered doubtful in the area[29]. The common mammalian species found in the area are Rhesus monkey, Assamese monkey, Langur monkey, Himalayan Goral, Wild boar, Bengal fox, Barking deer, Yellow throated martin, Jungle cat, Common leopard, Jackal, Squirrel, Bats, Porcupine, and Rabbits.

A total of 17 reptile and amphibian species are reported from the area[30]. Common among them are House lizard, Garden lizard, Frog, Toad, Green or Bamboo pit viper and Rat snake, while others are rare and only occasional.

Sixty-two bird species belonging to 14 orders and 34 families were recorded31. The most commonly found bird species are House Crow, Black Drongo, Indian Cuckoo, Fulvous-breasted Woodpecker, Asian Koel, House Sparrow, Spotted Dove etc. In terms of habitat utilized by species the highest number of species is associated with scrubby vegetation (30%); followed by Forest (26%), Grassland and Agricultural land (18%). Least number of species are associated with water (13%) and residential areas (13%). Of the 62 species recorded from the area, 81% species are residents and 19% are migratory birds.

4.2.3 Freshwater Acquatic System

River Seti and its tributaries have a rich assemblage of fish species. A total of 49 species of fish have been reported from Seti river[32]. The Seti River provides the migrating corridor for the fish species whereas the tributary streams acts as the spawning habitats for the fish species. The most dominant fish species in the Seti River are the *Neolissochilus hexagonolepis, Barilius bendilisis, Schizothorax richardsoni, Garra annandalei, Labeo panagusia, Garra goytla* and *Tor putitora*. Of the Total fish species, five species are long distance migratory species, while 5 are short to mid range migratory species and remaining are resident species.

4.2.4 Flora and fauna of Conservation significance

Of the recorded floral species 11 species fall under the conservation significance under Government of Nepal Protection List, CITES Appendix and IUCN redbook (Table 6)[33].

[29] Environmental Addendum, Upper Seti (Tanahu) Hydroelectric Project, 2012
[30] Upgrading EIA Study of Upper Seti Hydroelectric Project, 2006
[31] Upgrading EIA Study of Upper Seti Hydroelectric Project, 2006
[32] Environmental Addendum, Upper Seti (Tanahu) Hydroelectric Project, 2012
[33] Environmental Addendum, Upper Seti (Tanahu) Hydroelectric Project, 2012

Table 6: Plants of Conservation Significance

SN	Species	Conservation Status		
		GoN	CITES	IUCN
1	*Acacia catechu* (L.f.) Willd.	+		
2	*Alstonia scholaris* (L.) R. Br.			Least Concern
3	*Coelogyne sp*.		Appendix II	
4	*Dendrobium sp*.		Appendix II	
5	*Dioscorea deltoidea* Wall. Ex Griseb		Appendix II	
6	*Cymbidium sp*.		Appendix II	
7	*Oroxylum indicum* (L.) Kurz.			
8	*Pandanus nepalensis* St. John			
9	*Rauvolfia serpentina* (L.) Benth.	+	Appendix II	
10	*Shorea robusta* Gaertn.	+		Least Concern
11	*Vanda teres* Lindl.		Appendix II	

IUCN Red Book - VU: Vulnerable; EN: Endangered; NT: Near Threatened. CITES Appendices – I, II, II, GON – P protected by Law

Among the Mammalian fauna 15 species are under the conservation category of GON, CITES, and IUCN Red Book (Table 7)[34]

Table 7: Mammals of Conservation Significance

SN.	Common Name	Scientific Name	Local Name	Doubtful Presence	Conservation Status		
					CITES Annex	IUCN	GON
1	Royal Bengal tiger	*Panthera tigris*	Bagh	Yes	I	EN	P
2	Common leopard	*Panthera pardus*	Chituwa		I	NT	
3	Common Otter	*Lutra Lutra*	Ontt	Yes	I	NT	
4	Assamese monkey	*Macaca assamensis*	Asami Bandar		-	NT	P
5	Striped Hyaena	*Hyaena hyaena*	Hyaena / Bagh	Yes		NT	
6	Clouded leopard	*Neofelis nebulosa*	Dhwanse Chituwa		I	VU	P
7	Himalayan black bear	*Ursus thibetanus*	Kalo bhalu		I	VU	
8	Sloth bear	*Melursus ursinus*	Kathe Bhalu		I	VU	
9	Langur Monkey	*Semnopithecus entellus*	Langur (Kalo bander)		I	LC	
10	Bengal Fox	*Vulpes bengalensis*	Fauro		III	LC	
11	Jackal	*Canis aureus*	Syal		III	LC	
12	Yellow throated martin	*Martes flavigula*	Malsapro		III	LC	
13	Palm civet cat	*Paguma larvata*	Bharse		III	LC	
14	Red fox	*Vulpes vulpes*	Rato Fyauro	Yes	III	LC	
15	Leopard cat	*Felis bengalensis*	Chari bagh		-	LC	P

IUCN Red Book - VU: Vulnerable; EN: Endangered; NT: Near Threatened. CITES Appendices – I, II, II, GON – P protected by Law

[34] Environmental Addendum, Upper Seti (Tanahu) Hydroelectric Project, 2012

Among the fish species of the Seti River and its tributaries, six fish species have been listed in the IUCN Red Book (Table 8)[35].

Table 8: Fish Species listed in the IUCN Red Book

Scientific Name	Nepali Name	IUCN Red List Category
Tor putitora	Pahelo Sahar	EN
Bagarius yarrelli	Gounch	NT
Neolissochilus hexagonolepis	Katle	NT
Tor tor	Sahar	NT
Labeo pangusia	Rewa	NT
Schizothorax richardsonii	Asala	VU

IUCN Red Book - VU: Vulnerable; EN: Endangered; NT: Near Threatened.

4.2.5 Biodiverisity Conservation

The project area lies outside the biodiversity conservation sites (National Parks, Strict Nature Reserve, Wildlife Reserve, Hunting Reserve, Conservation Area, and Buffer Zone) officially declared by the Government of Nepal. The forest areas within the project area are the parts of Government Managed National Forests, some part of which are handed over to the Communities as Community Forests for the management purpose. One of the objectives of the community Forest is to conserve the local biodiversity.

4.3 Socio-economy and Cultural Environment

The rural electrification area covers 18 VDCs of the Tanahu district comprising of 46 VDCs and one municipality. By population the rural electrification coverage is about 30 percent of the total population[36].

4.3.1 Demographic Characteristics

The demographic characteristics of the rural electrification VDCs projected for 2011 is presented in Table ////. Total population of the project covered areas is estimated to be 114963 residing in 20999 household with an average household size of 5.47 varying from as low as 4.24 to as high as 6.88 among the covered VDCS. Female population is higher than the male population except for Chipchipe VDC.

Table 9: Demographic Characteristics of the VDCs covered by the Project

VDCs	HH	Total Population	Male	Female	Household size	Male Female Ratio
Arunodaya	1247	7177	3422	3755	5.76	1.10
Baidi	1034	5840	2758	3082	5.65	1.12
Chimkeshwori	444	2699	1303	1396	6.08	1.07
Chipchipe	480	3142	1539	1063	6.55	0.69
Deurali	628	3915	1898	2017	6.23	1.06

[35] Environmental Addendum, Upper Seti (Tanahu) Hydroelectric Project, 2012

[36] District Development Profile of Nepal, 2012, Mega Publication Research center.

Devghat	2114	8961	4340	4620	4.24	1.06
Dharampani	900	4603	2093	2509	5.11	1.20
Gajarkot	1515	7565	3503	4062	4.99	1.16
Ghiring Sundhara	1625	8785	4120	4665	5.41	1.13
Kahu-Shivpur	1379	9485	4740	4745	6.88	1.00
Kihu	1095	5153	2312	2841	4.71	1.23
Kot Durbar	1237	7462	3315	4111	6.03	1.24
Kota	766	4925	2431	2494	6.43	1.03
Maghkot	1748	9315	4331	4984	5.33	1.15
Ramjakot	955	5419	2542	2876	5.67	1.13
Rising Ranipokhari	939	4912	2270	2642	5.23	1.16
Savung Bhagwatipur	1694	9383	4417	4966	5.54	1.12
Virkot	1199	6222	2925	3297	5.19	1.13
Total	20999	114963	54259	60125	5.47	1.11

Nearly 42 ethnic groups reside in the Tanahun district[37] and the project covered area is not different from the rest of the Tanahun district. Of the total 59 ethnic groups put under the indigenous categories in the country, Tanahu district consists of 13 groups where Magars alone are dominant representing the single highest group. All other caste or ethnic groups figure out much less in the district population composition. In Project area/ VDCs, the presence of Magars among Janajati is quite considerable (>70%) which simply means that the Project area has dominance of Magar groups. In a few project VDCs, Magar ethnic Group constitutes over 80 percent of the VDC population[38].

The project area is predominated by people of Hindu religion with an overwhelmingly large percentage (96.6%)[39]. Interestingly, the large percentage of ethnic groups mainly Magars and few others viz Gurungs, Newars and some others who are put under the category of indigenous group are Hindus by religion. Because of the common religion that many caste and ethnic groups of the area adhere, they are naturally bound to have close connections in many respects. The common religion among diverse caste/ ethnic groups becomes a strong uniting force in many respects such as observing major festivals commonly with many of their values, beliefs and norms being more or less similar which are practiced in their day to day life. Buddhist, Muslim, Kirat, Christian and others are the religions followed by a very small percentage of the population.

4.3.2 Quality of Life Values

Seventy percent population of Tanahu district above 6 years of age is reported to be literate. The male population has higher literacy rate (79%) compared to the female (56%). Literacy rate of

[37] Tanahun District Profile, 2009 – District Development Committee of Tanahun
[38] Socio-economic Survey of the Project Affected VDCs, Upper Seti Hydro-electric Project, 2011.
[39] Socio-economic Survey of the Project Affected VDCs, Upper Seti Hydro-electric Project, 2011.

the project VDCs vary widely and is less than the Tanahun district[40]. Some of the VDCs have literacy rate as low as 24 percent, while some has literacy rate above 68 percent (Table 10)[41].

Table 10: Literacy Rate – Project VDCs

Project VDCs	Literacy Rate %	Project VDCs	Literacy Rate %
Arunodaya	61.4	Kahu-Shivpur	67
Baidi	40.5	Kihu	67
Chimkeshwori	24.3	Kot Durbar	46.3
Chipchipe	48	Kota	46.3
Deurali	28.4	Maghkot	54.4
Devghat	44.6	Ramjakot	68.6
Dharampani	35.8	Rising Ranipokhari	46.9
Gajarkot	44.8	Savung Bhagwatipur	67.9
Ghiring Sundhara	57.5	Virkot	60.3

Similar to the Tanahu district literacy rate again varies widely between the male and female population, Female population literary rate is estimated to be lower than the district female literacy rate in the project VDCs. Tanahu district is facilitated with 425 primary level schools, 59 lower secondary level schools, 96 secondary level schools and 12 higher secondary level schools and 7 campuses. The project VDCs has a primary level school at each village, however, the lower secondary level and secondary level school are not present at each village and in some village the secondary level schools are lacking.

The Tanahun district is served by two 30 bed hospitals, one three bed Primary Health Centers, 13 Health Posts, 31 Sub-health Posts etc. The project VDCs are serviced by at least one sub-health post or a Sub-health post. Health service outreach to the villages within the VDCs is not satisfactory both in terms of service facilities, medication, and health workers. Among the top ten diseases of the districts, skin diseases followed by ARI, PUO and diarrheal diseases are most prevalent and the case is not reported to be different from the district in the project VDCs.

According to DDC, about 74[42] percent population of the district has access to the piped drinking water facility, while almost 20 percent populations rely on well. Exact database on the water supply situation of the project district is not available but is not considered to be better than the district average because of its remoteness from motorable head. The village without any piped water supply systems still rely on the on spring, spout, river spring etc for household water use. Average Tanahun district sanitation is poor as only 31 percent[43] uses toilet facility. However, the VDCs located close to the highway and in the urban areas, more than 80 percent use toilets. Since the project area is located in relatively remote part of the Tanahun district, only 20 to 25

[40] Tanahun District Profile, 2009 – District Development Committee of Tanahun

[41] District Development Profile of Nepal, 2012, Mega Publication Research center

[42] Tanahun District Profile, 2009 – District Development Committee of Tanahun

[43] Tanahun District Profile, 2009 – District Development Committee of Tanahun

percent of households are estimated to use toilet facilities. The entire project area lacks sanitary sewer and wastewater treatment facilities. The wastewater is directly discharged into the nearby field or creeks.

Mobile Telephone service is now available in the entire project VDCs. Land line telephone service, however is still lacking. Of the total VDCs to be served by rural electrification, only four VDCs are partially electrified while rest is not electrified. The major source of lighting energy in these VDCs is traditional kerosene lamps, while a few also use solar energy. Cooking energy in the project VDCs is dominated by fuel wood. More than 98 percent use fuel wood for cooking while a few also use biogas, and LPG and Kerosene.

The media of communication and news in the project VDCs is mobile telephone and radio (MW and FM services). News paper and television as media of news is not in use due to remoteness and lack of electricity. Motorable access is lacking in most of the project VDCs. Most of the villages of the project VDCs have to walk nearly 3 to 5 hours to reach the motorable roads. Except for the Dharampani VDC postal service is available in the rest of the project VDCs.

4.3.3 Livlihood

Agriculture continues to be the major sector providing employment to the household members in the area. The second most important sector of employment after agriculture is foreign employment. Foreign employment as a source of livelihood is growing over the last decade with a corresponding share of reduction in other sectors, primarily the agriculture, study and other sub-sectors. Men's share in agriculture is less against women's which is due to higher migration of males in foreign employment in recent years[44]. Although agriculture still remains as a major occupation for a higher percentage of population as elsewhere in the country, the household members seem to be engaged in other activities too suggesting that agriculture alone does not fulfil their food and financial requirements.

Like elsewhere in the rural area, land is the only resource in the project area upon which many families depend for their employment and food grain production which supports their livelihood. The households mainly cultivate two types of lands: i) Khet land which is generally irrigated and paddy based with bonds for holding water, and ii) Bari land which is along slope terraces without bonds and used mostly to grow maize and millet. Kharbari/pasture lands are mostly maintained for grass and fodder for livestock and some rural households also maintain their small orchards for fruit production. Land holding size is an important economic indicator of the households in rural area. The average land holding size of the Tanahu district is 0.54 ha[45] and is estimated to be similar in the project VDCs.

Major cereal crops grown are paddy, maize, wheat, millet and buckwheat. Cash crops grown constitute potato, pulses, oilseed, vegetables and different types of fruits. Among cereal crops, maize, and paddy are the primary food staple crops, while wheat is grown by limited numbers of households. Pulses and oilseeds are the other cash crops which are commonly grown by most of the households. None of the project VDCs is food sufficient. More than 30 percent households of the project VDCs are reported to be food deficient from their farmlands.

[44] Socio-economic Survey of the Project Affected VDCs, Upper Seti Hydro-electric Project, 2011
[45] Tanahun District Profile, 2009 – District Development Committee of Tanahun

A significant number of household members are migrating from the area for seasonal earnings to meet their food deficit. The migration of households occurs irrespective of caste and ethnicity. At least one member of the household is reported to be migrating out of their place for the seasonal earning. Animal husbandry is the other strategy for the livelihood support of the households. Most of the households raise cow, buffalo, or goat including fowl as a secondary source of income or nutrient supplement.

4.3.4 Culture and Cultural Sites

The majority of the project VDC population is Magar and the Magar culture and traditions dominate the cultural practices in the project VDCs. Magar has distinct language and culture of their own. In the project area VDC Barha Magarati language is spoken by the Magars. Though the birth, marriage, and death rituals are similar to that of the mainstream Hindus, the Magars have distinct discernible features in the observation of these life time rituals. It is customary among the Magars of Tanahun to take service of Brahmin Purohit (priest) in their rituals. Some of the main rituals are Birth rituals, Pasni, Marriage, Divorce and Death rituals etc. Like Gurung communities of western Nepal, there is a tradition of Rodi among the Magars of Tanahun. The Rodi is a community place where unmarried girls and boys gather together and sing duet songs. Since the culture of the Magar is nearly similar to that of the main stream Hindu groups, there is no cultural conflict between the various ethnic groups exhibiting cultural harmony among the communities.

There are number of local village level temples within the project VDCs worshiped and spiritually observed by the locals. Some of the temples and shrines of regional significance in the project VDCS are:

- Chimkeshwori Mai - Chimkeshwori VDC
- Devghat – Devghat VDC
- Savung Bhagwati - Savung Bhagwatipur VDC

The historical site of some archeological significance is the Kot Durbar in the the Kot Durbar VDC.

V. ANALYSIS OF ALTERNATIVES

5.1 No Project Option

The project VDCs are not electrified. Electification through household solar panal is not only costly but also not affordable to the rural households relying on the subsitent rural economy. It is therfore the no project option of rural electrification based on hydropower project is rejected.

5.2 Location Options

There are number of alignment options of the rural electrification networks in the project VDCs. The most chepeast option, however, is governed by the feeder sub-station in the nearby location with sufficient capacity to feed the project VDCs. In tis context, the existing 132/33kV substation at Damauli close to the project VDCs is the best option not only from economic consideration but also from the environment consideration to avoid loss of resources from a longer feeder line.

As the electrification area covers wide area, establishment of electrification network from a single feeder/Sub-station is envisaged to incurr high loss of electrical energy in the distribution network. To avoid such loss selection of sub-stations feed by 33kV distribution line from the existing sub-station and distribution to the rural households through 11Kv line and 230/240 volt lines using appropriate capacity trasformers is the best option. Keeping the above consideration in mind, a preliminary route selection is done by THL based on the interpretation and walk over surveys according to the 1:25,000 Maps/Topographical maps and Google images of the area. The proposed rural distribution line, particularly while aligning the MV line (33kv/11 kV) has taken care of the followings:

- The route of the proposed transmission lines avoids or minimizes passage through human habitations.
- Any monument of cultural or historical importance is not affected by the route of the transmission line.
- The proposed route of transmission line does not create any threat to the survival of any community with special reference to Tribal Community.
- The proposed route of transmission line does not affect any public utility services like playgrounds, schools, other similar establishments etc.
- The line route does not pass through any sanctuaries, Protected Parks, etc.
- The line route avoids or minimizes infringement with areas of natural resources.

The preliminary layout of the sub-station and MV line has taken an approach to cover the area in the shortest possible route to minimize the cost vis a vis to minimise the loss of the environmental and social resources. It is therfore the selected layout of the sub-station, and MV line alignment is the best possible option among the options available for rural electrification network in the geven geographical area.

5.3 Design Alternatives

The sizing of the sub-station components, selection of the 33kV sub-transmission line poles (11 m long steel tubular pole) and 11 kV poles (telescopic poles), choice of conductor and size of

conductor in the different areas, and sizing of the distribution transformer and the protection accessories all are based on the consideration of the environment and economy while designing the project.

VI POTENTIAL ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

The potential environmental impacts associated with the projects during the pre-construction, construction, and operation phases, are envisaged to involve the following impacts:

- Land acquisition the sub-station and economic displacement of people
- Removal of vegetation, including trees and crops along the distribution line
- Excavation of sites for project sub-station and transmission pole foundation, including transport and disposal of excavated materials, erosion at excavation sites, possible noise/dust pollution, and management of workers and waste
- Spills of fuel and other lubricants at the construction site/workshop/repair site that may affect soils and water quality
- Noise from construction equipment
- Affects to the built structures including residential, educational, and cultural sites and artifacts.

6.1 Environmental Impacts and Mitigation Measures Needed during the Design/Pre-Construction Phase

6.1.1 Final Route Selection

The preliminary route selection is done by THL based on the interpretation and walk over surveys according to the 1:25,000 Maps/Topographical maps and Google images of the area. Though a number of considerations have been excercised to minimise the environmental impacts in the preliminary survey and there is no need to change the layout of the sub-station and distribution networks in general (refer section 5). As the present layout interfinge at few locations with built residential and educational structures (Refer Figure 28, 29, 30, 31, 32, and 33 below), it is essentail to avoid these built sturctures during the final alignment survey.

Nearly 27 percent of the MV line passess through the forested land which will require clearence of vegetation and trees. As per the forest Guideline 2006, all the projects have to analyse the alternatives and identify alternative that cause little disturbance to the forested land and vegetation. Though the selected alternative avoid the forest land while laying out the alignment route, there are still possiblitiites to avoid the forest land or pass the MV lines through the degraded area of the forested land to minimise the loss of vegetation and trees.

Of significance importance is aligning the MV and LV lines close to the existing motorable routes and foot trails. Aligning the lines close to the motorale roads and trails will facilitate easy maintenance of the lines during operation phase, and minimize the cost of transportation as well as reduce the loss of natural resources for the establishment of trails along the alignment during construction for material transport.

Figure 28: MV Line Alignment and locations of the Schools, Temples and Health Posts (Dharmapani Sub-station and Feeder Line)

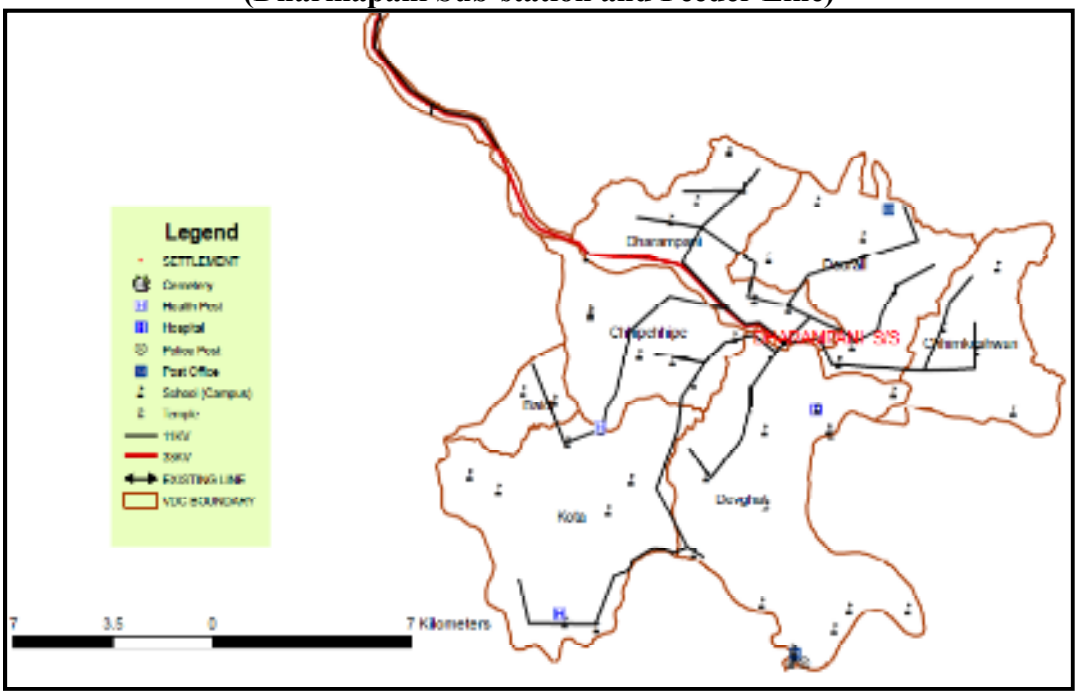


Figure 29: MV Line Alignment and locations of the village built structures (Dharmapani Sub-station and Feeder Line)

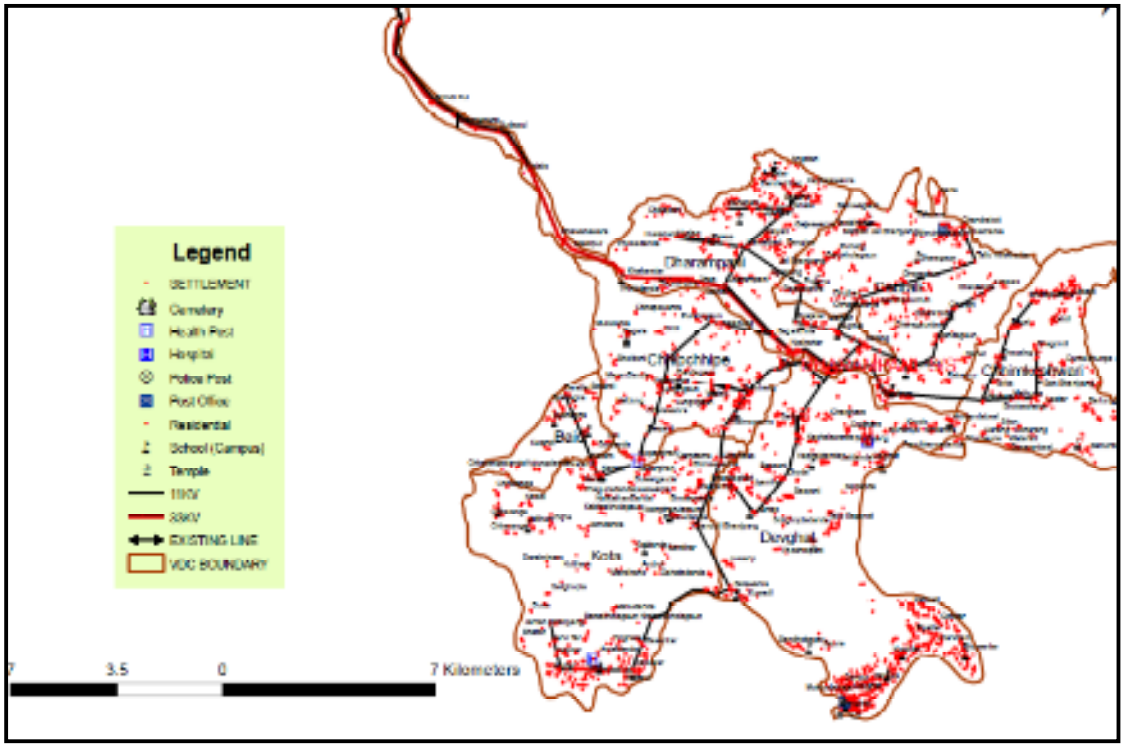


Figure 30: MV Line Alignment and locations of the Schools, Temples and Health Posts (Jaruwa Sub-station and Feeder Line)

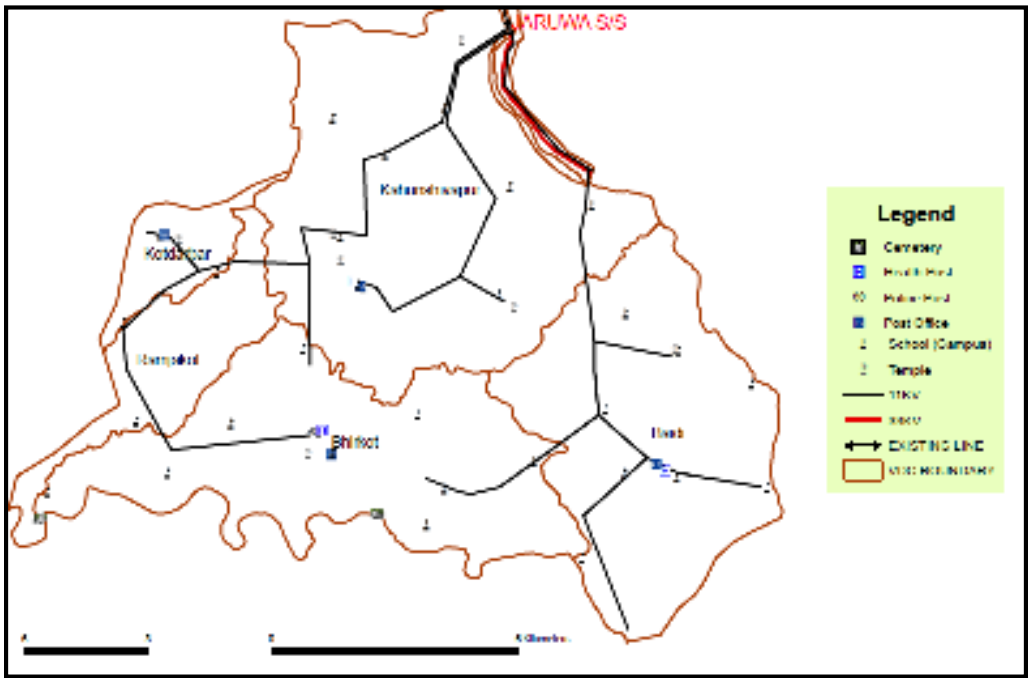


Figure 31: MV Line Alignment and locations of the village built structures (Jaruwa Sub-station and Feeder Line)

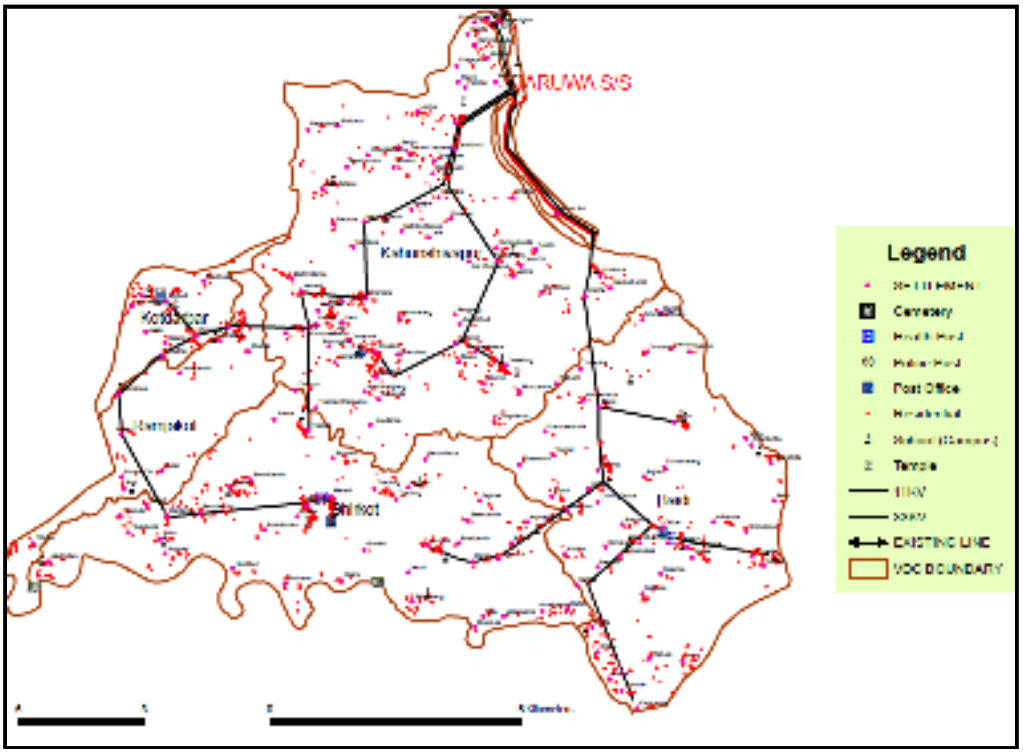


Figure 32: MV Line Alignment and locations of the Schools, Temples and Health Posts (Maghkot Sub-station and Feeder Line)

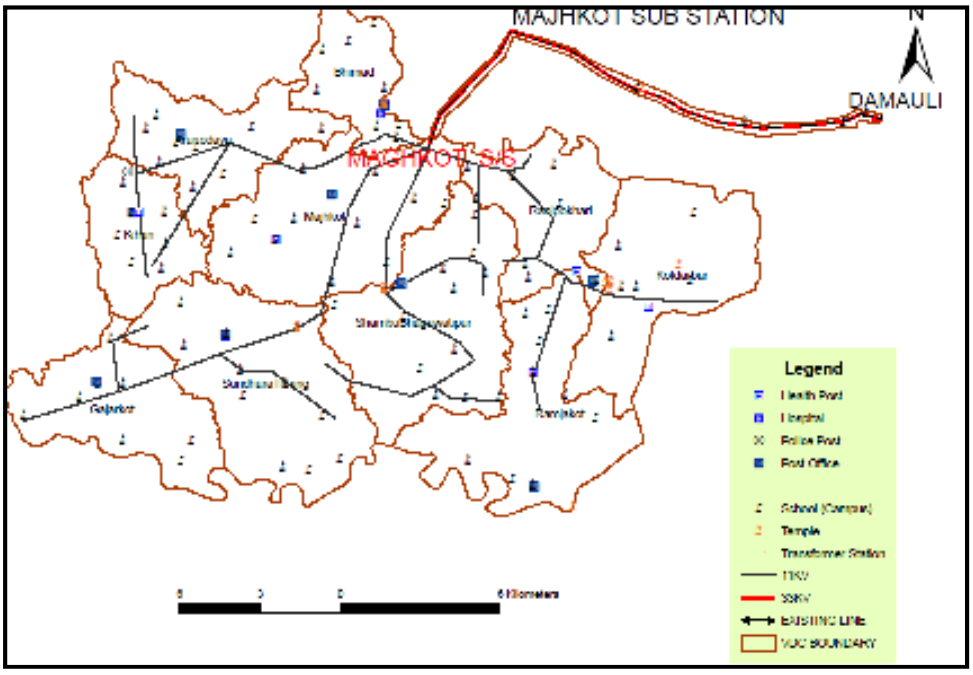
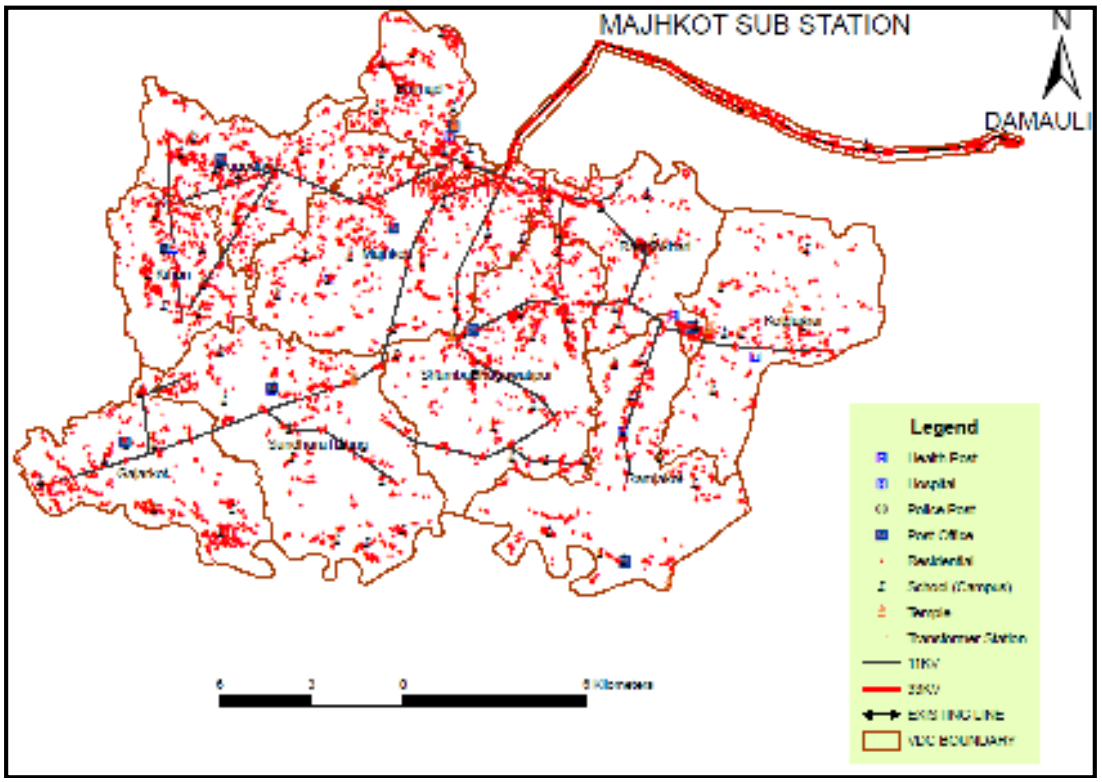


Figure 33: MV Line Alignment and locations of the village built structures (Maghkot Sub-station and Feeder Line)



6.1.2 Equipment Selection

The transformers and other equipment used in the Project must be free from poly-chlorinated biphenyl (PCB). Production of PCBs has now been banned in most countries including Nepal, therefore equipment (transformers) procured under the project will not contain PCBs. Procurement of new transformers will specify that PCB should not be used and only non-PCB coolant such as hydrocarbon mineral oil will be used. At any stage, during transformer replacement process in the Damauli Sub-station, if presence of PCB in the existing transformers is confirmed, the developer of the project will adopt best industry practices with regard to handling of hazardous materials, implement it within its already existing work and safety handling procedures, and will recommend the appropriate disposal of these equipments in accordance with the applicable National and International standards.

6.1.3 Resettlement and Rehabilitation Issues

The MV and LV line and their pole locations as per the existing legislations does not provision ROW. It is therefore, land acquisition is not required for the MV and LV line. The final route selection, however, will take into care that any built property will be avoided to the safety distance as recommended by the Electricity Regulation Schedule 13. Consultation with the village leaders and the property owners under the MV/LV line and poles will be conducted at the time of the survey by the developer. The erecting of poles for MV/LV distribution line, stringing of the cables and placing of the distribution transformers will be carried out in seasons when there are minimal standing crops at the fields so as to avoid the loss of standing crops. Any loss of standing crops will be compensated as to the prevailing market price or at replacement costs.

The sub-station extension and development of new substation will require nearly 3 ha of agricultural land. Proposed area for sub-station is free of built structure; hence physical relocation of the households is not envisaged. The economic displacement due to loss of land to the owners of the land property will be treated at par with the Resettlement and Rehabilitation Policy and Entitlement Matrix adopted for the Tanahun Hydropower Project. The land property will be acquired as per the Land Acquisition Act. Identification of households and prior consultation with the households will be undertaken by the developer to address other issues not foreseen at the project development sites. The land for the substation will be acquired at least 3 months before the start of the construction works.

6.1.4 Vegetation Clearance

As per the Forest Act and Regulation, approval from the concerned Ministry/ Department and Office is essential for the forest clearance. It is therefore prior to the start of construction works, the developer will have to take approval from the concerned offices for forest clearance, which will require joint inspection with the forest officer, enumeration of trees, etc during the approval process. The forest guideline 2006 mandates afforestation of the lost trees in 1: 25 ratio at the sites designated by the district forest officer and look after for 5 years. The developer before

afforestation, will request the designated district forest officer for the afforestation area as per the guideline provisions and any additional approval conditions.

6.2 Environmental Impacts and Mitigation Measures Needed during the Construction Phase

Environmental impacts identified during construction are limited in size and are temporary. The scale of the works is relatively minor involving few peoples the need of workforce camps during construction may not be required. However, storage yards for stockpiling the poles, cables, and transformer is required at least at three different places one each for the substation areas.

The impacts on the environment from various activities of the project construction could be broadly discussed under the following headings.

- Impact on Physical Resources
  - Impact on Topography
  - Impact on Climate
- Impact on Environmental Resources
  - Impact on Air Quality
  - Impact on Noise Levels
  - Impact on surface Water Quality
  - Impact on ground Water Quality
  - Impact on Soils and Geology
- Impact on Ecological Resources
  - Terrestrial Ecology
  - Wild Life
  - Aquatic Ecology
- Impact on Human Environment
  - Health and Safety
  - Agriculture
  - Socio-economics
  - Resettlement and Rehabilitation
  - Cultural sites
  - Traffic and Transport
  - Interference with other utilities and traffic
- Waste Disposal
  - Solid waste disposal
  - Liquid waste disposal.

A brief description of the impacts of the project activities on various environmental attributes during construction phase is presented in sections below.

6.2.1 Impact on Physical Resources

6.2.1.1 Impact on Topography

The natural terrestrial environment of the proposed project areas has already been significantly altered and disturbed by the inhabitants of the rural electrification area which includes

deforestation, grazing, cultivation of gently sloping areas, and development of residential structures. Therefore the project limited excavation of pole foundations, and clearing of vegetation under the line is not envisaged to cause any significant impacts to the existing environment amidst the given landscape nor will it affect any environmentally significant areas. However, to minimize the envisaged impacts following measures will be implemented.

- Foundation excavations of the distribution poles will be limited to the requirement and the spoil will be backfilled and compacted,
- The vegetation clearance under the distribution line will be limited to the requirement of the safety of the cables and risk to community.

6.2.1.2 Impact on Climate

The study area along the distribution line route is predominantly agricultural with scattered settlement areas occasionally covered by patches of highly fragmented and disturbed/degraded forest area. The impact on the climate conditions from the proposed project limited activities during the construction phase will not be significant. The envisaged impacts will be the residual impacts.

6.2.2 Impact on Environmental Resources

6.2.2.1 Impact on Air Quality

As the construction activity involves only limited excavation for pole foundations and in the substation area, will not have any negative impact on the air quality of the region due to their temporary nature. Excavation works in the dry season may pulverize the bare soil and possibility of fugitive dust emissions from the working site could not be ruled out. As the site lies in the rural area, vehicular use for the transportation of materials and accessories is limited only to the highway road head. The contribution of the combustion emission from vehicular traffic used for the project is insignificant. To avoid and minimize the fugitive dust emissions following measures will be implemented.

- The bare dry ground will be watered before excavation to minimize the dust emissions
- Water sprinkling will be undertaken in the excavation sites as required
- The spoil will be backfilled and compacted with required watering

6.2.2.2 Impact on Noise Levels

As most of the accessories for distribution lines and construction materials will be transported from the nearest motor head (Prithibi Highway) by workforce into the interior areas, the noise and vibration related to vehicular traffic is not envisaged in and around the construction sites. The labor based limited excavation works at the pole foundation for a limited period is also not envisaged to cause significant noise and vibration. In the sub-station areas, there is a possibility of night shift working by the contractors. As the sub-station sites are located close to the residential areas, working noise at night might disturb the local people. To avoid such disturbances following mitigation measures will be implemented.

- Restriction of noise generating activities at night at the substation construction sites.

6.2.2.3 Impact on Surface Water Quality

The overhead conductor will not affect any of the man made or natural water ways there will be no impact on the streams and rivers of the area. However location of the pole foundation and sub-station sites might interfere with the natural water way, particularly monsoon runoff. Besides, the excavated soils might erode from the excavation sites and reach to the natural water bodies to pollute the water. Similarly spills of lubricants, and oils from the transformers might be drained to the natural water bodies. The sanitation habits of the workforce are the other issue that might pollute the surface water bodies. Open defecation by the workers along the water course is the likely possibility and same is the case with the kitchen wastes of the camps. Though expected level of pollution contribution is very limited to cause significant surface water pollution to minimize the envisaged impacts following measures will be implemented.

- Pole foundation sites will avoid the natural water course of the monsoon run off
- Pole foundation will be placed at stable places a safe distance away from the natural water ways
- The sub-station site will have a peripheral drainage network to catch the monsoon runoff away from the construction sites
- Excavated soil material will be placed at safe area protected from the runoff erosion
- With completion of works, the excavated material will be backfilled and compacted.
- Spilling of lubricants and oils will be minimized through proper care in storage and handling of the transformers and containers of lubricants and oils.
- Toilets and soak pit arrangements at the sub-station construction sites and at the camps
- Prohibition on open defecation by the workers.

6.2.2.4 Impact on Ground Water Quality

Ground water pollution can take place, if chemical substances and oily waste get leached by precipitation of water and percolate to the ground water table. Fuel and other lubricants will need to be stored at the construction sites. Best industry practice will be required to ensure that accidental spills and discharge to the soil and aquatic environments are prevented. The mitigation measures listed in section 6.2.2.3 are measures to minimize the ground water pollution.

6.2.2.5 Impact on Soil and Geology

The impact on soils will be due to the soil erosion at the sub-station/pole erection site and along the access routes. To minimize the soil erosion from the above areas following measures will be implemented.

- Excavation activity and land clearance of the erosion prone areas has to be minimized while conducting site selection for MV/LV poles/towers.
- Leveling and stabilization of MVlLV erection sites will be done after completion of construction activity.
- Maximum effort will be employed to minimize removal of trees and green cover vegetation and
- Avoid obstruction or destruction to natural drainage pattern of the surrounding areas.

6.2.3 Impact on Ecological Resources

The project area is characterized with forested lands though in a highly degraded conditions. The proposed MV line route is expected to pass across 27 percent of the line length from such forested areas. The ecological impacts of MV line route are briefly described in the following sections.

6.2.3.1 Affect on Flora and Fauna

It is not expected that any flora and fauna that are rare, endangered, endemic or threatened will be affected. Migratory paths of small mammals and reptiles may be affected due to construction activities. The impacts related to above activities are temporary and can be mitigated through following measures:

- Detail survey in the pre-construction phase will avoid dense forested sections and align the MV line through the degraded sections wherever possible
- The trees and plant species of conservation significance will be avoided by altering the alignment route
- Strict attention on worker force regarding disturbance to surrounding habitats, flora and fauna including hunting of animals and fishing in water bodies
- Selection of approved locations for material storage yards and labor camps away from the environmental sensitive areas
- Avoid entering of construction waste (cement particles, rock, rubbles and waste water) and sanitary waste to the surrounding water bodies.

6.2.3.2 Impact on Terrestrial Ecology

There is no sensitive ecological area / protected forest area such as national wildlife park, bird sanctuary crossing the proposed MV route alignment. Some trees in the agricultural and forest land might be required for the safety of the MV cables and communities. An expected tree clearance from the alignment route is around 500, while more than 2500 trees might require lopping and trimming of the branches for the cable safety. Most of the trees are the common species of dominance in the project area. The removal of herbaceous vegetation from the soil and loosening of the top soil generally causes soil erosion. However, such impacts would be primarily confined to the pole foundation sites during initial periods of the construction phase and will be minimized through adoption of the following mitigation measures.

- Efforts will be made to minimize the felling of trees along the MV line route,
- The private trees requiring felling and lopping or trimming will be compensated at the prevailing market price,
- The trees requiring felling in the forested areas will comply with the compensatory afforestation as per the forest guideline 2006. For every tree felled 25 trees will be planted and looked after for 5 years in areas designated by the district forest Officer,
- Communality forest user groups will be contracted out for the compensatory afforestation and takecare of the planted trees for 5 years
- Ground vegetation clearance will be limited to the plants that have potential of growth up to the cable height . Ground vegetation below 2 m height will not be cleared except in the pole foundation area.

- The excavated soil will be placed safely and backfilled on the foundation area and rehabilitated.

6.2.3.3 Wild Life

The project area has a sparse population of wildlife. Most of the wildlife in the area are accustomed with the human habitation and are not likely to be affected by the limited construction activity along the alignment route. However, to avoid any impact to the wildlife population of the area following measures will be implemented.

- The MV route alignment will avoid any wild life travel routes during the final route selection
- The construction workforce will be prohibited to hunt, and roam in the wilderness and the use of wild animal meat in the camps

6.2.3.4 Impact on Aquatic Ecology

As the overhead cables pass through the safe distance across the water courses, there will no impact on the aquatic life. Further, the placing of the pole foundation will be at distance from the water course there will be no impact to the aquatic life. Spillage of oils and lubricants is a possibility to pollute the water to case impacts on the aquatic life. As these materials will be safely stored and handled chances of seepage into the surface water will be low. It is therefore the envisaged impacts to the aquatic life are insignificant from the project activities and no additional mitigation measures will be required.

6.2.4 Impact on Human Environment

6.2.4.1 Health and Safety

The construction works involving excavation, working in the poles, stringing of the cables, fixing of the conductors, transformer involves health and safety issues related to occupational workforce and the communities in general. To avoid such health and safety issues following measures will be implemented.

- Necessary training regarding safety aspects to the personnel working at the line will be provided by the contractor.
- Personal protective equipments like safety gloves, helmet, mufflers etc will be provided during construction period and during the maintenance work.
- First aid facilities will be made available with the labor force and doctors called in from nearby towns when necessary.
- Workers are also covered by the statutory Workmen Compensation as per laws of the land by the contractor.
- Handling of fuel and lubricants should only be undertaken by trained personnel.
- Machinery will be properly maintained and all waste oil and oil filters must be disposed of to meet best industry practice. This will be the contractor's responsibility.
- Organize awareness program s relevant to personal safety of the workers and general public in the area.
- Installation of warning signs to particular locations such as transverse points of local road net work by MV/LV lines

6.2.4.2 Agriculture

The envisaged impacts and mitigation actions have been dealt already in section 6.1.3. No additional measures will be required.

6.2.4.3 Socio-Economics

Construction of lines will generate local employment, as number of unskilled labors (men/women) will be required at the time of construction activities. Local employment during this period will increase socio-economic standards. To enhance the local socio-economy following measures will be implemented.

- Encourage the local communities for the project related construction jobs
- Preference to employment is given to the households whose land is affected by the pole foundation

6.2.4.4 Temporary Outage of the Electricity

Temporary disconnection of power supply will occur during the construction activities particularly the extension works at Damalui Substation. Thus general public and the industrial places, which are located in project-affected area, will face inconvenience for short periods of time. Thus following measures will have to be taken:

- Advance notice to the public about the time and the duration of the utility disruption, and
- Restore the utilities immediately to overcome public inconvenience.

6.2.4.5 Resettlement and Rehabilitation

The envisaged impacts and mitigation actions have been dealt already in section 6.1.3. No additional measures will be required.

6.2.4.6 Cultural Sites

No sites of archaeological, cultural or historic significance fall under the MV alignment and the impact is not envisaged to the cultural sites.

6.2.4.7 Traffic and Transport

The envisaged transport of the materials for the project is small and will be confined to the highway road head. However, to minimize the disturbance during on loading of the materials from the transport vehicles care should be taken that disturbance and obstructions to the local communities is avoided.

6.2.4.8 Interference with Other Utilities

The electrification area is devoid of telecommunication and other power lines and there will no interference to other utilities during the cable stringing activities.

6.2.5 Waste Disposal

Except at the Damauli sub-station extension, other substations and distribution lines will be equipped with the new batteries and transformers. In case the batteries and transformer oil is

required to be disposed it must be disposed of through lead waste re-processors in accordance with the provisions of MOEST.

6.2.5.1 Solid Waste Disposal

The solid waste generation will be at the location of the MV pole erection site which will include metal scraps, wooden packing material etc. Wooden waste and metal scrap will be collected and disposed of in compliance with applicable regulations and rules.

6.2.5.2 Sanitary Waste Disposal at Construction Sites and Labor Camps

The labor camps at the site of MV pole erection will be temporary in nature and the human excreta will not be significant to cause contamination of ground water. Those places where most labor will be staying will be near hamlets which shall use the community services for solid waste, water and sanitation. Adequate drinking water facilities, sanitary facilities and drainage in the temporary sheds of the construction workers should be provided to avoid the surface water pollution. Provision of adequate washing and toilet facilities will be made. This will from an integral component in the planning stage before commencement of construction activity.

6.2.5.3 Liquid Waste Disposal

There will be no oil or chemical waste generated during the erection of MV/LV line, hence no mitigation is required. However care should be taken to minimize the leakage from the new transformers.

6.3. Environmental Impacts and Mitigation Measures Needed during Operations

6.3.1 Electro-magnetic Field and Electric Shocks

Electro-magnetic field for the proposed 33/11 kV lines with a ground clearance of 5.5 m is expected to be around 1.5μT and 1 μT at the centerline which dies out away from the centerline. Similarly the electric field for 33 kV transmission line at the maximum of 0.8kV/m at the center line and dies out away from the center line. The above values are at the lower side are not reported to impact the public health.

As the proposed lines are naked weirs, dangers signs must be installed at each of the poles, whereas the substation sites be fully fenced and marked with danger signs and also prohibit the common man to enter the site. The safety provisions stipulated in the Electricity Regulation Chapter 6 shall be complied. Apart from this community will be made aware of the associated dangers of the overhead feeder lines and the poles of the distribution lines.

VII PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

7.1 Methods of Public Consultation

7.2 Findings of Public Consultations

VIII GRIEVANCE REDRESS MECHANISM

During the course of the Project, people may have concerns with the project's environmental performance. Issues may occur during construction and again during operation. Any concerns will need to be addressed quickly and transparently, and without retribution to the Affected People (AP). The following process is to be used and commences with an attempt to sort out the problem directly at project level. If this cannot be resolved then the grievance moves to the resolution process outlined below.

8.1 During Construction

Most complaints during construction are expected to be minor complaints concerning location of poles, crossing of overhead cables, or damage to crops, or damage to standing trees etc that should be able to be resolved quite easily and acted upon immediately by the Project Site Engineer. The affected person's are in the first place to discuss their complaint directly with the VDC chairperson in their village. If the VDC chairperson supports the complaint both persons take the complaint to the project site engineer. All complaints raised to the project site engineer are to be entered in a Register by; date, name, contact address and reason for the complaint. A duplicate copy of the entry is given to the affected person for their record at the time of registering the complaint. The Register will show who has been directed to deal with the complaint and the date when this was made together with the date when the affected person was informed of the decision and how the decision was conveyed to the affected person. The Register is then signed by the person making the complaint. The duplicate copy given to the affected person will also show the procedure that will be followed in assessing the complaint, together with a statement affirming the rights of the affected person to make a complaint. No costs will be charged to the affected person for making a complaint. The project Site Engineer will consider the complaint and within a maximum of two days will convey a decision to the affected person. The affected person and the VDC chairman may discuss the complaint directly with the project site engineer or his representative. If the complaint of the affected person is dismissed, the affected person will be informed of their rights in taking the next step. A copy of the decision is sent to the project manager.

Should the affected person not be satisfied, the affected person may take the complaint to the Chief District Officer in accordance with section 17 of the Environment Protection Act as per the procedures stipulated in Rule 45 of the Environment Protection Rules.

Should the affected person not satisfied, the affected person may elevate complain to the Court of Appeals and finally to the Supreme Court for the final decision.

8.2 During Operation

The same procedure is followed except that the complaint is now directed to sub-station office of Dharmapani, Maghkot and Jaruwa . During operation the same conditions apply; i.e. there are no fees attached to the affected person for making a complaint, the complainant is free to make the complaint which will be treated in a transparent manner and the affected person will not be subject to retribution for making the complaint.

IX ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) has been prepared for the sub-project that discusses the anticipated impacts, monitoring requirements, and development of mitigation measures with respect to the following stages: (i) pre-construction, (ii) construction, and (iii) operation and maintenance. Detailed, site-specific mitigation measures and monitoring plans were developed and will be implemented during the project implementation phase.

9.1 Institutional Structure and Stakeholder's Roles and Responsibility

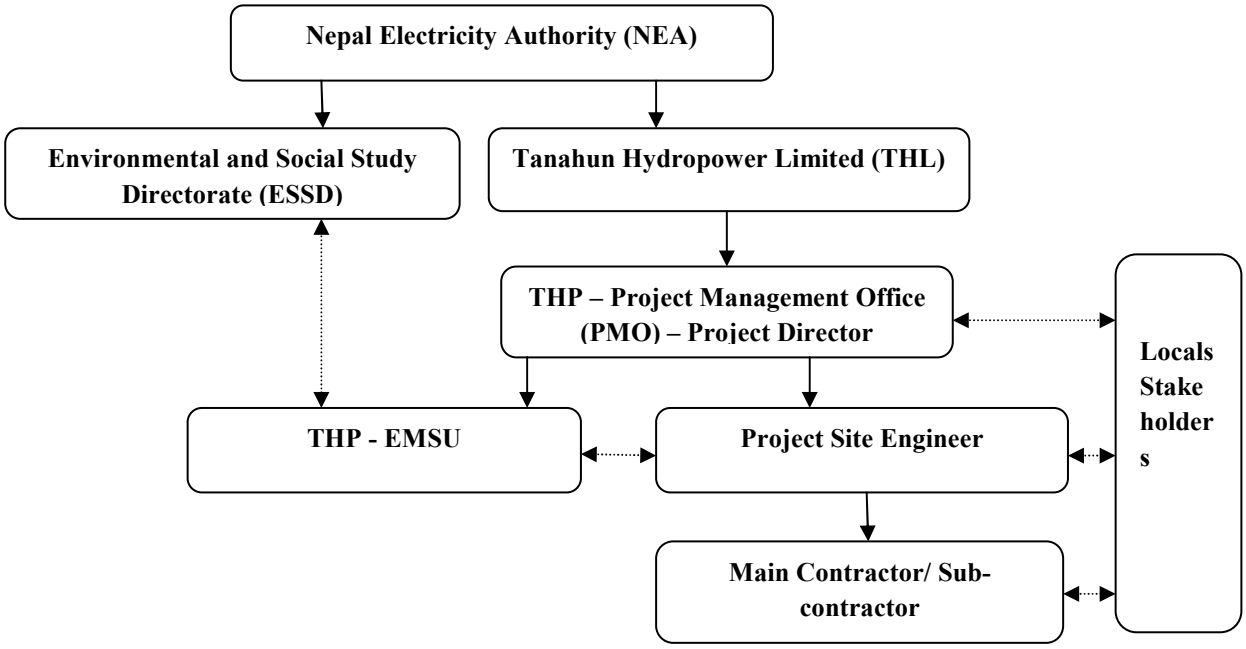
Primary responsibility for the implementation of the EMP lies with the THL. As the project involves a number of stakeholders, there is need of shared responsibility among the stakeholders to realize the objective of the EMP during various phases of project development and operation. Nevertheless, THL has to take a lead role in the implementation of EMP. The key frontline stakeholders of the project for the EMP implementation are presented in Table 4.11.

Table 4.11: Key Frontline Stakeholders of the Project

Stakeholders	Responsible organisations/persons
NEA	• Environmental and Social Study Division • Sub-station Operators
THL	• THP Project Management Office /Project Manager
Construction Supervision	• Project Site Engineer • THP Environmental and Social Management Unit (ESMU)
Contractor	• Main Contractor • Sub-contractors
Local Stakeholders	• Affected Persons (APs) • Project VDC chairpersons • Local communities • Local NGOs/CBOs

The institutional structure for EMP implementation and the interrelationship of the various stakeholders involved will be as per the following (Figure 34) which also shows the overall supervisory framework of the proposed EMP.

Figure 34: EMP Institutional Structure



The roles and responsibilities of the various stakeholders are briefly presented below:

Stakeholders	Responsibilities
Project Proponent NEA/THL/PMO - PD	• Make timely decisions on applicable policies to the project ▪ Ensure that the mitigation prescriptions stipulated in the IEE are incorporated in the project design ▪ Ensure that the mitigation prescriptions related to contractor's activitities are incorporated in the contract bid documents, particularly in the specific provisions of contract, contract specfifications, and bill of quantities • Overall responsibility for EMP implementation during the operation phase • Responsible for working with stakeholders in developing an integrated environmental management • Develop an environmental and social management unit, headed by the Project Environmental Officer to implement EMP responsibilities • Provide all supervisory and management staff with an awareness and understanding of their responsibilities under this EMP. • Provide appropriate and adequate resources to allow for the effective implementation of the EMP. • Review of EMP performance and implementation of correction

	actions, or stop work procedures, in the event of breaches of EMP conditions, that may lead to serious impacts on local communities, or affect the reputation of the project ▪ Monitoring of EMP performance ▪ Ensuring compliance to all project social commitments, including implementation of the resettlement and rehabilitation plans ▪ Report environmental performance of the project directly to the ADB ▪ Representing the project at community meetings ▪ Ensuring the effective functioning of the grievance redress mechanism established to timely act on the individual or community concerns
Project Site Engineer	▪ Be aware and understand the contents of, and the reason for implementing the elements of the EMP. ▪ Preparation and implementation of the Environmental Supervision Plan during construction ▪ Preparation and implementation of the Environmental Monitoring Plan during construction ▪ Supervision of contractor performance of implementation of the Environmental Management Plan Components ▪ Reporting any incidents or non-compliance with the EMP to the project Management office ▪ Prepare environmental reports summarizing project activities, required ▪ Making recommendations to the PMO regarding EMP performance as part of an overall commitment to continuous improvement ▪ Represent the project in the meetings with contractors
Contractor	▪ Be aware of and understand the contents of and the reason for implementing the elements of the EMP and ensure all personnel including sub-contractors adhere to these requirements. ▪ Provide adequate training in the elements of the EMP to all personnel, including contractors. ▪ Provide personnel involved in the project, including subcontractors and visitors, with the appropriate environmental training required to provide them with awareness and understanding of their responsibilities under the EMP as well as understanding of the environmental approvals that adhere to the strategies outlined in the EMP. ▪ Carry out all work in accordance with the procedures outlined in the EMP. ▪ Make sure that all environmental safeguards and precautions are in place and adhered to at all times at the site and activity.

	▪ Regularly inspect and monitor all activities for adherence to proper environmental safeguards. ▪ Ensure that all equipment used is properly serviced and that all precautions are in place to prevent the likelihood of an environmental incident occurring. ▪ Report all environmental incidents to the project site engineer or Representative as soon as practicable ▪ Prepare and maintain records and all required reporting data as stipulated by the EMP, for submission to the project site engineer
Local Stakeholders	▪ Advice and assistance in the grievance redress process ▪ Advice and assistance in the compensatory afforestation ▪ Take part in the supervision of the EMP, where applicable ▪ Review progress and monitoring reports of the project and provide feedback to the project management for environmental and social management ▪ Advice and assistance in the maintenance of law and order in the project area

9.2 Environmental and Social Impact Management

The environmental and social impacts of the project were identified in section 6 and are linked to specific mitigation actions**.** The mitigation management measures in a matrix format with details of environmental impacts, specifics of mitigation measures, responsible agency for mitigation action, and timing of mitigation is provided in Table 12 for pre-construction/construction and operation phases.

Table 12: Framework for Environmental and Social Impact Management, Pre-construction /Construction/Operation Phase

Impacts	Magnitude of Impacts	Mitigation Measures	Timing of mitigation action	Agency Responsible	Estimated costs	Remark
Pre-construction						
Human Environment						
Impacts to built structures	M	Final alignment selection avoiding the built structures	During final survey of the alignment	Project Site Engineer (PSE)		Include in civil cost
Impacts to land property and crops	**L**	Prior consultation with the APs	At the time of Survey	PSE/ESMU	150000	
		Compensation to the affected land (substation) at market price	At least 2 months before construction	PSE/ESMU	96000000	
		Rehabilitation package as per THP resettlment policy	At least 2 months before construction	PSE/ESMU	250000	
Ecological Resources						
Impacts to Forest	**M**	Final alignment selection avoiding the forest areas as far as possible	During final survey of the alignment	PSE		
		Consultation with district Forest Officer and initiate approval process for forest clearence and compensatory afforestation	During and after final survey of the alignment	PSE/ESMU		
Construction Phase						
Physical and Environmental Resources						
Impacts to Topography		Foundation excavations of the distribution poles will be limited to the requirement and the spoil will be backfilled and compacted	During foundation works (construction)	Contractor		Include in Civil Cost
		The vegetation clearance under the distribution line will be limited to the requirement of the safety of the cables and risk to community	During vegetation clearance (construction)	Contractor		Include in civil cost
Impact on air quality	**L**	The bare dry ground will be watered before excavation to minimize the dust emissions	During foundation works (construction)	Contractor		Include in Civil Cost
		Water sprinkling will be undertaken in the excavation sites as required	During foundation works (construction)	Contractor		Include in Civil Cost
		The spoil will be backfilled and compacted with required watering	During foundation works (construction)	Contractor		Include in Civil Cost
Noise impact	**L**	Restriction of noise generating activities at night at the substation construction sites	Construction	Contractor		Include in civil cost
Impact on surface and sub-surface	**L**	Pole foundation sites will avoid the natural water course of the monsoon run off	Construction	Contractor		Include in civil cost

water quality		Pole foundation will be placed at stable places a safe distance away from the natural water ways	Construction	Contractor		Included in civil cost
		The sub-station site will have a peripheral drainage network to catch the monsoon runoff away from the construction sites	Construction	Contractor		Include in civil cost
		Excavated soil material will be placed at safe area protected from the runoff erosion	Construction	Contractor		Include in civil cost
		With completion of works, the excavated material will be backfilled and compacted	Construction	Contractor		Include in civil cost
		Spilling of lubricants and oils will be minimized through proper care in storage and handling of the transformers and containers of lubricants and oils	Construction	Contractor		Include in civil cost
		Toilets and soak pit arrangements at the sub-station construction sites and at the camps	Construction	Contractor		Include in civil cost
		Prohibition on open defecation by the workers	Construction	Contractor		Include in civil cost
Impacts on Soil and Geology	**L**	Excavation activity and land clearance of the erosion prone areas has to be minimized while conducting site selection for MV/LV poles/towers	Construction	Contractor		Include in civil cost
		Leveling and stabilization of MVlLV erection sites will be done after completion of construction activity	Construction	Contractor		Include in civil cost
		Maximum effort will be employed to minimize removal of trees and green cover vegetation	Construction	Contractor		Include in civil cost
		Avoid obstruction or destruction to natural drainage pattern of the surrounding areas	Construction	Contractor		Include in civil cost
Ecological Resources						
Impacts on Floral and faunal ecology	**L**	Avoid forested areas during the final route survey	Pre-construction	PSE		
		The trees and plant species of conservation significance will be avoided by altering the alignment route	Construction	Contractor		Include in civil cost
		Strict attention on worker force regarding disturbance to surrounding habitats, flora and fauna including hunting of animals and fishing in water bodies	Construction	Contractor		Include in civil cost

		Selection of approved locations for material storage yards and labor camps away from the environmental sensitive areas	Construction	Contractor		Include in civil cost
Impacts on terrestrial ecology	**M**	Efforts will be made to minimize the felling of trees along the MV line route	Construction	Contractor		No cost
		The private trees requiring felling and lopping or trimming will be compensated at the prevailing market price	Construction	PSE/ESMU	350000	
		The trees requiring felling in the forested areas will comply with the compensatory afforestation as per the forest guideline 2006. For every tree felled 25 trees will be planted and looked after for 5 years in areas designated by the district forest Officer	Construction	PSE/ESMU	1000000	
		Communality forest user groups will be contracted out for the compensatory afforestation and take care of the planted trees for 5 years	Construction	PSE/ESMU		No cost
		Ground vegetation clearance will be limited to the plants that have potential of growth up to the cable height . Ground vegetation below 2 m height will not be cleared except in the pole foundation area	Construction	Contractor		Include in civil contract
Impacts Wildlife	**L**	The MV route alignment will avoid any wild life travel routes during the final route selection	Pre-construction	PSE		
		The construction workforce will be prohibited to hunt, and roam in the wilderness and the use of wild animal meat in the camps	Construction	Contractor		No cost
Impacts on aquatic ecology	**L**	Restriction on disposal of wastes and excavated soils in the water body	Construction	Contractor		Include in civil cost
		Safe storage and minimization of spills of oils and lubricants	Construction	Contractor		Include in civil cost
		Prohibition on fishing to the construction workforce	Construction	Contractor		No cost
Human Environment						
Impacts on Health and safety	**L**	Necessary training regarding safety aspects to the personnel working at the line will be provided by the contractor	Construction	Contractor		Include in civil cost

		Personal protective equipments like safety gloves, helmet, mufflers etc will be provided during construction period and during the maintenance work	Construction	Contractor		Include in civil cost
		First aid facilities will be made available with the labor force and doctors called in from nearby towns when necessary	Construction	Contractor		Include in civil cost
		Workers are also covered by the statutory Workmen Compensation as per laws of the land by the contractor	Construction	Contractor		Include in civil cost
		Handling of fuel and lubricants should only be undertaken by trained personnel	Construction	Contractor		Include in civil cost
		Machinery will be properly maintained and all waste oil and oil filters must be disposed of to meet best industry practice. This will be the contractor's responsibility	Construction	Contractor		Include in civil cost
		Organize awareness program s relevant to personal safety of the workers and general public in the area	Construction	PSE/ESMU	350000	
		Installation of warning signs to particular locations such as transverse points of local road net work by MV/LV lines	Construction	Contractor		Include in civil cost
Loss of Standing crops	**L**	Compensation to the crop loss at the market price or at replacement cost	Construction	PSE/ESMU	150000	
Socio-Economic Impacts	**Positive**	Encourage the local communities for the project related construction jobs	Construction	PSE/ESMU		No cost
		Preference to employment is given to the households whose land is affected by the pole foundation	Construction	Contractor		No cost
Interference on utility services	**L**	Advance notice to the public about the time and the duration of the utility disruption, and	Construction	Contractor		Include in civil cost
		Restore the utilities immediately to overcome public inconvenience	Construction	Contractor		Include in civil cost
Waste Disposal						
Impacts of Solid waste	**L**	Collect the solid waste generated at the work sites and camps including hazardous waste and disposed in accordance with the applicable regulations	Construction	Contractor		Include in civil cost
Impacts of	**L**	Provision of adequate toilet facilitiea t the	Construction	Contractor		Include in civil

sanitary waste		construction sites and camp areas				cost
		Establishment of drainage facilities at the camps and substation sites	Construction	Contractor		Include in civil cost
		Establish separate facility of drinking water supply at the camps	Construction	Contractor		Include in civil cost
Operation Phase						
Community safety	**L**	Community awareness programs associated with the dangers of overhead feeder line	Regularly Operation phase	Sub-station operators		Include in operation maintenance cost
		Regular and periodic maintenance of distribution system (such as removal of branches of trees, trimming of vegetation) and transformers	Regularly operation phase	Sub-station operators		Include in operation maintenance cost
Occupational health and safety	**L**	Provide regular training on occupational health and safety to the maintenance workers	Regularly operation phase	Sub-station operators		Include in operation maintenance cost
		Provide protective equipments and gears to the maintenance workers	Regularly operation phase	Sub-station operators		Include in operation maintenance cost

9.3 Environmental Monitoring Plan

The Environmental Monitoring Framework outlines the responsibilities of the Project Management Office, Project Site Engineer, ESMU and the Contractor to monitor the environmental and social mitigation measures of the project to ensure that the project is constructed and operated in a manner that is compliant with Nepal government regulations and EMP commitments.

Monitoring shall start as soon as the project is given the go-ahead, and monitors shall be ready to be mobilized at least three months before the onset of construction activities. Monitoring will be implemented throughout all project phases and managed by the Project Management Office ensuring that the surrounding environment and social communities are protected throughout the life of the project.

Table 13 identifies the monitoring activities to be carried out during the pre-construction and construction phase in a matrix format along with the monitoring parameters and responsibility and costs.

9.4 Reporting

The following section describes the communication and reporting mechanisms to be implemented as part of the EMP.

Reports shall be produced through the course of implementation of monitoring programs, collecting incident/grievances forms, consulting with local villages and project-affected communes and auditing performance of existing programs/mitigation measures within the EMP. ***Table 14*** describes the types of reports that shall be produced.

Table 13: Monitoring Framework – Pre-construction Construction and Operation Phase

Issues for Monitoring	Monitoring Indicator	Monitoring Location	Monitoring Method	Monitoring Frequency	Monitoring Responsibility	Monitoring cost
Pre-construction Phase (Impact Monitoring)						
Final alignment survey	Avoidance of built structures, forest areas, and wild animal migratory paths	All Project sites	Filed visits, Review of the layout maps, consultation with the PSE and local communities	Once during pre-construction	ESMU/PSE	Include in PMO costs
Resettlement and rehabilitation	Satisfaction of the APs at substation areas	Sub-station area	Field visits, review of documents and consultation with APs	Every month during pre-construction	ESMU/PSE	Include in PMO costs
Construction Phase (Impact Monitoring)						
Erosion and land instabilities	Incidence of erosion in and around the construction sites	Sub-station area, pole foundation sites	Filed visits and direct observation	Once in a month	ESMU/PSE	Include in PMO costs
Spoil	Spoil management and rehabilitation	Sub-station area, pole foundation area	Field visits and direct observation	Once in a month	ESMU/PSE	Include in PMO costs
Air quality	Fugitive dusts	Sub-station area, and pole foundation sites	Direct observation	daily	PSE	Include in PMO costs
Water Quality	Release of wastes and spoil into the water bodies	Sub-station area, and pole foundation sites	Direct observation	Daily	PSE	Include in PMO costs
Noise	Disturbance due to noise	Sub-station area	Direct observation and consultation with communities	Once in a month	ESMU/PSE	Include in PMO costs
Tree and vegetation clearance	No of trees felled, No of trees trimmed, ground clearance of vegetation under the cable	All along the distribution lines	Records of tree felled species wise, direct observation	Once in a month	ESMU/PSE	Include in PMO costs
Community safety	Setback distance to nearest house, ground clearance as per the law	Along distribution lines	Field visits, records of contractor, direct observation	Daily during the foundation works and cable stringing	ESMU	Include in PMO costs
Sanitation	Sanitary conditions of the work sites camps	Sub-station and workers camp storage sites	Direct observation	Once in a month	ESMU	Include in PMO costs

Occupational Health	Occupational health status of the construction workers	All project site	Field visits, direct observation, records of injuries and other health problems, consultation with the workers	Once a month	ESMU	Include in PMO costs
Operation Phase (Impact Monitoring)						
Community health and occupational health	Death or injury to the workers and public due to electric shocks	Substation and distribution line alignment	Records of injuries, and death, consultation with the local communities	Once in six months	Sub-station operator	Include in Sub-station operation cost
Noise level	Noise nuisance to the communities	Substation sites	Consultation with the nearby households of substation	Once in six months	Sub-station operator (if the problem is seen then provide corrective measures such as noise barrier)	Include in Sub-station operation cost
Pre-construction Phase (Compliance Monitoring)						
Mitigation Provisions of Table 12 for pre-construction phase	Compliance to the provisions	All project sites	Records of PSE, direct observation and consultation with local communities	Once a month during pre-construction	ESMU	Include in PMO costs
Construction Phase (Compliance Monitoring						
Mitigation provisions of Table 12, for construction phase	Compliance to the provisions	All project sites	Records of PSE, and contractor and consultation with local communities	Once a month during construction Phase	ESMU	Include in PMO costs
Operation Phase (Compliance Monitoring)						
Mitigation provisions of Table 12 for the operation period	Compliance to the provisions	All project sites	Records of the operation and maintenance staff and direct observation	Once in six months	Sub-station Operator	Include in Sub-station operation cost

Table 14: Types of external reports

Responsibility	Type of Report	Purpose of Reporting	Frequency of submission	Submit to
Contractor	Records of employment (local, outsiders), records of land rental agreement for land used on temporary basis, records of tree felled and lopped species wise,	Furnish records of employment and loss of trees due to the project	Once in a month	PSE/ESMU
	Accidents/Incident Report	Filing/notification of accidents or unplanned events	Within 24 hours of the incident	PSE/ESMU
	Non-compliance Report	Detail the cause, nature and effect of any environmental and/or socio-economic non-compliant act performed	Within one week of the event	PSE/ESMU
	Monthly Compliance Report	Contractor performance	Report of compliance and non-compliance measures on a monthly basis	PSE/ESMU
ESMU	Daily Compliance Checklist	Checklist of environmental and social compliance of construction	Daily	Internal for PSE daily supervision
	Monthly Compliance Report	Monthly report of compliance within 10 days of receipt of report from Contractor	Monthly	PMO
	Environmental monitoring reports	Notification of non-compliance with standard environmental guidelines and parameters	Dependent on environmental parameter: weekly, monthly, quarterly or annually	UKHPP Management

9.5 Critical Environmental Review Criteria

9.5.1 Loss of irreplaceable resources

The rural electrification projects do not involve any large scale excavation and land loss is insignificant. The EMP includes compensation for the loss by minimizing the impact of loss of vegetation as per existing norms under the Forest Guideline 2006. There will be no net biodiversity loss in this project due to the compensatory afforestation at a ratio of 25 trees for each tree loss.

9.5.2 Accelerated use of resources for short-term gains

The project will not use any natural resources found in the area during construction and operation phases. The construction material such as distribution poles, cement etc. shall come from outside the area while the excavated soil will be used for backfilling and revetment to restore the surface. Thus the project will not cause any accelerated use of resources for short term gains.

9.5.3 Endangering of species

Endemic species of flora and fauna exist in the project area and adjoining forest areas, but the project activities will not threatened or cause their extinction.

9.5.4 Promoting undesirable rural-to urban migration

The project, except at the sub-station site is not expected to cause loss of private land holdings that normally trigger migration. Even at the sub-station site, the households who lose their land is not envisaged to physically relocate the people. The market price compensation at replacement cost will not incur the economic displacement. Hence, there is no possibility of any migration.

9.5.5 Increase in affluent/poor income gap

The project will increase availability and reliability of power in the project area. It is well known that power is a key input to the economic development of any area. Past experience indicates that economic development leads to generation of more jobs which in turn should raise the living standards of poor. Thus the project is expected to contribute in reduction of affluent/poor income gap by providing opportunities for employment and rural based economic activities.

9.6 Environmental Management Plan Budget

The main benefits of the environmental mitigation plan are (i) ensuring that environmental standards are met during design, construction, and operation of the project; (ii) providing offsets to negate project impacts especially ecological impacts. The compliance with the EMP has been prepared based upon optimum and reasonable costs that are derived upon minimization of mitigation measures on a "least-cost" basis. Since major parts of the mitigation costs are included in the civil contract costs and are the obligation of the contractor in normal civil works have not been reflected in the EMP cost. Similarly, the monitoring and supervision costs of the staffs involved is the part of the project management office, and the project does not require any specific instrumental monitoring activities of the environmental monitoring laboratories, it is also not reflected in the EMP cost. The EMP cost includes only costs of compensation to the land and property, and compensatory afforestation only. Itemized breakdown of the cost is presented in Table 12 and 13. The total EMP cost excluding cost included in civil costs, and project management cost is NRs. 98.25 million.

X FINDINGS AND RECOMMENDATIONS

The envisaged impacts of the Rural Electrification are manageable and can be managed cost effectively by employing the proposed mitigation actions in conjunction with the monitoring activities. As discussed, there are ample of opportunities to further avoid the impacts of the proposed project during final survey of the alignment. It is assumed that the final survey of the alignment and design of the project will ensure to include the environmental impacts that could not be identified at this stage of the preliminary layout design. The impact monitoring has a special focus on the effectiveness of the employed mitigation actions. If any mitigation actions proposed were not effective to mitigate the impacts, corrective action could be proposed by the monitoring team for the betterment of the environment as a adaptive environmental management strategy.

The proposed project will have number of positive impacts and negative impacts on the existing environment. Significantly electricity supply to the project affected areas according to current demand is the main positive impact. In addition electricity supply will help:

- Agricultural activities, students and general public for their work
- Increase land value
- Create lot of income generating activities
- Enhancement of the safety at night
- Prevent and control of elephant damages
- Increase mobility during night.

Environment pollution due to cut and fill operations, transportation of construction materials, disposal of debris, nuisance from dust, noise, etc due to construction activities are the short term negative impacts due to proposed project.

Proper Grievance Redress Mechanism will have to be implemented through PSE to overcome public inconvenience during the proposed project activities.

Benefits far outweigh negative impacts - The proposed project will improve quality of power. Supply of power to the area will boost economic development of the area. Overall, the major social and environmental impacts associated with distribution projects are limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures and by best engineering and environmental practices. The impact matrix depicts that the project will not have significant negative environmental impacts and the project would help in improving the socio-economic conditions of this developing state. As the project falls in category B as per the ADB's guidelines, no detailed EIA study is required.

XI CONCLUSION

The Environment Protection Regulation 1997 as amended does not require environmental approval for this type of project in Nepal. However, the ADB's Safeguard Policy Statement, 2009, the proposed project (new substation, MV/LV lines and equipment procurement) is categorized as category B and requires only IEE level study.

Distribution projects require minimum land for the establishment of substation, whereas the distribution line does not require any land for the ROW. Though land acquisition will be carried out for the substations , physical displacement of people from the area is not envisaged as the acquisition avoids built structures and property. The compensation at replacement cost to the acquired land is envisaged to mitigate the effects of economic displacement. Given the landscape, and type of the distribution system, the loss of trees is considered insignificant as it does not involve loss of biodiversity and critical wildlife habitat. Compensatory afforestation as per the norms of the Forest Guideline 2006 is considered to improve the terrestrial habitats within 10 to 15 years of the project implementation.

The proposed construction activities will cause insignificant environment impact and most of the potential environment impacts are temporary in nature and will be restricted during pre-construction and construction periods. The Environment Management Plan (EMP) have been prepared for the project and responsibilities for implementation assigned. The anticipated environmental impacts can be easily mitigated through implementation of EMP.

Overall, the social and environmental impacts associated with distribution project is limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures and by best engineering and environmental practices.