AMADABLAM MINIHYDRO SUBPROJECT (911kW)

Terms of Reference (ToR)

For

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY

Submitted To

Alternative Energy Promotion Centre
Nepal: Private Sector-Led Mini Grid Energy Access Project (MGEAP)
Mid Baneshwor, Kathmandu
Nepal

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ACRONYMS

AC	Alternate Current
ACSR	Steel Reinforced Aluminum Conductor
AEPC	Alternative Energy Promotion Centre
AMHP	Amadablam Mini Hydro Project
AMSL	Above Mean Sea Level
BA	Basal Area
BOD	Biological Oxygen Demand
CBD	Convention on Biological Diversity
CBO	Community Based Organization
CBS	Central Bureau of Statistics
CBS	Central Bureau of Statistics
CDO	Chief District Officer
CED	Clean Energy Developers
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COD	Chemical Oxygen Demand
CSR	Corporate Social Responsibility
CTs	Current Transformers
D/ha	Density per hectare
dB	Decibel
DBH	Diameter at Breast Height
DCC	District Coordination Committee
DHM	Department of Hydrology and Meteorology
DIA	Direct Impact Area
DNPWC	Department of National Park and Wildlife
DO	Dissolved Oxygen
DoED	Department of Electricity Development
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMAP	Environmental Management Action Plan
EMIMAP	Environmental Management Implementation Management Action Plan
EMP	Environmental Management Plan
EPA	Environment Protection Act
EPR	Environment Protection Rule
ESCOs	Energy Service Companies
ESIA	Environmental and Social Impact Assessment
GIS	Geographical Information System
GLOF	Glacier Lake Outburst Flood
GoN	Government of Nepal
GWh	Giga Watt hour
ha	Hectare

hhs	Households
Hz	Hertz
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IIA	Indirect Impact Area
ILO	International Labor Organization
INGO	International Non-Government Organization
INPS	Integrated Nepal Power System
IUCN	International Union for Conservation of Natural Resources
IVI	Important Value Index
KII	Key Informant Interview
Km	Kilometer
KV	Kilovolt
kVA	Kilovolt Ampere
KW	Kilo Watt
L/C	Letter of Credit
m	Meter
MAPs	Medicinal and Aromatic Plants
MGEAP	Mini Grid Energy Access Project
MoEWRI	Ministry of Energy, Water Resources and Irrigation
MoFE	Ministry of Forest and Environment
mVA	Milli Volt Ampere
MW	Mega Watt
NEA	Nepal Electricity Authority
NTFPs	Non-Timber Forest Products
ONAN	Oil Natural Air Natural
pH	Potential of Hydrogen
PID	Proportional Integrative Derivative
PPA	Power Purchase Agreement
Ppm	Parts per Million
PTs	Potential Transformers
RCC	Reinforced Cement Concrete
RD	Relative Density
RF	Relative Frequency
RM	Rural Municipality
ROR	Run of River
RPM	Revolutions per Minute
SD	Scoping Document
SNP	Sagarmatha National Park
SPSS	Statistical Package for Social Sciences
TDS	Total Dissolved Solids
ToR	Terms of Reference
VCBs	Vacuum Circuit Breakers
WB	World Bank

WECS Water and Energy Commission Secretariate

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND OF SUBPROJECT

The proposed subproject, Amadablam Mini Hydro Subproject (911 kW) is being developed under Mini Grid Energy Access Project (MGEAP) of Alternative Energy Promotion Centre (AEPC), a Government institution established on 3 November 1996 under the Ministry of Science and Technology (MoST) with the objective of developing and promoting renewable/alternative energy technologies to meet the energy needs in Nepal. At present, it is under theMinistry of Energy, Water Resources and Irrigation (MoEWRI).

AEPC has been implementing the Private Sector - Led Mini-Grid Energy Access Project (MGEAP) since September 2019 with support from the World Bank (WB). The objective of the MGEAP is to increase electricity access and delivery from renewable energy mini-grids (Micro/Mini Hydro, Solar, Wind and Solar/Wind Hybrid Subprojects) by mobilizing private Energy Service Companies (ESCOs). The subproject will deliver financial support to the ESCOs to facilitate financial closure and enhance financial viability of the subprojects, provided in the form of loans through Partner Banks (PBs).

Based on the above scenario, Amadablam Mini Hydro Pvt. Ltd., a private Energy Service Company registered at company registrar office, Kathmandu on ward number 8, Tilganga(**Annex I**), has proposed to develop Amadablam Mini Hydro Subproject at Khumbu PasangLhamu Rural Municipality, Ward No. 4 of Solukhumbu district in Province No. 1, Nepal. Amadablam Mini Hydro Pvt. Ltd. has got permission letter (**Annex II**) for detail survey study for the proposed work from Khumbu Pasang Lhamu Rural Municipality (RM) on 23/10/2076 (6 February 2020). The proposed subproject is located in the Sagarmatha National Park, which is listed as World Heritage Site by United Nations Educational, Scientific and Cultural Organization (UNESCO), incorporates a Ramsar Site and Important Bird Area.

The proposed subproject is a run-off-river scheme and uses water from Cholunche Khola (also known as Nare Khola), which is a perennial river and is a tributary of Dudhkoshi River. The subproject is planned to develop 911 kWcapacity to provide electricity facility to 444 households in Chukhung, Debuche, Dingboche, Dole, Lawi-Schyasa, Lobuche, Luza, Milingo, Mingbo, Mochhermo, Pangboche, Pheriche, Phortse, PhortseTenga, FhungiTenga, Shomare, Thukla, Tyangbocheand Worshyo Villages of Ward No. 4, where majority of residents are indigenous people. These areas are off-grid areas. Environmental and Social Impact Assessment (ESIA) is mandatory as per World Bank's Operational Policies(OPs)[1] to

[1] [1]This project was originally processed and approved under the World Bank's old safeguard policies, which therefore apply rather than the ESF.

identify potential environmental and social (E&S) risks and impacts associated with the subproject.

1.2 OBJECTIVES OF TOR

The main objective of the ToR is guide for the ESIA study of the proposed subproject as per the WB's Operational Policies (OPs). The general objectives of ToR are:

- To list and delineate the specific activities to be performed during ESIA study
- To delineate subproject influence area(Direct and Indirect Impact Zone)
- To provide the technical guidance in order to accomplish the work within the time frame.
- To list the major issues and impacts to be addressed during ESIA study and
- To provide guidance for the ESIA report preparation.

1.3 OBJECTIVES OF THE ESIA STUDY

The main objective of the study is to conduct Environmental and Social Impact Assessment (ESIA) and prepare environmental and social management plan to ensure safeguard compliance during implementation and operation of the proposed Amadablam Mini Hydro Project (911 kW). The specific objectives of the study are:

- To carry out Alternative Analysis and compare options in terms of social and environmental consequences. Options may include solar, extension of rural electrification program, alternative sites (including of components), construction technologies, and a 'no option';
- To provide information on the existing environmental and social setting of the subproject area with baseline data;
- To identify the subproject influence area;
- To identify the adverse and beneficial impacts that may arise as a result of proposed works on physical, biological, socioeconomic and cultural environment due to the location, construction and operation of the subproject structures & associated facilities in the subproject areas;
- To determine the eligibility of the subproject for financing under the project considering country's legal provisions & requirements including gudlines of the Nepal Rastra Bank, requirements stipulated in the project's ESMF, and World Bank's OPs including OP 4.04 Natural Habitats and assess if the subproject, directly or indirectly, could have significant conversion or degradationof critical natural habitats.
- To propose suitable, practical and site-specific mitigation & enhancement measures to avoid, reduce, mitigate, and/or compensate for identified impacts, including the institutional arrangements, budget and required human resources to implement all such measures and monitor their effectiveness;
- To define and prepare an Environmental and Social Management Plan (ESMP) as well as effective monitoring, reporting and auditing program for the subproject;

- To prepare (i) Occupational Health and Safety Plan, (ii) Emergency Preparedness Plan, (iii) Labour Management Plan, (iv) Gender Development Plan,(v) Traffic Management Plan,(vi) Stakeholder Engagement Plan,(vii) Benefit Sharing Plan,(viii) Biodiversity Management Plan and (ix) Landslide and slope stability management plan.
- To carry out Cumulative Impact Assessment, if found necessary after initial assessment of the other hydropower schemes (operational, under construction, planned to be constructed in foreseeable future) in the upstream and downstream of the subproject,
- To identify relevant project stakeholders and inform them regularly about the proposed subproject, involve them in the implementation process and receive their feedback and concerns for safeguarding the natural environment and affected people; and
- To advise decision makers regarding environmental and social implication of the subproject.

1.4 STUDY METHODOLOGY

1.4.1 DATA REQUIREMENT FOR PREPARING THE REPORT

The study requires the baseline data on physico-chemical, biological, socio-economic and cultural environment. Relevant data on the environmental and social conditions of the subproject area will be collected and assembled into concise description.

1.4.1.1 PHYSICAL AND CHEMICAL ENVIRONMENT

The following baseline data on physical environment those need to be included in the ESIA report are;

- Topography
- Geomorphology
- Geology (soil, rock types, structures, slope condition and stability)
- Land use
- Seismicity
- Soil erosion and landslides
- Sediment yield
- Natural hazards
- Drainage (type and characteristics) and Hydrology (data on river regime)
- Climate (temperature and precipitation);
- Air and noise quality
- Surface water quality(testing different parameters like temperature, pH, turbidity, TDS, alkalinity, DO, COD, BOD, Sulfate, Iron, Total Coliform, E-Coli)
- River water quality
- Solid waste generation

1.4.1.2 BIOLOGICAL ENVIRONMENT

The following baseline data on biological environment will be included in the ESIA study:

- Forest area, forest types andtheirdistribution, management and protection status
- Vegetation status, distribution of plant species and their importance, plant density, tree volume and biomass
- Herb and shrub species
- Ecosystem services, including NTFPs andMAPs
- Wildlife (mammal, bird and herpetofauna) found in and around subproject area including protected, rare, endangered species (listed in the IUCN Red List or CITES, or in the national list).
- Human wildlife conflict
- Aquatic life (including macroinvertebrates, riparian vegetation and protected, endangered, endemic and migratory fish species)
- Natural and critical habitat (wildlife and their movement route and migratory bird movement route) and their ecological importance
- Threat and conservation status of flora and fauna based on the Government of Nepal list, National Park and Wildlife Conservation Act (1973); Red Data Book of International Union for Conservation of Nature (IUCN) and Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) appendices
- Presence and state of legally protected areas, internationally recognized areas of high biodiversity value and world heritage sites within the area of influence of the project.

1.4.1.3 SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

Data required on Socio-economic and cultural environment basically at Rural Municipality level and specific at settlement level as needed and as appropriate include the following:

- General profile of the district, Rural Municipality and Subproject influence area
- Demography characteristics (population, households' size, age and gender composition, migration) of the subproject influence area
- Ethnicity (marginalized groups and ethnic minorities), Language and Religion (including traditional and cultural practices)
- Status and Issues of women and Children
- Literacy and Education
- Occupation and Livelihood (Sources of income and expenditure pattern)
- Economic Status (employment, occupation and skill, income)
- Economic activities (agriculture/horticulture, livestock, trade, tourism, business etc.)- Sources of income and expenditure pattern
- Health and sanitation
- Social service facilities and community infrastructures (drinking water supply, educational institution, health care facilities, irrigation, electricity, communication, transportation, etc)

- Local institutions and activities: Government and non-government agencies, cooperatives, CBOs;
- Price list of commodity goods of subproject affected settlements
- Vulnerable groups (poor, people with disabilities, women-headed households, Dalits, religious minorities, people living in government land in the project area/squatters)
- Description of settlements of indigenous people, Dalits and other religious minorities within the project affected area (If any)
- Touristic sites and any aesthetically important / unique sites
- Archaeological, cultural, historical and religious sites (Festivals, Tradition, Languages and Religious Landmarks)
- Major religious and social functions observed in the area
- Main source of information for locals (social media, TV, radio, newspapers etc.) and customary dispute settlement mechanism, if any
- Presence of social or community organizations (youth club, women/mothers clubs or groups, religious group etc.)
- Public infrastructures (schools, hospitals/health centers, community hall, public gathering/meeting places etc.)

1.4.2 METHODOLOGY FOR DATA COLLECTION

Data and information required for ESIA will be collected through primary as well as secondary sources. The data collection procedure includes the followings:

1.4.2.1 DESK STUDY AND LITERATURE REVIEW

Available useful data and information with the line agencies at the local, district and central level shall be collected and reviewed. Possible source of information are District Coordination Committee (DCC), Rural Municipality, Sagarmatha National Park (SNP) Office, Department of National Parks and Wildlife Conservation (DNPWC), UNESCO, RAMSAR, Birdlife International, World Wildlife Fund (WWF), IUCN, ICIMOD, NTNC, other line agencies, related NGOs and other project offices in the district. Topographic map, Geological map and maps/information from the Department of Hydrology and Meteorology (DHM) are the other sources of information.

Topographic and geological maps of the subproject area will be reviewed to collect information about land use, topography, geology and other features. Study of climate and air quality of the study area will be done by analyzing the data of the nearest meteorological station and monitoring station. Meteorological and hydrological data will be collected from DHM. Other information such as Hydrology and Sedimentation, Geology and Seismicity, Watershed etc. will be collected referring from the secondary sources such as topographic, geological and seismic hazard maps and project technical reports and data base of DHM etc.

Secondary data on forest and wildlife will be obtained from publications of the Ministry of Forests and Environment (MoFE), SNP and DNPWC office, WWF, IUCN etc and other institutions and research papers. District/Rural Municipality level socio-economic and cultural information such as population of affected Rural Municipality, household size, male-female ratio, infrastructures, ethnicity, schools, development activities in the subproject area, festivals and cultural activities shall also be reviewed from Central Bureau of Statistics (CBS) publication, RM profiles, district profiles and other available literatures.

Moreover, review of the pertinent legal documents such as Acts, Rules, Manuals, Standards, Guidelines, and Policies etc. will also be carried out in order to analyze the legal and policy implications of subproject implementation (**refer Chapter3**).

Additionally, ESIA, EIA and IEE reports of the similar hydropower projects (especially of the Dudhkoshi Basin) will be reviewed to take assistance in developing study methodologies, identifying impacts and mitigation measures. Hence, desk study and literature review will start at the beginning till the completion of the ESIA study.

For the cumulative impact assessment, review the relevant documents of existing the projects/infrastructure. The planning documents of new development projects/infrastructure which are foreseeable in the near future will also be reviewed.

1.4.2.2 FIELD STUDY

A multi-disciplinary study team comprising of environmental expert, biodiversity expert, sociologist, hydrologist and geologist will visit the subproject site and carry out field investigation through survey, inspection, observation and measurement to collect baseline information on physical, biological and socio-economic and cultural environments and identify possible issues including seasonal differences such as water flow and aquatic fauna and impacts on environmental and social aspects. Various participatory tools like focus group discussion, key informant interview, consultations with relevant stakeholders and interactions will be employed to aid collection of relevant information. The collected baseline data will be verified by citing standard references and evaluated before accessing impacts on them.

When seasonal data would be required for more precise baseline study and impact analysis but is difficult to collected through field study, such data should be supplemented through secondary data collection.

1.4.2.2.1 Physical Environment

Walkover survey and field observation will be carried out to collect site-specific information about physical environment of the subproject area. Geological investigation will be made to explore the general geology, geomorphology, geological features like discontinuities and possible geologic hazard, land stability within the subproject area. Hydrological analysis will be conducted using the method suggested by the GON Water and Energy Commission

Secretariat (WECS). Information derived from secondary sources will be verified with site observation, site specific photography and consultation with local communities. Walkthrough survey and field observation will be carried out to study and record soil erosion prone area, landslide areas, and other geologically vulnerable areas in the subproject surroundings (including specific project locations), which could adversely affect the subproject activities during construction and operation phase. Baseline data on existing pollution levels of water, air and noise in the subproject area will be generated. Water samples from the Cholunche Khola and the drinking water sources in the subproject area will be collected and tested for physical, chemical and biological parameters. Baseline data on noise level at the major construction sites such headwork and powerhouse sites as well as major settlement areas will be measured using a sound pressure level meter (dB meter). Visual observations and analysis of presence of the sources causing deterioration in air quality such as industries, quarry site, frequency of vehicular movement etc. will be made and qualitative information on air quality will be prepared. Quantitative data on air quality will be collected from secondary sources if available.Solid waste situation of the subproject area will be studied through direct observations.

1.4.2.2.2 Biological Environment

(a) Vegetation

Composition, distribution patterns and characteristics of vegetation and forest types and sensitive habitat in the subproject area will be assessed from direct field observations, systematic forest sampling (wherever applicable), transect walk survey, photography, maps, interaction with local people and concerned authority. The types of forest and management practices around the subproject area will be studied and identified. Complete enumeration of the standing trees will be carried out during ESIA study in those component sites where tresses are there. Diameter at Breast Height (dBH) and height of each of the enumerated standing tree (>10cm dBH) within these sites will be recorded for calculation of loss of timber and ecological values. In addition, random plots of size 5m×5m and 1m×1m will be laid to record saplings and seedlings in the subproject component sites, respectively. In addition, systematic vegetation sampling using quadrate method will be carried out to make an assessment of vegetation in subproject area. For this, quadrate plot of 20x20 m^2, 5 x5 $m^2$and 1x1 m^2will be laid out with systematic purposive sampling for trees, shrubs including tree sapling and herbs including tree seedling respectively. Canopy cover of the forest will be estimated by visual observation. Trees will be classified as per community forestry inventory guidelines 2061 BS.Standard vegetation record checklists will be prepared and used during forest measurement (**Annex III**). In the case of unknown plant species, pressed samples of twigs, flowers and/or seedpods will be prepared and identified with the help botanical experts of the National Herbarium at Godawari, Lalitpur. Local names as well as the use of all species recorded on the data-sheet will be noted consulting with the local people. The data obtained from the sampling of the vegetation and sample plots will be quantitatively analyzed only for density, frequency, abundance, dominance, basal area, standing wood volume and

importance value index. These parameters will be calculated by using standard formulae **(Annex IV).**

The forest vegetation assessment shall include calculation of forest loss at different subproject components, total loss in terms of plant species, total forest loss, loss of Non-Timber Forest Product (NTFP) and economic valuation of loss in forest product (**Annex V**).

Ethno-botanical information will be obtained by conducting Rapid Rural Appraisal tools. The loss of protected, rare and endangered species based on the CITES Appendix, IUCN Red Data and Government of Nepal protected lists will be enumerated in the field throughout the subproject area. Local people shall be consulted regarding the local uses of the plant species such as medicinal, food, timber, fuel wood etc. Commercially important plant species will also be documented. Similarly, information on the protected floral and faunal species of the subproject area will also be identified by tallying the species list with GoN protected list and various international protection categories such as CITES appendices and IUCN Red Data Book and will be described in the ESIA report.

(b) Wildlife and Birds

Direct observation as well as study of pug marks, fecal droppings, vocal sounds, interaction with local communities etc. will be used to record the wildlife (mammals and avian fauna) in the subproject area and their natural as well as critical habitat. Birds will be observed with the help of binocular and identified using standard key developed by Fleming (1976) and Inskipp (1985). It has been reported that there are no records of herpetofauna and fishes in the area, but shall be confirmed through consultation with local communities. Key informant interviews will be taken for the information on crop and livestock depredation by the wild animals, human wildlife conflicts, hunting and poaching activities in the subproject area and other relevant information.

Recorded wildlife will be tallied with relevant references (IUCN Red Data Book, CITES Appendices, Government of Nepal's list of mammals and birds assigned respective threat and protection statuses.

(c) Protected Areas

The current state of legally protected areas, UNESCO World Heritage Sites and internationally recognized areas of high biodiversity value (such as key biodiversity areas, important bird areas and Ramsar sites) and will be observed and documented. Assessments will include an overview of current threats, the standard of enforcement, management and capacity to implement actions provided in available management plans. Data will be collected through review of management plans, observations made in the field, consultation with local communities, field managers, DNPWC and UNESCO representatives. Particular focus will be placed on the Outstanding Universal Values (OUV) of the Sagarmatha National Park World Heritage Site.

1.4.2.2.3 Socio-economic and Cultural Environment

Primary information on socio-economic environment will be obtained through group discussion with communities, key informant interviews, onsite observation and questionnaires and stakeholder consultations. All these have been planned for basic health and sanitation conditions, educational, gender issues, infrastructure facilities, water and energy related issues, customs, practices and traditions with focus on community consultations, dispute settlement and acquiring public information, and expectations from the subproject (**Annex VI)**.

Focus Group Discussions (FGD) with the peoples of the concerned wards (such as buffer zone user's group, women groups' etc.) and local level agencies will be carried out. Similarly, Key Informant Interviews (KIIs) and FGDs with women's group (gender), school teachers (education), CFUGs (Resource use) will be carried out during the field survey to gather information on socio-economic and cultural activities as well as customs & tradition of the subproject area communities. The information and data collected from the field will be processed and analyzed by using Statistical Package for the Social Sciences (SPSS) and excel.

1.4.2.2.4 General

The study requires the baseline data on physical, biological, socio-economic and cultural environment. Relevant data on the environmental conditions of the subproject area will be collected and assembled into concise description. Such documentation should focus on those aspects likely to be altered through subproject implementation and will include physical, biological, social, cultural and economic environment. Source of all data and information given in the report will be identified. If the source is field survey and specific methodologies used will be given, and if source is published report or literature then standard reference format will be used with reference list. For a comprehensive ESIA study of the proposed subproject, database on the following environmental resources of the subproject's direct and indirect impact area is required.

CHAPTER 2: DESCRIPTION OF THE SUBPROJECT

2.1 GENERAL INFORMATION ON THE SUBPROJECT

Amadablam Mini Hydro Subproject is a proposedsubproject to generate electricity. The proposed subproject is a run-of2.1-river scheme and uses water from CholuncheKhola (also known as NareKhola). The subproject is planned to develop 911 kWcapacity releasing 50% of minimum monthly flow as per "Directive on Physical Infrastructure Construction and Operation in Conservation Areas, 2065"[2]. However, the required minimum discharge to maintain the riverine biota in the reduced flow zone of the river stretch will further be assessed during ESIA study. The subproject has been designed to provide electricity facility to 445 households inChukhung, Debuche, Dingboche, Dole, Lawi-Schyasa, Lobuche, Luza, Milingo, Mingbo, Mochhermo, Pangboche, Pheriche, Phortse, PhortseTenga, FhungiTenga, Shomare, Thukla, Tyangbocheand Worshyo Villages of Ward No. 4, where majority of residents are indigenous people. These areas are off-grid areas.

2.2 LOCATION AND ACCESIBILITY

The subproject has been proposed to implement in Pangboche, Ward No.4,KhumbuPasangLhamu Rural Municipality, Solukhumbu District, Province 1 of Republic of Nepal (**For Maps, Annexes VII**). Major subproject components such as headworks (including intake, desanding basin), penstock pipe, tailrace and powerhouse facility as well as the switchyard station are proposed to be located on the left bank of CholuncheKhola, which is a tributary of ImjaKhola, a tributary of Dudhkoshi River. Geographically, the proposed subproject lies between 27°50'50"Nto27°51'40"N latitude and 86°47'49"E to 86°49'19"E longitude. The elevation within the subproject area varies from 3951.50 meter (m) to 4422 m above mean sea level (amsl).

From Kathmandu, the subproject site is accessible by commercial air flight and on foot. Flight from Kathmandu to Lukla takes 30 minutes. From Lukla, the site is either accessible by helicopter or on foot. Travel on foot from Lukla via Namche Bazaar requires three days for a trekker. Materials and equipment to the subproject site can be transported either by helicopter or mules. Alternatively, the subproject site can be accessible by amotorable road from *Katari* along East-West highway connects Salleribazzar, Headquarter of Solukhumbu. From Salleribazzar there is seasonal road to Buksa and from Buksa the subproject site is accessible either by helicopter or on foot. Travel distance on foot from road head via Lukla to subproject site is around 65 km and requires 6 days for a loaded porter. From Lukla to Pangboche, it is about 31 Km foot trail.

[2]At least 50% of the monthly discharge should be released to river/stream in order to generate electricity using river/stream in National Parks and Conservation area,

2.3 SALIENT FEATURES

The salient feature of the proposed subproject is as follows given in table.

Table 1: Salient feature of the Subproject

1	**Location**		
	Province	:	1
	District	:	Solukhumbu
	Gaupalika	:	KhumbuPasangLhamu Rural Municipality Ward No. 4
	Geographical Coordinates Latitude Longitude	:	27°50'50"N to27°51'40"N latitude and 86°47'49"E to 86°49'19"E longitude
	Intake	:	27°50'56.52"N and 86°49'6.15"E, elevation 4422 amsl
	Power House	:	27°51'12.98"N, 86°47'44.21"E, elevation 3951.50amsl
	Total Households to be Electrified		444
2	**General**		
	Name of River	:	CholuncheKhola
	Nearest Town	:	Namche Bazaar (13 Km)
	Type of Scheme	:	Run of River
	Gross Head	:	471.87 m
	Installed Capacity	:	911 KW
	Average Annual Energy	:	7,231,758.14 kWh
3	**Hydrology**		
	Catchment Area at Headworks Site	:	28 km^2 (Total), 21 km^2 (>5000 m) 7 km^2(5000 m< A> 4000 m)
	Design Discharge ($Q_{80\%}$)	:	0.25 m^3/s
	Design Flood (1 in 100 year)	:	15 m^3/s
	Compensation flow	:	50% of discharge at river every month*
4	**Diversion Weir**		
	Type	:	Concrete gravity type weir
	Length	:	12m
	Height	:	2.57 m
	Crest level	:	El. 4423.57 m
5	**Resoirvoir (due to Diversion Weir)**		
	Surface Area	:	360 m^2
	Volume	:	493.2 m^3
	Average depth	:	1.37 m
	Average Width	:	12 m
	Average Length	:	30 m

6	**Undersluice**		
	Type	:	Rectangular Flat Gate
	Size	:	1.0 m x 1.3m
	Invert level	:	El. 4421.08 m
7	**Intake**		
	Type	:	Orifice type side intake
	No of Orifice	:	2 No.
	Size of Opening	:	1.5 m (B) x 0.3 m (H)
	Intake Invert Level	:	El. 4422.00 m
8	**Gravel Trap**		
	Size (L x B x H)		8 m x 1.5 m x 1.3 m
	Bed load size to trap		2 mm
9	**Headrace Pipe**		
	Type	:	Pressurized pipe flow
	Length	:	10 m
	Diameter	:	450 mm
	Thickness	:	4 mm
	Shape	:	Circular
	Type	:	Pressurized pipe flow
10	**DesandingBasin cum forebay**		
	Type	:	Conventional with headpond
	Size (L x B x H)	:	28.65 m x 2.65 m x 2.30 m
	Number of Bay	:	1 No.
	Nominal size of trapped particle	:	0.15 mm
11	**Penstock Pipe**		
	Type	:	Mild Steel Pipe (Buried)
	Internal Diameter	:	400 mm dia
	Thickness	:	4-15 mm
	Total Length of the pipe	:	2930 m length
	No of Anchor Block	:	58Nos
12	**Powerhouse**		
	Type of powerhouse	:	Surface Type
	Size (L x B x H)	:	19.95 m x 7 m x 5.8 m
13	**Tailrace Conduit**		
	Type	:	Pipe and Canal
	Size (L x B x H)	:	18 m x 0.5 m x 0.68 m
	Pipe	:	MS 400 mm dia, 4 mm thick, 21 m long
	Turbine Axis Level	:	El. 3951.50 m
14	**Turbines**		
	Type	:	Horizontal Shaft Pelton Turbine Single Jet
	Number of Units	:	2
	Discharge per unit	:	0.15 m^3/sec
	Rated Output (Mechanical)	:	485kW X 2 units
	Synchronous Speed	:	1500 rpm
	Rated Net Head	:	448.86 m

	Rated Efficiency at 100% Discharge	:	88%
15	**Generators**		
	Type	:	3-Phase, Synchronous, Brushless
	Rated Output Capacity per Unit	:	650 kVA
	Rated Efficiency	:	96%
	Frequency	:	50 Hz
	Rated Voltage	:	0.4 kV
	Number of Poles	:	4
	Speed	:	1500 rpm
	No of units	:	2 Nos.
16	**Governor**		
	Type	:	Electronic, PID Oil-hydraulic, self-closing without electric power
	No of units	:	2 Nos.
17	**Transformer**		
	A. Power Transformer		
	Type	:	ONAN Cooling, YNd11, 3 phase
	Rated capacity	:	630 kVA
	Voltage ratio	:	0.4/11 kV
	Efficiency	:	98%
	No of units	:	2 Nos.
	B. Distribution Transformer		
	Type		11/0.4 kV, 3-phase, oil immersed, copper owned AVR with parallel operation
	Rated Capacity	:	150 kVA- 2 Nos
			125 kVA- 2 Nos
			100 kVA- 4 Nos
			65 kVA-5 Nos
			50 KVA-1 No.
18	**Transmission & Distribution line[3]**		
	A. Single Line Distribution		
	Total Length of 11 kV underground line (underground XLPE armored 3 core 35 sq. mm aluminum)	:	40.00 km
	Total length of 11 kV overhead line during river crossings (squirrel ACSR)	:	1 km
	1.1 kV 95 sq.mm. 4 Core XLPE Insulated UnarmouredAluminium Cable	:	11.00 km
	1.1 kV 35 sq.mm. 4 Core XLPE	:	9.5 km

[3] Detail of coordinates has been given in Annex VIII

	Insulated UnarmouredAluminium Cable		
	1.1 kV 25 sq.mm. 2 Core XLPE Insulated UnarmouredAluminium Cable	:	1.5 km
	B. Distribution Transformor		
	Type	:	Outdoor installation type
	Quantity required	:	Fifteen (15)
	Type of cooling	:	ONAN
	Number of phases	:	Three phase
	Frequency	:	50 Hz
	Rated voltage	:	
	1) Primary	:	11 kV
	2) Secondary	:	0.4 kV.
	Vector group symbol (by IEC designation)	:	Dyn11
	C. Major Crossings		
	Chukung	:	70
	Dingboche	:	50
	Thukla	:	170
	Power House	:	120
	Phortse	:	100
	Dole	:	70
	Luza	:	70
	Machhermo	:	80
	Milingo	:	100
	Fungi Tenga	:	100
	D. Poles for Overhead Transmission During Crossings		
	Type	:	Galvanized Mild Steel Tubular poles
	Total Length	:	9 m
	Bottom Section	:	5m long, outer diameter 165.1 mm, thickness 4.5 mm
	Middle section	:	2m long, outer diameter 139.7 mm, thickness 4.5 mm
	Top section	:	2m long, outer diameter 114.3 mm, thickness 3.65 mm
	Minimum weight	:	120 kg
	E. Sub-Station		
	Type	:	Pole mounted
	Total Sets	:	14

	Pole Type	:	Galvanized steel tubular poles
	Length of Poles	:	9 m
	F. Conductors		
	Type	:	ACSRConductor (Weasel)
	Code Name	:	Weasel
	Nominal Aluminum Area, mm^2	:	30
	Specific Weight, kg/km	:	128
	Resistance, ohm/km	:	95 A
	Inductive Reactance	:	0.345
	G. Underground Cables	:	Poly Vinyl Chloride (PVC) insulated armored aluminum cable
	H. Distribution Box		
	Total Number	:	80
	Coordinate of DB (Lobuche)	:	X: 86.813247 ^{0}E;Y: 27.957777 ^{0}N [North most]
	Coordinate of DB (Chukung)	:	X: 86.871694^{0}E;Y: 27.904166^{0}N [North-East Most]
	Coordinate of DB (Machhermo)	:	X: 86.715327^{0}E;Y: 27.902013^{0}N[North-West Most]
	Coordinate of DB (Lawi Schyasa)	:	X: 86.739166^{0}E;Y: 27.830000^{0}N [South Most]
	System	:	Double Door
	Size	:	L X B X H = 45 cm X 30 cm X 60 cm
19	**Switchyard**		
	Type	:	Indoor, Single Bus Configuration, 11 kV
	Dimension	:	3.55 m X 6.32 m
	Location	:	Inside Powerhouse
20	**Load Center**	:	Number of Consumers (HHs) (444 Beneficiary Households)
1	Chukung	:	12
2	Debuche	:	6
3	Dingboche	:	86
4	Dole	:	14
5	Fungi Tenga	:	11
6	LawiSchyasa	:	12
7	Lobuche	:	3
8	Luza	:	3
9	Milingo	:	1
10	Mingbo	:	13
11	Machhermo	:	102
12	Pangboche	:	35
13	Pheriche	:	106
14	Phortse	:	3
15	PhortseTenga	:	9

16	Shomare	:	19
17	Thukla	:	2
18	Tyangboche	:	7
19	Worshyo	:	1
21	**Power and Energy**		
	Type of Power Plant	:	Run-of-river
	Design Discharge	:	0.25 m^3/s
	Total Gross Head	:	471.87 m
	Rated Net Head	:	448.86 m
	Installed Capacity	:	911 kW
	Total Annual Energy	:	7,231,758.14 kWh
22	**Subproject Cost Estimate**		
	Total Project Cost with VAT and Provisional Sums and IDC	:	NRs. 478,899,034.82
	Cost Per kW	:	NRs. 525,685.00
	Net Present Value (@ 10% discount factor)	:	NRs. 77,578,882.45
	Project rate of return	:	13.06%
	Payback	:	8.23 years
	BC Ratio	:	1.16
23	**Construction Period**	:	18 Months
* the required minimum discharge to maintain the riverine biota in the reduced flow zone of the river stretch will further be assessed during ESIA study			

2.4 SUBPROJECT COMPONENTS

Water of Cholunche Khola will be diverted by constructing a 12m wide and 2.0757m high diversion weir to generate annual average energy of about 7,231,758.14 kWh. Entire major civil components of the subproject are site on/along the left bank of CholuncheKhola. The major civil components of the subproject are discussed briefly as follows.

2.4.1 HEADWORKS

The headworks of the proposed subproject are situated at about 3.5Km upstream from the confluence of CholuncheKholaandImjaKhola at Pangboche.

i) Diversion Weir

A permanent concrete gravity type weir is provided across the river to divert the required flow through the intake. The length of weir is 12 m and its crest level is fixed at 4423.57 m amsl. The bed level of river at upstream side of weir is 4422.00 m amsl and at downstream of weir is 4421.00 m amsl. The highest flood level at weir is 4424.33 m amslwith discharge of 15 m^3/s at 100 yrs return period. The platform level for gates operation is fixed at 4424.83 m amsl. Upstream apron of 2m length is provided whereas downstream apron is of length 5m.

ii) Undersluice

The width and height of undersluice provided is 1m and 1.3 m. The bed level of undersluice is fixed at 4421.09 m amsl. The opening of undersluice is designed to pass 20% of design flood discharge for weir.

iii) Side Intake

The width of orifice is 1.5 m and height is 0.3m. The orifice is capable of diverting 0.30 m^3/s of discharge which is 20% more than the design turbine discharge. The invert level of orifice is at 4422.00 m amsl and the normal water level at intake is fixed at 4423.37 m amsl. Trash rack is provided at orifice to prevent entry of gravels and other floating materials.

iv) Gravel Trap

The design size of particle to settle is 2mm in gravel trap. The length of gravel trap is 8m, width is 1.5m and depth is 1.3m. The normal water level at gravel trap is 4423.30 m amsl. Side spillway of length 6m is provided at gravel trap to spill the excess flood discharge. The crest level of spillway is fixed at 4423.35 m amsl. The size of flushing gallery provided at gravel trap is 0.4m x 0.4m. The outlet from gravel trap is pressurized headrace pipe to the desanding basin.

v) Headrace Pipe

Headrace pipe of diameter 450 mm and length 10m is provided to convey water from gravel trap to desanding basin. The pipe is buried below the ground to prevent the freezing of water during winter. The velocity in pipe is maintained so that settlement of gravel particles will not occur inside the pipe. The pipe is of mild steel with 4mm thickness.

vi) Desanding Basin

The design size of particle to settle at desanding basin is 0.15mm. The length of basin is 26.5 m, width is 2.65 m and average depth is 2.30m. Additional depth is provided for storage of sediments and freeboard. The inlet transition of length 5.70m is provided to maintain the steady flow at basin. Side spillway of length 7m is provided to spill the excess water in the desanding basin. The size of flushing gallery provided at basin is 0.4m x 0.4m. The bed slope of 1:50 is provided at basin.

At the end of desanding basin, headpond of length 1.95m, width 2.65m and depth 2.05m is provided to maintain the adequate submergence depth for penstock pipe. Air vent pipe of diameter 100mm is provided at head pond to release the air entered into the pipe. Fine trashrack is provided at head pond to prevent entry of floating particles. The normal water level at head pond is maintained at 4422.87 m amsl.

2.4.2 PENSTOCK PIPE, ANCHOR BLOCKS AND SADDLE SUPPORT

Mild steel penstock pipe of internal diameter 400 mm and length 2930 m is proposed for conveying water from head pond to the turbine. The penstock pipe will be buried in the ground with minimum burial depth of 1 m. The thickness of pipe varies from 4 mm to 15

mm. After bifurcation, two manifolds of 7.84 m length and 200 mm internal diameter is provided.

Total 58numbers of anchor blocks are provided (including bifurcation and branches) to restrain the forces generated at bends in the subproject. A total of 364 saddle supports in form of pads are provided at every 7m interval between two anchor blocks.

2.4.3 POWERHOUSE AND TAIL RACE

i. Powerhouse

The powerhouse is located near Pangboche Village on left bank of Imja Riverat an elevation of 3950 mamsl and is of surface type. It contains two units of horizontal shaft Pelton turbine which drives two generators with total installed capacity of 911 kW. The dimension of the powerhouse is 23.05 m x 7.5m x 6.5m. The floor level of powerhouse is fixed at 3950.79 m elevation and the turbine axis level is at 3951.50 m elevation. All the structures of powerhouse are made up of M25 RCC.

ii. Tailrace

The water form two units of powerhouse are conveyed to a nearby Kholsi through combination of tailrace canal and pipe with the length of tailrace canal is 18 m and that of pipe is 21 m. The bed slope of 1:200 is provided for tailrace canal. Tailrace canal have width of 0.5 m and overall depth of 0.68 m. The canal is to be constructed with stone masonry structure in 1:4 c/s mortar and is lined with 12 mm plastering with 1:4 c/s concentration on sides and with M20 PCC on base. The diameter of pipe used in tailrace is 400 mm. At outlet portion, gabion and boulder riprap protection are provided to prevent erosion of soil.

2.4.4 SWITCHYARD AREA

An indoor switchyard of 3.55 m X 6.32 mhas been proposed for the transmission of 911 kW of power. The generated powers from two 650 kVA alternators are transferred to a 400 V busbar. From this busbar two transformers of 630 kVA each are connected in parallel operation and the power is fed to a single bus system of 11 kV. This bus system will be used to transmit electricity in high voltage majorly through a high voltage underground cable. The transformers, transformer protection system, CTs, PTs, isolators, VCBs and bus bars are major equipment of the outdoor switchyard. The details of switchyard equipment can be viewed in the electrical single line diagram of Amadablam Mini Hydro Subproject.

2.4.5 TRANSMISSION AND DISTRIBUTION LINE

In the DFS, the transmission and distribution network are designed considering the following load centers:

i. 161 HHs with the demand of 1.5 kW per household and 42 HHs with 1 kW demand.

ii. 56 big hotels with the demand of 4 kW per hotel, 65 medium hotels with the demand of 2.5 kW per hotel and 58 small hotels with the demand of 1.5 kW per hotel.

iii. 38 restaurants, with the demand of 1.5 kW each.

iv. 13 Social Institutions with the demand of 5 kW each

v. 2 hospitals with the demand of 5 kW each.

vi. 3 Snooker houses and 4 shops with demand of 1 kW each.

Further as a part of subproject, the power/energy to be generated at AMHP will be evacuated and distributed to the proposed KhumbuPasangLhamu RM-4through a 63 km long transmission and distribution with 11kV transmission line and 400/230 V as distribution voltage.

2.5 SUBPROJECT ACTIVITIES

2.5.1 PRE-CONSTRUCTION PHASE

- Detail design of the subproject components;
- Preparation of bid documents and Selection of contractors for the construction works;
- Arrangement of land for the subprojectand establishment of construction power;
- Appointment of contractors and suppliers and organization of subproject management group;
- Generation license acquisition and Power purchase agreement, and
- Financial closure of the subproject.
- Obtaining required permits, including the final approval of ESIA
- Institutional arrangement to implement EMIMAP and conduct training

2.5.2 CONSTRUCTION PHASE

- ***Preparatory works:*** Land acquisition, Establishment of construction facilities and Arrangement of borrow area of construction materials
- ***Civil works:*** Construction Activities of sub-project components
- ***Hydromechanical works:*** Fabrication, transportation, erection and testing of gates, trash racks, penstock pipes etc., Civil works for steel structures and then the installation works.
- ***Electromechanical works:*** Equipment installation
- ***Transmission Line work***
- ***Commissioning of Power Plant***
- EMIMAP ***implementation and periodic reporting***
- Continuation of consultations with stakeholders and functioning of GRM

2.5.3 OPERATION AND MAINTENANCE PHASE

- Trial Operation/Staff training;
- Defect liability maintenance;
- Adjustments and provisions;

- Final Bills and Completion Certificates;
- Review of output;

❖ Availability Declarations;

❖ O & M Scheduling;

2.6 CONSTRUCTION PLAN

2.6.1 LAND REQUIREMENTS

An estimated land area of about 5.287 ha is required for construction of the subproject components and provisioning for subproject facilities (**Table 2**).

Table 2: Estimated Land Requirement and Ownership for AMHP

SN	Component	Land Area (Ha)	Acquisition (Temporary or Permanent)	Land Ownership
1	Headworks	0.097	Permanent (Long Term Lease)	Public
2	Office, Powerhouse, Switchyard and Tailrace	0.085	Permanent (Long Term Lease)	Public
3	Penstock	0.4	Temporary (Long Term Lease)	Public
4	Spoil Disposal Sites	0.025	Temporary (Short Term Lease)	Public
5	Quarry and Borrow Sites	0.38	Temporary(Short Term Lease)	Public
6	Workshop and Material Storage	0.08	Temporary(Short Term Lease)	Public
7	Subproject camps	0.05	Temporary(Short Term Lease)	Public
8	Underground Transmission/ Distribution Lines	4.55	Temporary(Long Term Lease)	Public
9	Electric pole at river crossings	0.008	Permanent (Long Term Lease)	Public
10	Resoivoir	0.036	Permanent (Long Term Lease	Public
	Total	5.331		

2.6.2 HUMAN RESOURCES

It has been estimated that about a total of 200 unskilled and 80 skilled workers will be involved daily during the peak construction period in two shifts. The details of workers and their type (in terms of skilled, semiskilled and unskilled) will be assessed during ESIA study as per different stages of the subproject.

2.6.3 CONSTRUCTION MATERIAL

Estimated volumes 783.73 $m^3$of concrete and stone masonry work of volume 287.53 $m^3$are estimated to be required for the subproject construction. The main construction materials and their estimated quantity are presented in **Table 3**.

Table 3: Estimate of construction materials

SN	Construction materials	Quantity	Source

1	Cement (bags)	5,560	Factory
2	Aggregate (m^3)	600	Quarry Sites
3	Sand (m^3)	420	Quarry Sites
4	Boulder Stone (m^3)	1,100	Quarry Sites
5	Reinforcement Bars (ton)	47	Factory

2.6.4 CONSTRUCTION WORK PLAN

The proposed AMHP will require an estimated time frame of about 29 months for completion from the date of commencement to the date of commercial operation (**Annex VIII**).

2.6.4.1 ENERGY REQUIREMENTS

As there is no National Grid, two diesel generator sets each with 10 kVA capacities will be required at the headworks site and powerhouse respectively to meet the electricity demand of the construction purpose and for lighting of construction camps. Alternatively, a nearby micro hydro of 15 kW (Pangboche MHP) can be used for required energy.

2.6.4.2 ANCILLARY FACILITIES

a) Site Access

Site access shall be provisioned by using existing trails from Pangboche to reach to various subproject component sites. The details of the access trails are provided in **Table 4** hereunder.

Table 4: Site Access

SN	Description	Length	Width of trail	Remarks
1	Pangboche to Powerhouse	1.6 Km	4 ft	
2	Powerhouse to Headwork	3.25 Km	4 ft	

b) Subproject Camps and Storage

Two subproject camps (one each at headworks and powerhouse location) are proposed to accommodate Contractor's construction workforce as personnel of supervising Engineers and the Employer's staff. The camps will be constructed on the left bankof the Cholunche Khola whereas the nearest settlement is located at the right bank of Imja Khola.A careful assessment is needed in the ESIA to understand potential E&S impacts of the labor camp, its location, proximity to settlements and the way workers will be managed.

c) Material Storage and Workshop

Material storage and mechanical workshops are located on the left bank of CholuncheKhola both at headworks and the powerhouse location.

d) Quarry Site and Borrow Pits

Various probable quarry sites have been identified based on geological investigation which is discussed below in **Table 5**.

Table 5: Proposed quarry and borrow sites for AMHP

SN	Coordinate	Dimensions Length (m)*Breadth (m)*Depth(m)	Approximate Quantity (m^3)	Remarks (geological characteristics)
A. Intake Area	27°50'56.52"N 86°49'6.15"E	70 m * 20 m * 2 m	2800 m^3	The quarry site is heterogeneous mixture of boulder, cobble, gravel and sand
B. Powerhouse Area	27°51'12.98"N 86°47'44.21"E	80 m * 30 m * 1 m	2400 m^3	Alluvial soil composed of loose, subrounded to rounded, gravel of gneiss with sand and silt

e) Batching Plants and Aggregate Crushing Plants

The facilities for aggregate crushing and batching plants will be located at the headwork and powerhouse sites close to the active construction sites. These facilities will be operated with provisions of air pollution control, noise control/arresting facilities, and water and waste water management facilities. These will be temporary facilities to be demolished at the end of the construction period.

f) Spoil Volume & Disposal Area

About 450 cubic meters of spoils has been estimated to be generated due to excavation for subproject component construction. Two disposal sites are proposed for the purpose all of which are on the left bank of CholuncheKhola(**Table 6**). The ESIA study will prescribe rehabilitation of spoil disposal sites considering erosion prevention and aesthetic retention.

Table 6: Proposed Spoil disposal Sites for AMHP

SN	Location	Coordinate	
		N	E
1	Intake	27°50'56.52"	86°49'6.15"
2	Powerhouse	27°51'12.98"	86°47'44.21"

g) Materials and Equipment Transportation

Materials and equipment will be transported to site by appropriate means of transportation. As the subproject area is lack of motorable road, air transport and manual carrying of load by man and animals will be used.

2.6.4.3 POWER AND ENERGY

The proposed AMHP with an installed capacity of 911 KW will utilize a net head of 471 mwith design discharge of 0.25 m^3/s to generate total average annual energy 7,231,758 kWh(**Table 7**).

Table 7: Estimated Monthly Power and Energy Generation from the proposed AMHP

Month	Numbers of operating days/ month	Turbine discharge	Head loss	Net head	Generation capacity	Total energy
		m3/s	m	m	kw	kWh
Jan	31	0.250	27.775	444.09	911.10	650742.37
Feb	28	0.250	27.775	444.09	911.10	587767.31
Mar	31	0.181	14.793	457.08	678.82	484843.33
Apr	30	0.139	8.953	462.92	528.71	365441.20
May	31	0.250	27.775	444.09	911.10	650742.37
Jun	30	0.250	27.775	444.09	911.10	629750.69
Jul	31	0.250	27.775	444.09	911.10	650742.37
Aug	31	0.250	27.775	444.09	911.10	650742.37
Sep	30	0.250	27.775	444.09	911.10	629750.69
Oct	31	0.250	27.775	444.09	911.10	650742.37
Nov	30	0.250	27.775	444.09	911.10	629750.69
Dec	31	0.250	27.775	444.09	911.10	650742.37
Total annual energy generated (GWH)						7231.75

CHAPTER 3: LAW AND POLICY

Government of Nepal has developed various acts, regulations and guidelines for environmental friendly development activities. Similarly, WB has some guidelines and requirements for ESIA study. A brief review of the policy and legal mechanisms shall be presented focusing on the provisions attracting the implementation and operation of the subproject in ESIA report. Moreover, an analysis on the gap between national legislation and WB policies and EHS guidelines will be done.The policies, laws, rules and regulations, and other guidelines and directives, which will govern the undertaking of ESIA, include the followings:

Table 8: Relevant law, regulations and policies

SN	Acts/Regulations/Guidelines
1	**Constitution of Nepal**
2	**Plans, Policies and Strategy**
2.1	**Plan**
2.1.1	Fifteenth Plan (FY 2076/77-2080/81)
2.1.2	Nepal Biodiversity strategy and Action Plan 2071-2077 BS (2014-2020 A.D.)
2.1.3	Nepal Environmental Policy and Action Plan, 2050 B.S. (1993 A.D.)
2.2	**Policy**
2.2.1	National Occupational Safety and Health Policy, 2076
2.2.2	National Environmental Policy 2076 B.S. (2019)
2.2.3	Renewable Energy Subsidy Policy,2073BS (2016 AD)
2.2.4	AEPC Gender Equality and Social Inclusion Policy, 2075 (2018 AD)
2.2.5	Public-Private Partnership Policy, 2072 (2015)
2.2.6	Land Acquisition, Resettlement and Rehabilitation Policy, 2071 BS (2015 AD)
2.2.7	Rural Energy Policy 2063 BS (2006 AD)
2.2.8	Hydropower Development Policy, 2058 BS (2001 AD)
2.2.9	Environmental and Social Safeguard Policy of AEPC (undated)
2.3	**Strategy**
2.3.1	National Energy Efficiency Strategy, 2075
2.3.2	Water Resource Strategy, 2058 BS (2002 AD)
3	**Act, Rules and Regulations**
3.1	Act
3.1.1	Environment Protection Act, 2076 B.S. (2019 AD).
3.1.2	Local Government Operation Act, 2074 (2017)
3.1.3	Intergovernmental Fiscal Arrangement Act, 2074
3.1.4	Act to Regulate and Control on International Trade in Endangered Species of Wild Fauna and Flora Act, 2074 (2016)
3.1.5	Muluki Criminal Code Act, 2074(2017)
3.1.6	National Civil Code Act, 2074
3.1.7	Solid Waste Management Act, 2068 BS (2011 AD)
3.1.8	Plant Protection Act 2064 (2007)
3.1.9	Child labor (Prohibition and regularization) Act, 2056 BS (2000 AD)
3.1.10	Electricity Act, 2049 BS (1992AD)

SN	Acts/Regulations/Guidelines
3.1.11	Water Resources Act, 2049 BS (1992AD)
3.1.12	Land Acquisition Act, 2034 (1977)
3.1.13	National Parks and Wildlife Conservation Act, 2029 BS (1973AD)
3.1.14	Aquatic Animal Protection Act, 2017 BS (1960 AD)
3.2	**Rules/Regulations**
3.2.1	Environment Protection Regulation, 2077 (2020 AD)
3.2.2	Labor Rules, 2075 BS (2018 AD)
3.2.4	Electricity Regulatory Commission Rules, 2075
3.2.5	Solid Waste Management Regulation, 2070
3.2.6	Plant Protection Rules, 2067 BS (2010 AD)
3.2.7	Child Labor (Prohibition and Regulation) Rules, 2063 BS (2006 AD)
3.2.8	Conservation Area Management Rules, 2053
3.2.9	Buffer Zone Management Regulation, 2052
3.2.10	Forest Regulations, 2051 BS (1995 AD)
3.2.11	Electricity Rules, 2050 BS (1993)
3.2.12	Water Resources Regulations, 2050 BS (1993 AD)
3.2.13	Himali National Park Rule, 2036
3.2.14	National Parks and Wildlife Conservation Rules, 2030 BS (1974 AD)
4	**Guidelines/manuals/Directives**
4.1	Directive Relating to Licensing of Power Projects 2075
4.2	Hydropower Environmental Impact Assessment Manual, 2075 (2018)
4.3	Working Policy on constructing and operating physical infrastructures in Protected Area 2065 (2008)
4.4	Community Forest Inventory Guidelines, 2061 BS (2003 AD)
4.5	National EIA Guidelines, 2050 BS (1993 AD)
4.6	Guideline on Environmental & Social Risk Management (ESRM) For Banks And Financial Institutions, May 2018
5	**Working Procedures/Work Plan**
5.1	Working Procedure for the Use of National Forest Area for National Priority Project, 2074 BS (2017 AD)
5.2	Renewable Energy Subsidy Delivery Mechanism 2073 BS (2016 AD)
5.3	Renewable Energy Subsidy Delivery Mechanism for Special Program 2073 BS (2016 AD)
6	**Standards**
6.1	National Ambient Air Quality Standard, 2069 BS (2012 AD)
6.2	National Noise Quality Standard, 2069 BS (2012 AD)
6.3	Standards for Emission from in-use and Imported Diesel Generators, 2069 BS (2012 AD)
6.4	Tolerance Limits for Industrial Effluents to be Discharged into Inland Surface Waters, 2003
7	**World bank ESS Instruments**
7.1	**Operation Policy**
7.1.1	Environmental Assessment EA (OP 4.01)
7.1.2	Natural Habitats (OP 4.04)

SN	Acts/Regulations/Guidelines
7.1.3	Involuntary Resettlement (OP 4.12)
7.1.4	Physical and Cultural Resources (0P 4.11)
7.1.5	Indigenous People (0P 4.20)
8	**International Instruments**
8.1	The United Nations Declaration on the Rights of Indigenous Peoples, UNDRIP, 2007
8.2	International Labour Organization Convention, 1998
8.3	Convention on Biological Diversity (CBD), 1992
8.4	Concerning Indigenous and Tribal Peoples in Independent Countries, 1991 Convention (No.169)
8.5	World Heritage Convention, 1975
8.6	World Heritage Advice Note: Environmental Assessment (18 Nov 2013): Astep-by-step guidance on environmental assessment for world heritage properties.
8.7	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), (1973 amended1979)

CHAPTER 4: BASELINE ENVIRONMENTAL CONDITIONS

4.1 PHYSICAL ENVIRONMENT

4.1.1 TOPOGRAPHY

The topography of the subproject area is of gentle to steep. The Amadablam Mini Hydro Subproject is situated in the gentle topography. The river slopes are covered with colluvial soil deposit while the bedrock outcrops are exposed at the slopes. The deposit is moist, and seepage is frequent. The elevation ranges from 3951.5 masl to 4422 m masl. Intake area is somewhat flat. The elevation falls from 4422 masl to 3951.5 masl at powerhouse site. The powerhouse site is at alluvial terrace which is flat.

4.1.2 GEOLOGY

The subproject area is located at around the boundary of Higher and Trans Himalaya Zone. This zone is basically created by the tectonic upliftment, wind and glacial erosion, and slope degradation by rock disintegrations. Main rock type found in this region are Gneisses, schists and marbles of the Higher Himalayan Zone and Tethyan sediments (limestones, shale, sandstone etc.) belonging to the Tibetan-Tethys Zone.

The subproject area geologically lies on the Trans and Higher Himalayan Crystalline Zone in the eastern part of Nepal. The subproject area possesses the high-grade metamorphic rocks. The subproject site falls within the Khumbu Migmatite Schuppe Zone. This zone is

distributed widely in the upper reaches of the BhoteKoshi Khola and DudhKoshi, occupying the main part of the crystalline Schuppen in this region.

4.1.3 METEOROLOGICAL CONDITION

4.1.3.1 PRECIPITATION

The precipitation in the Khumbu Region may be considerably greater on the upper slopes than in the valleys. The average annual precipitation is about 100m mm at elevations between 3,500 to 4,500 amsl and around 500 mm above 4,500 amsl. The non-monsoon precipitation is around 150 mm at altitudes above 3,500 amsl. Likewise, average annual monsoon precipitation is 1000 mm whereas monsoon wetness index of the catchment area is taken as 1000 from Isolines in Monsoon Index Map.

Table 9: Monthly Precipitation at Meteorological stations in Khumbu Region (mm)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Syangboche	21	23	29	43	52	135	213	191	145	47	8	9
Tengboche	13	13	23	35	48	210	307	309	209	113	10	2

Source: DHM

4.1.3.2 TEMPERATURE

Meteorological Stations at Syangboche and Tengboche have mean monthly temperatures below sub-freezing during winter only. January is the coldest month and July is the warmest month.

Table 10: Mean monthly temperature at meteorological stations (degrees Celsius)

Meteorological Station	Elevation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Syangboche	3700	-3.5	-2.3	0.7	4.0	6.4	8.6	9.4	9.2	7.5	4.4	1.4	-1.2
Tengbochee	3857	-1.7	-0.9	2.5	5.6	7.4	10	10.5	10	8.6	6.3	1.6	0

Source: DHM

4.1.4 AIR QUALITY

The subproject area is in rural setting and there is no industry causing air pollution. Thus, air quality of the area seems good.

4.1.5 NOISE QUALITY

The noise quality seems to be within tolerable limits and there are no any means of noise pollution sources except naturally flowing streams and helicopters movement in air.

4.1.6 SUBPROJECT LOCATION FROM FLOOD LEVEL

The intake area is in flood level. Other structures are away from flood plain areas.

4.1.7 SOIL QUALITY

Soil quality is poor as it mostly contains quaternery alluvial deposits. In headwork area, most dominant proportion (about 60%) is of boulder and gravel. . The cobble pebble and sand deposit constittue the remainining proportion. Such soil is almost up to powerhouse site. There are colluvial soil deposits in the hill slope. The colluvial soil comprises subangular to angular, boulders, gravels, cobble and pebbles of gneiss with sand. Most dominant proportion (about 70%) is of boulder and cobble . The pebble, gravel and sand deposit constittue the remainining proportion. The power house lies above alluvial soil composed of loose, subrounded to rounded, gravel of gneiss with sand and silt. Most of the materials are gneiss. The thickness of soil is expected to be 7-10 m according to field observation.

4.1.8 WATER RESOURCES

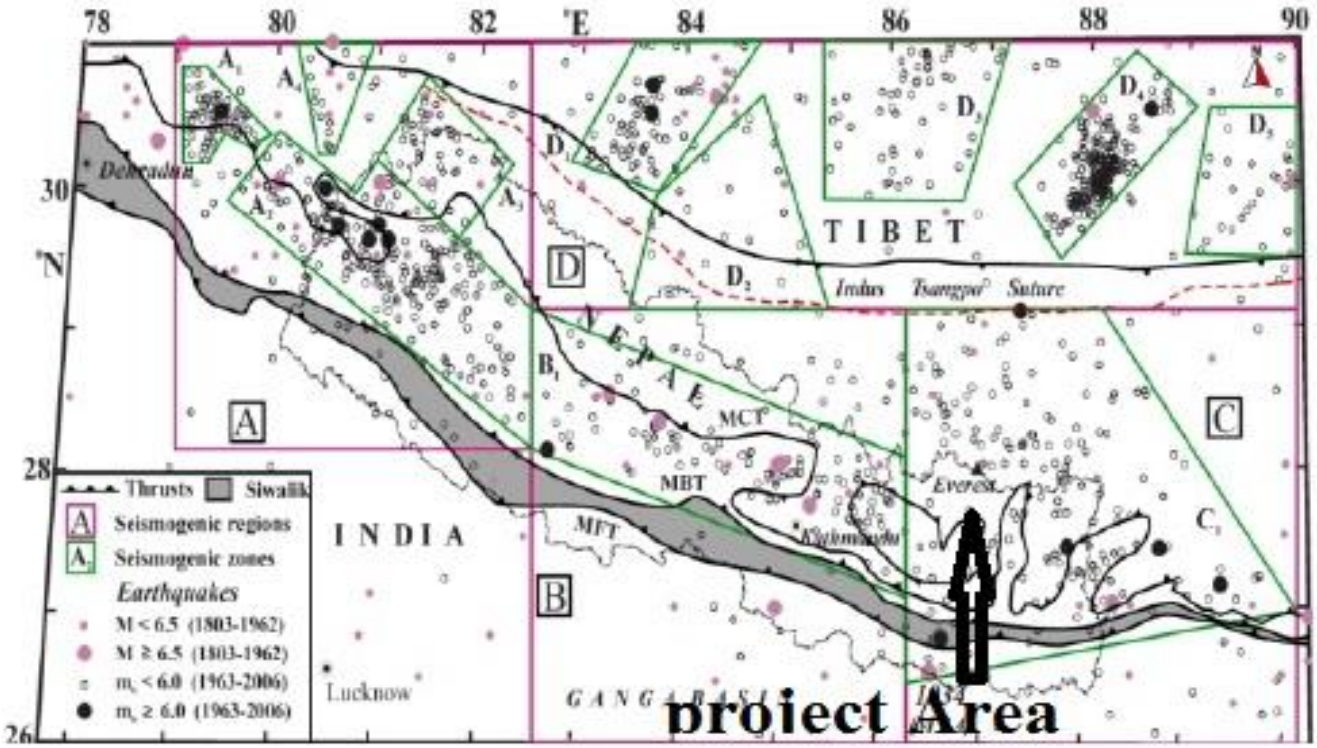
Imja and Cholunche are the major streams in the area. Both are snow fed streams. The stream water is not used for any household and irrigation purposes. Livestock use the water for drinking and some people for bathing and washing clothes in the stream, especially in Imja.

4.1.9 AGRO-ECOLOGICAL ZONES WITHIN SUBPROJECT AREA OF INFLUENCE

Agriculture land is very premium in the area. Crop diversity is also poor due to harsh climatic condition. Potato and buck wheat are major agriculture products in the area. Some people have started vegetable farming in plastic tunnel.

4.1.10 SEISMICITY

The Himalayan region is considered to be seismically active zone. Thus, being a part of the Himalayas, the Nepal Himalaya also falls in active seismic zone. Furthermore, the existence of tectonic features such as Main Central Thrust (MCT), Main Boundary Thrust (MBT) and Himalayan Frontal Fault (HFF) further increases the amount of seismic risk. The recent seismic activities are mainly due to the shallow focus events and these are mostly confined between the surface manifestations of the MBT and the MCT in the Himalayan frontal arc and to the north of the Indus Tsangpo Suture (ITS) in the South-Central Tibet. The intermediate earthquakes have occurred mostly in three localities associated with intense shallow focus activity: Western Nepal, north-northeast of Mount Everest, and north of the ITS along 88°E. The medium size earthquakes ($mb \geq 6$) in Himalayan thrusts occur at deeper levels as compared to the similar magnitude earthquakes at shallowest level in the adjoining Tibet region.



Map 1: : Seismic Map (1803-2006) of Nepal and Seismic Zoning its adjoining Region in Nepal Himalaya.
(MCT, MBT, MFT and ITS are the major tectonic features in the region)

The project area falls in the Class (C) (Figure 1) having high seismic risk Considering the historical and recent earthquake and design parameter of Upper Karnali project and Arun 3 Hydropower Project, the Seismic coefficient for Amadablam Mini Hydropower Project is evaluated based on Nepalese and Indian Standards. During the recent earthquake 2015, the Peak Ground Acceleration recorded as 0.30g and same would be expected at the site and the same may be adopted as Maximum Credible Earthquake (MCE) value 0.30g for the project and a value of 0.18g may be appropriate as Design Base Earthquake (DBE). Further details for these parameters needs to be verified during detailed design phase. The recommended value for MCE of 0.30g has been considered to be sufficient to use for the detail design purpose.

4.1.11 CLIMATE CHANGE AND NATURAL DISASTERS

In Sagarmatha, Nepal, air temperatures have risen by 1ºC since the 70s, leading to a decrease in snow and ice cover of 30 percent in the same period and replacing a 4000 m high glacier on Mt. Everest by a lake. Glacier lake outburst floods (GLOFs) are now much more frequent, creating serious risks for human populations and having implications for the water supply in South Asia and the flow of major rivers such as the Ganges, Indus and Brahmaputra (Khanal et. al. 2012). The issue of climate change and GLOFs is prominent in the subproject area. According to locals, melting of ice seems increasing at present days than past. TheDudhKoshi basin is the largest glacierized basin in Nepal. It has 278 glaciers of which 40,

amounting to 70% of the area, are valley-type (Bajracharya and Mool 2010). Within the CholuncheKhola catchment, there is a Nare glacier. Due to moraine collapse of Nare glacier on 1977, a GLOF event was occurred, which took two or three lives and destroyed all the bridges for 35 km downstream including other properties (ICIMOD 2011). Imja is another most dangerous glacial lake with high probability of brust. If it brusts, it will may impact the power house region.

4.2 BIO-ECOLOGICAL ENVIRONMENT

The majority of the subproject area lies in lower alpine bio-climatic zone (elevation range: 4000-4500 m) and some part in upper sub-alpine bioclimatic zone (elevation range: 3500-4000 m).As per The Conservation Science Programme WWF-US (1998), the subproject area falls under East Himalayan alpine shrub/meadow Ecoregion (4000-4500 m) with Montane grasslands and shrub lands vegetation, and East Himalayan sub-alpine conifer forest ecoregion (3000-4000 m) with sub-alpine conifer forest vegetation. The intake area lies in Alpine pastureland with almost no trees at all while majority of the penstock pipeline lies in Juniper Scrublands in the vegetation zone of Moist Alpine Scrubs. The proposed powerhouse area lies in the vegetation zone of Birch-Rhododendron Forest with subalpine juniper forest.

4.2.1 VEGETATION IN SUBPROJECT AREA

4.2.1.1 HEADWORKS/INTAKE

Headworks/Intake area lies with in Alpine Pasturelands. The area has notree. Similarly, shrubs are barely found the site. Some herbaceous and grass species are found in the area. Shrubs are also very few. Some common shrubs are *Bistortavaccinifolia, Rhododendron nivale,*Salix sp. etc. Similarly, some common herbs are *Anaphalistriplinervis, Bistortavivipara, Juncusconcinnus, Pedicularisconfertiflora,Potentillacoriandrifolia, Ranunculus brotherusii,* Saxifraga sp. *etc.*

4.2.1.2 PENSTOCKS

Majority part of the Penstock pipes lies above 4000 m. Although the area lies within Juniper Scrub vegetation Zone, the area is mostly dominated with shrub species of Rhododendron such as *R.anthopogon, R. nivale*and *R. lepidotum*at higher elevation. While reaching down, some sparse dwarf species of junipers such as *Juniperusindica and J. recurva* are also seen. Some regenerating tree species such as *Betulautilis, Abiesspectabilis, R.wightii, and R. fulgens*are also found at lower slope. Other common shrubs are *Berberisangulosa,Cassiopefastigiata, Ephedra gerardiana,Juniperussquamata, Salix lindleyana*etc.Aconitum sp., *Agrostispilosula*, Anaphilis sp.,Anemone sp., Aster sp., *Bistortamacrophylla, Juncusleucanthus,* Leontopodium sp., Pedicularis sp., Primula sp., Saxifraga*sp*. etc. are some herbs found in the area.

4.2.1.3 POWERHOUSE AND TAILRACE AREA

The powerhouse site lies in sub-alpine region. It falls in Sub-alpine Juniper forest, a subgroup of Birch-Rhododendron Forest. Sparse trees are seen here. In the subproject area, some common tree species such as *B.utilis, A. spectabilis, R. wightii, and R. fulgens*are seen around the periphery of proposed powerhouse site. *Berberiswallichiana, Ephedra gerardiana, Juniperussquamata, Potentillafructicosa, R.campanulatum, R. lepidotum, Spiraeabella*etc. are some shrubs found in the area. Similarly, *Aconitum laciniatum, Arisaemajacquemontii, Bergeniapurpurascens, Corydalis longipes, Deschampsiacaespitosa,* Primula sp., *Swertiaracemosa*etc. are some herbs found in the area.

4.2.1.4 NON-TIMBER FOREST PRODUCTS USED (NTFPS) IN SUBPROJECT AREA

There are many plants used by local communities as medicines, foods, incenses, timber, fuelwood, fodder and also decorative purposes. More than 50 plants species have been used by locals for various purposes. Some commonly used NTFPs by locals are Aconitum sp., Anaphilis sp., *Arisaemaflavum,* Barberis sp., Clematis sp., *Cotoneaster microphyllus,* Drepanostachyum sp., *E. gerardiana, Euphorbia sikkimensis, Gaultheria fragrantissima,* Juniperus sp., *Meconopsishoridula, Micheliachampaca, Nardostachys grandiflora, Plantagoerosa, Rheum austtrale, R.anthopogon, R.campylocarpum, Rumexnepalensis, Urticadioica*etc.Similarly, wild edible mushrooms are extensively used by local people. Such common mushrooms are*Armillariellamellea*, Boletus sp., *Hydnumrepandum*, Ramaria sp., *Paxillusinvolutus, Tylopiluseximus*etc.

4.2.2 FAUNA (MAMMALIAN AND AVIAN)

In this section, wildlife found in and around the subproject areas have been given. According to locals, there are no any reptiles, amphibians and fishes seen till date. So, only lists of mammals and birds have been given here.

4.2.2.1 MAMMALS

Altogether 14 mammals were reported from the subproject areas. The subproject area is almost bare land. Large mammals visit this area in search of food while small mammals such as *Lepus oiostolus,Ochotanamacrotis*and *Marmota bobak*reside in the rock areas of the subproject area. *Hemitragusjemlahicus, Canis aureus, Canis lupus, Unciauncia, Moschuschrysogaster, Alticolastrachey,Ursusthibetanus*etc. are seen in the area.

4.2.2.2 BIRDS

More than 80 different bird species have been reported from the subproject area. Some common birds are *Aquilla heliacal, Buteo, Gyps himalayensis, Eremophilaalpestris, Collocaliabrevirostris, Columba leuconota, Corvuscorax, Corvusmacrorhynchos, Clamatorjacobinus, Falco tinnunculus,* Carpodacus sp.,*Delichondasypus, Delichonnepalensis, Laniustephronotus,* Luscinia sp., *Zootheradixoni,* Motacilla sp.,

Montifringilla sp., *Passer domesticus,* Prunella sp.,*Lophophorusimpejanus,Tragopansatyra, Garrulaxocellatus,* Yuhinasp,*Upupaepops*etc.

4.2.3 PROTECTED AREAS

The subproject area lies within the Sagarmatha National Parkwhich is also a world heritage site recognized by UNESCO.A conservation management plan has been approved for the SNP, and Outstanding Universal Values (OUV) of the world heritage site are published online by UNESCO.

The SNP and adjacent Buffer Zone are described by Birdlife International as an Important Bird Area (IBA), which recognizes the important biodiversity value of the area. The SNP also incorporates Ramsar Wetlands of international importance.

4.2.4 CONSERVATION STATUS OF WILD FLORA AND FAUNA

Conservation status of flora and fauna has been given in Table 11 to 13.

Table 11: Conservation Status of some Flora of Subproject Area (not comprehensive)

S.N.	Nepali Name	English Name	Scientific Name	CITES Appendix	IUCN Red List	GoN
1	Talispatra	Webb Fir	*Abiesspectabilis*	-	NT	Protecte
2	Chanp	Mangolia	*Micheliachampaca*	-	LC	Protecte
3	Jatamansi, Bhutle	Himalayan Spikenard	*Nardostachysjatamansi(formerly N. grandiflora)*	II	CR	Protecte
4	Jhyau	Lichen	*Parmelia sp. & others spp.*	-	-	Protecte

Table 12: Conservation Status of Mammals potentially occurring in Subproject Area with updates from IBAT

SN	Nepali Name	Common Name	Scientific Name	Conservation Statu	
				Nepal Red Data Book (2012)	IUC Red
1	Ghanse Muso	Alpine/Sikkum Vole	*Pitymyssikimensis*	LC	I
2	Chhuchundro	Brown Toothed Shrew	*Episoriculuscaudatus(formerly Soriculuscaudatus)*	LC	I
3	Chituwa	Common Leopard	*Pantherapardus*	VU	V
4	PaniChuchundro	Elegant Water Shrew	*Nectogaleelegans*	LC	I
5	Chuchundro	Golden Jackal	*Canis aureus*	LC	L
6	Bwasho	Grey Wolf	*Canis lupus*	CR	L
7	KaloBhalu	Himalayan Black Bear	*Ursusthibetanus*	EN	V
8	Muse Thutekharayo	Himalayan Mouse-hare	*Ochotona roylei*	DD	L
9	Jharal	Himalayan Thar	*Hemitragusjemlahicus*	NT	N

SN	Nepali Name	Common Name	Scientific Name	Conservation Statu	
				Nepal Red Data Book (2012)	IUC Red
10	DuhureGhar Muso	House Mouse	*Mus musculus*	LC	L
11	Ghar Muso	House Rat	*Rattusrattus*	LC	L
12	Dhendu	Langur	*Semnopithecuspriam ssp. thersites*(formerly*Presbytis entellus)*	LC	V
13	Kasturi	Himalayan Musk Deer	*Moschusleucogaster (formerly M. chrysogaster)*	DD	E
14	Habre	Himalayan Red Panda	*Ailurusfulgenssubsp. fulgens*	EN	E
15	Rato Bandar	Rhesus Macaque Monkey	*Macacamulatta*	LC	L
16	Saiberiyalimalasapro	Siberian Weasel	*Mustelasibirica*	LC	L
17	Malsapro	Yellow-throated Marten	*Martesflavigula*	LC	L
18	KaloSalak	Chinese Pangolin	*Manis pentadactyla*	EN	C
19	Ban Kukur	Dhole	*Cuonalpinus*	EN	E
20	MandellikoMusakaneChamero	Mandelli's Mouse-eared Myotis (Bat)	*Myotissicarius*	VU	V
21	DwanseChituwa	Clouded Leopard	*Neofelisnebulosa*	EN	V
22	HiunChituwa	Snow Leopard	*Pantherauncia*	EN	V
23	Gainda	Greater One-horned Rhino	*Rhinoceros unicornis*	EN	V
24	Jarayo	Rusa	*Rusa unicolor*	VU	V
25	Sano Oat	Asian Small-clawed Otter	*Aonyxcinereus*	DD	V
26	Thar	Mainland Serow	*Capricornissumatraensis*	NT	V

Key to threatened status: CR – Critically Endangered; EN – Endangered; VU – Vulnerable; NT – Neat Threat Concern; DD – Data Deficient.

Table 13: Conservation Status of Birds in Subproject Area

SN	Nepali Name	English Name	Scientific Name	CITES Appendix	IUCN Red List	Nepal Red Data Book
1	Giddha	CinereousVulture	*Aegypiusmonachus*	-	NT	EN
2	Chilime	Blood Pheasant	*Ithaginiscruentus*	II	LC	LC
3	Cheel	Osprey	*Pandion haliaetus*		LC	LC
4	Danphe	Impeyan Pheasant	*Lophophorusimpejanus*	I	LC	NT
5	Tibbati Him-Kukhura	Tibetan Snowcock	*Tetraogallustiebetanus*	-	LC	-
6	DadiBhayekoGiddha	Bearded Vulture	*Gypaetus barbatus*	-	NT	VU

SN	Nepali Name	English Name	Scientific Name	CITES Appendix	IUCN Red List	Nepal Red Data Book
7	Munal	Crimson-horned Pheasant	*Tragopansatyra*	III	NT	VU
8	ShahiBaaj	Peregrine Falcon	*Falco peregrinus*	I	LC	LC

4.3 SOCIO-ECONOMIC AND CULTURALCONDITIONS

4.3.1 DISTRIBUTION OF POPULATION IN THE SUBPROJECT AREA IN TERMS OF AGE, SEX, HOUSEHOLD SIZE, ETHNICITY ANDRELIGION

The total population of Khumbu Pasanglahmu RM is 9084 in 1737 houses with average family size of 5.23 (Source: KPLRM, 2019). The female population (50.2%) is slightly more than male population. The total population in Ward No. 4 where the subproject site lies is 1469 in 348 HHs with average family size of 4.22. Nearly two third of the population of Ward No. 4 is economically active. Nearly 12% people are of old age group. The most dominant ethnic group is Sherpa (95.27%) (Figure 1). Other Castes are negligible. Base on religion, majority of HHs are Buddhists (78.80%), followed by Hindu (20.63%) and Christian (0.57%).

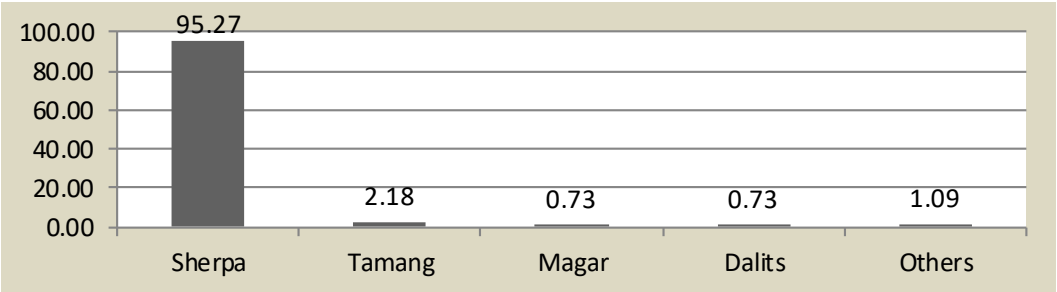


Figure 1: HHs Percentage Based on Caste/Ethnicity in Ward No. 4

(Source: KPLRM, 2019)

4.3.2 SUBPROJECT LAND

The proposed land for the subproject implementation area is public land which is under the jurisdiction of Sagarmatha National Park. There is no any kind of physical structure at present in the proposed site. It is open land used for grazing by locals.

4.3.3 LAND USE AND OWNERSHIP (INCLUDING TRADITIONAL USE AND OWNERSHIP)

Total area of the RM is 1539.11 Km^2. Out of total land area; nearly 44% is snow/glacier, followed by barren land (19.93%), grass land (15.61%), forest (9.98%) and shrub land

(9.30%). Other land category areas are very less (Agriculture-0.67%, Built up Area- 0.005% and water Body-0.58%). Out of total area 702.16 11 Km^2in Ward No.4, snow/glacier is 52.40%, barren land 20.86%, grassland 14.52%, shrub land 8.02%, forest 2.83%, water body 0.67%, built up 0.45% and agriculture 0.25% (KPLRM, 2019).

Traditionally, Sherpas are the custodians of the whole Khumbu area. But after declaration of National Park, SNP is the major authority having the land within National Park area. All the lands except private registered land belong to SNP. The land used by local people for settlements and agricultural purposes are private land.

4.3.4 CROPPING AND/OR GRAZING PATTERNS

The RM has diverse climate due to altitudinal variation 1,543 m amsl to 8,848 m amsl. Ward numbers 1, 2 and 3 have relatively warm climate and so more people dependent on agriculture activities. In Ward No. 4, agriculture land is very limited (KPLRM, 2019). People in general cultivate barley and potato only. Now days some people are cultivating some vegetables in plastic tunnel.

Yak, nak, cow, horse, jyokpo and bull are the livestock reared in the Ward No. 4. A total of 152 HHs have reared any one of the above mentioned livestock. Yak is the livestock that mostly reared by more HHs in more numbers. There is no specific grazing system. Open grazing is common.

4.3.5 VULNERABILITY OF THE AFFECTED PEOPLES (APS)

The subproject does not affect the people directly or indirectly. All the subproject features will be in public land. Nobody will be displaced and none of land will be acquired for proposed subproject activities.

4.3.6 EMPLOYMENT AND LIVELIHOOD

Tourism activities like trekking, mountain climbing, hotel and restaurant are the major economic activities of the area. Agriculture land is very premium, and productivity is also very less. Major occupations are agriculture, tourism, services, foreign employment and business (Figure 2). Unemployment figure is also significant in ward number 4 of the RM.

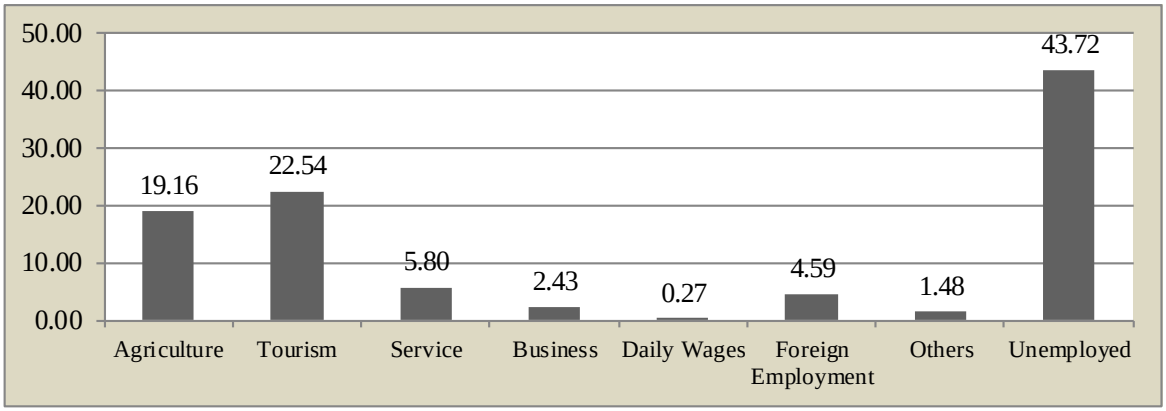


Figure 2: Population Percentage by Occupation in Ward Number 4

(Source: KPLRM, 2019)

4.3.7 LABOUR INFLUX

Very less Sherpas are involved in off-tourism activities. Most of the working people come from other parts of the district and neighboring districts. Shankhuwasabha, Kotang, Ramechhap, Okhaldhunga Bhojpur and Dolakha are the major sources of workforce in the area.. The outsider workers mainly involve in hotels/restaurants, construction activities and tourism industries.

4.3.8 PHYSICAL AND CULTURAL RESOURES

There are 3 schools in Ward Number 4; two primary and one secondary school. Similarly, there are three health institutions in ward number 4: Khunde Hospital, Khumjung Health Post and Fortse Health Clinic. There is no temple in the Ward No. 4 but 10 Gumbas. The nearest Gumba is Pangboche Gumba (about 800 m in westwards from powerhouse site) from the proposed subproject site.

4.3.9 INDIGENOUS SETTLEMENT

There are more than 20 different settlements in Ward No. 4 of the RM. The nearby settlements are Tallo Pangboche (about 400 m in westwards from powerhouse site),MathilloPangboche (about 800 m in westwards from powerhouse site) and Somare (about 2 Km in north-east from powerhouse site). All the settlements in the Ward are Indigenous Settlements.

4.3.10 COMMUNICATION FACILITY

4 G mobile network facilities are available in the subproject area. There are two post offices in the RM. Internet facilities are also available in major settlements. Details regarding the quality of internet service should be obtained during ESIA.

Map 2: Nearby Settlements of AMHP in Google Map

CHAPTER 5: TIME, BUDGET AND HUMAN RESOURCES

5.1 TIME REQUIRED FOR REPORT PREPARATION

The ESIA study is planned to be completed within a period of 5 months after the approval of Terms of Reference (**Table 14**).

Table 14: Time Schedule for ESIA

SN	Activities	Time in Month																													
		June				July				August				Sept				Oct				Nov.				Dec							
1	ToR of ESIA Submission to AEPC/WB																														
2	Approval of ToR from AEPC/WB																														
3	Preparation of ESIA Report [includes field study also]																														
5	Public Hearing																														
7	Incorporation the issues form Public Hearing in ESIA Report																														
8	ESIA Report Submission																														
9	Submission of Final ESIA for Approval																														

*Note: It does not include the time taken by concerned authority for approval.

5.2 ESTIMATED BUDGET

The estimated budget for the ESIA study of the proposed subproject will be as per agreement between Developer (Amadablam Mini Hydro Pvt. Ltd.) and consultant (EFI), and it has been estimated to NPR 795,000.00for ESIA study.

5.3 EXPERTS (HUMAN RESOURCES)

The ESIA team includes multidisciplinary experts on different environment domains (physical, biological and socio-economic and cultural environment) as in Table 15. Independent Biodiversity Specialist and Geological Specialist will review the different milestone of ESIA and provide suggestion/guidance on the ESIA report. ESCO and the consulting firm shall coordinate and cooperate with the independent specialists.

Table 15: Study Team and Qualification

SN	Name	Expertise	Academic Qualification	Experience
1	DhanB.Shresth a	Environment/ EIA/Team Leader	MSc, Environmental Science	14 Years
2	LokeshSapkota	Physical Environment Expert	ME, Environmental Engineering	10 Years
3	Ramji Bogati, PhD	Biodiversity Expert	PhD- Spatial Planning: Landscape Ecology and Landscape Planning; MSc, Zoology	10 Years
5	Heramba Adhikari	Scocio-economic and Cultural Expert	MA, Sociology/Economics	10 Years
6	Toya Nath Ghimire	Geologist	Msc, Geology	10 years

Independent Biodiversity Specialist and Geological Specialist will review the different milestone of ESIA and provide suggestion/guidance on the ESIA report. ESCO and the consulting firm shall coordinate and cooperate with the independent specialists.

CHAPTER 6: ALTERNATIVES

Alternative analysis has been considered as an integral part of ESIA study, which involves an alternative ways of achieving the objectives of the proposal. The aim of alternative analysis is to arrive at a development option, which maximizes the benefits while minimizing the unwanted impacts. The likely impacts of each alternative will be assessed and compared in terms of adverse environmental impacts and benefits, and the environmentally sound alternative will be recommended. Alternative analysis shall be assessed based on the following 5 aspects i.e. technical, financial, Administrative and environmental & social ground. The study team will conduct alternative analysis considering the following issues keeping these as an option:

- **No subproject option:** The alternative analysis will be done on implementation of subproject or without subproject scenarios.
- **Types of Subproject:** Alternative analysis will be done based on different types of subproject including solar, extension of rural electrification program.
- **Use of Forest Area:**Subproject will be designed in such a way to use forest area in minimal, so its alternatives will be analysed.
- **Design of the subproject:**Various design alternatives (diversion weir and intake, waterway alignment Transmission & Distribution and powerhouse) shall be considered and analyzed with a view to opt for the best alternative so as to minimize impacts on environment and ensuring safety
- **Subproject Site: A**nalysis of different alternatives of subproject component sitting could result in recommendation of best alternative so as to avoid some of the significant impact such as decreased number of trees to be clear felled, avoiding prime cultivation land or major forest area, interference with the local trails etc. If the subproject requires houses and property acquisition culminating to relocation or resettlement of the people, location alternatives of the subproject component shall be assessed to avoid resettlement as far as possible.

- **Technology, Procedures of Operation Time Schedules:** Subproject implementation technology (mechanized, labor intensive, labor based); process of proposal implementation (contractors, local labor groups etc.) shall be assessed. Similarly, subproject operation time shall be assessed in terms of whether it is round the year operation or seasonal operation.

- **Alternate Technology Analysis:** Alternative analysis shall be carried out for other technology such as solar. The analysis shall be carried out based on secondary information.

- **Energy and Raw Materials to be used:** Alternatives to different sources of energy which would be required for subproject construction as well as for camps for day to day living will be assessed and the best suitable energy (from environmental point of

view) will be recommended. Similarly, alternative resources required for the subproject works shall be assessed including use of local resources.

- **Capability to deal with Risk:** The various subproject alternatives shall be evaluated based on the acceptability of risks during subproject implementation. The ESIA study shall critically scrutinize and identify environmental risks, if any associated with the subproject implementation and shall prescribe the measures to avoid those risks.

CHAPTER 7: IMPACTS AND MITIGATION MEASURES

This section provides a description of beneficial and adverse physical, biological and socioeconomic and cultural environmental impacts and issues that have been identified to date for both construction and operation phase. The impact assessment will be focused within the coordinate (Boundary)/subproject influence area considering general profile at Rural Municipality and district level. These issues will be considered by the proponent to develop and follow the detail field investigation program and data collection on physical, biological and socio-economic and cultural environment to predict impacts and propose appropriate mitigation measures. The impacts will be classified in terms of magnitude (low, medium and high), extent (site specific, local, and regional) and duration (short term, medium term and long term) as per National EIA Guidelines 1993. The likely impact shall be assessed covering both adverse and beneficial ones. Adverse and beneficial impacts/issues that are not identified or anticipated at this stage but discovered during ESIA study, will be incorporated in ESIA study report.

The methodology adopted for impact identification and prediction shall be standard checklist and matrix methods. Moreover, impact identification and prediction shall also be based on experts' judgment and literature review. More importantly, public consultation to be carried out during different phases of ESIA study such as during baseline data collection, scoping and when the draft ESIA reports is prepared and public hearing will be an essential tool for impact identification and prediction.

7.1 IMPACTS

7.1.1 BENEFICIAL ISSUES

7.1.1.1 CONSTRUCTION PHASE

i) Employment generation and skill enhancement
ii) Benefits from community and social support programs
iii) Benefits from implementation of environmental mitigation programs and benefit augmentation measures
iv) Increase in economic activities in the subproject area and associated beneficial impacts in local economy
v) Benefits for Exposure of local population to new technologies and technology transfer
vi) Utilization of Local Resources

7.1.1.2 OPERATION PHASE

i) Employment Generation and Skill Enhancement
ii) Benefits to be incurred from addition of 911 KW of power to local people
iii) Sharing of electricity royalty to concerned authorities

7.1.2 ADVERSE ISSUES

7.1.2.1.1 Physical Environment

7.1.2.1.1.1 Construction Phase

i) Change in Land Use
ii) Change in Topography
iii) Possible Glacier Lake Outburst Flood (GLOF) and associated impacts
iv) Landslide and Soil Erosion
v) Generation of spoils and spoil disposal related issues
vi) Impact due to quarrying activity
vii) Impact on materials quarrying sites
viii) Water Pollution and Increase in sediment loads
ix) Noise Pollution
x) Soil Pollution
xi) Issues of Haphazard Stockpiling of Construction Material
xii) Solid Waste Generation
xiii) Air pollution related issues
xiv) Hydrology and River Morphology
xv) Loss of Top Soil

7.1.2.1.1.2 Operation Phase

i) GLOF and associated impacts
ii) Change in topography and land use
iii) Impacts on river morphology and possible microclimatic changes
iv) Land submergence due to diversion weir and associated impacts
v) Management/final disposal of solid waste and waste water (both black water and grey water)
vi) Change in water quality
vii) Noise and vibration at power house
viii) Soil erosion due to tailrace discharge
ix) Impact on downstream due to sediment flushing

7.1.2.1.2 Biological Environment

7.1.2.1.2.1 Construction Phase

i) Loss of forest area
ii) Loss on forest vegetation and overall vegetation diversity
iii) Pressure on Forest for Fuelwood
iv) Impact on natural and critical habitat(wildlife and their movement route and migratory bird movement route)
v) Impact on aquatic flora and fauna
vi) Road kills of wildlife along the access road
vii) Impact on legal harvest of non-timber forest products/MAPs

viii) Possible Risk of forest fire
ix) Illegal wildlife hunting and poaching
x) Increased incidence of Human wildlife conflict
xi) Impacts to integrity of protected areas

7.1.2.1.2.2 Operation Phase

i) Reduced river flow between intake point and the powerhouse outlet
ii) Disturbance to the wildlife due to resident workforce
iii) Fragmentation of wildlife habitat and disturbance to wildlife movement
iv) Blocked and disrupted fish movement and migration
v) Impact on rare , endangered, protected and threatened species of flora and fauna
vi) Birdcasualties duetoelectrocution and collision with transmission line
vii) Forest fire
viii) Pressure on fuelwood
ix) Impacts to integrity of protected areas

7.1.2.1.3 Socio-economic and Cultural Environment

7.1.2.1.3.1 Construction Phase

i) Land acquisition and compensation related issues
ii) Crop loss
iii) Pressure on existing facilities, services and resources of the subproject area
iv) Health and sanitation
v) Occupational health and safety related issues
vi) Social-cultural conflict between local community and the outside work force
vii) Issues relating to unsocial activities like gambling, alcoholism , girl trafficking and prostitution
viii) Gender discrimination (issues of equal pay between women & men for work of equal value)
ix) Stakeholder Engagement and information disclosure
x) Issues of Grievances Management
xi) Issues related to disturbance to community during construction
xii) Child labour
xiii) People's Behaviors due to change in economy
xiv) Stress on local resources &infrastructure
xv) The pattern of uses of natural resources in festivals and religious rituals (if any)
xvi) Impact on historical, religious, cultural& touristic important sites

7.1.2.1.3.2 Operation Phase

i) Occupational health and safety related issues of the power station workers
ii) Public Safety Related Issues/Movement of people in dangerous places
iii) Issues related to benefit sharing of subproject
iv) Issues related to tariff of electricity

v) Issues relating to sudden release of water to downstream
vi) Withdrawal of economic opportunity
vii) Water right issues
viii) Stress on local resources &infrastructure

7.2 MITIGATION MEASURES

To overcome any adverse impacts by the subproject, the team will suggest appropriate site specific measures to avoid, reduce, mitigate, and/or compensate for all evaluated impacts. The basic philosophy of mitigation is to outline measures appropriate to mitigate the adverse impacts to the level required by National Standards and Guidelines as well as WB Safeguard Policies and EHS guidelines; or to reduce the impacts to what may be considered as tolerable level, or as indicated by the National Standards and WB policies and EHS guidelines where available. Therefore, the proposed mitigation measures will be in commensurate with the level of impact and compatiblewith the related existing laws of Nepal and WB policies and guidelines. Measures will be proposed based on nature of environmental impacts and components of environment that is affected, appropriateness and cost analysis. Each of the identified adverse impacts will be evaluated in detail and cost effective mitigation measures shall be suggested to avoid and/or minimize the adverse impacts. The criteria of such evaluation will be included in the ESIA report. Furthermore, enhancement measures shall be proposed to enhance or augment beneficial impacts due to implementation of the subproject.

Furthermore, the ESIA report shall also include Environmental Mitigation Implementation and Management Action Plan (EMIMAP) with responsible agency/party to carry out environmental mitigation activity, the location of mitigation implementation, methods, time schedule and estimated amount. The ESIA report shall define organizational set up to carry out these activities. The cost for mitigation and enhancement measures will be provided separately for both construction and operation stages for Physical Environment, Biological Environment, Socioeconomic and Cultural Environment. The proposed mitigation matrix will be as given in **Table 16**.

Table 16: Proposed Mitigation Matrix

SN	Environment & Social Impact	Mitigation Measures	Mitigation Cost(NPR)	Responsibility	Timeline	Remarks
Pre-Construction Phase						
Construction Phase						
Operation Phase						

CHAPTER 8: STAKEHOLDERS ENGAGEMENT AND GRIEVANCE REDRESS MECHANISM

8.1 STAKEHOLDER ENGAGEMENT

The stakeholder engagement process will be focused on obtaining free, prior and informed consultation (FPIC) with local community and other relevant stakeholders taking consideration of indigenous peoples or other types of vulnerable and marginalized communities. The consultation shall be included prior disclosure of information in a manner accessible and understandable to communities, key informant interviews, focus group discussion (male& female, youth) and public consultation. The consultation shall be documented with required facts, figures and evidence including diagreegated data of participant list (disagreegated data with contact details, gender, cast & ethnicity, race, age, and photographs. Information shall be disclosed as per the requirement of National Regulations and relevant OPs of the World Bank.

Mechanisms of stakeholder's engagement will include: (1) periodic public meetings in the subprojects' influence area; (2) information disclosure and awareness campaigns through the engagement with localClubs and Groups and NGOs; (3) interviews/surveys in subproject affected households; (4) focus group discussions; (5) formation of committees and/or groups including stakeholders at various stages; (6) development of grievance redresses mechanism; (7) disclosure/dissemination of subproject information including decision making process and how the grievances of Affected Persons (APs) will be addressed.

The subproject triggers Nepal Rastra Bank's (NRB's) "Guideline on Environmental & Social Risk Management (ESRM) for Banks and Financial Institutions" and it is noticed that any "Operations impacting UNESCO World Heritage Site or other cultural heritage in Nepal" is included in Exclusion list (Ref. Annex-4 S.No. 3), which also need to be clarified from the concerned institution as soon as possible. Therefore, AEPC/ESCO shall coordinate with the Nepal Rastra Bank in this regard. Besides, opinions/suggestions, written feedbackshall be obtained.

The key stakeholders at the centre include MoFE, DoNPWC, NTNC, as well as UNESCO Nepal Office, WWF Nepal, IUCN Nepal, Sagarmatha National Park and Buffer Zone Management Committee. Stakeholder analysis and mapping will be done for effective stakeholder's engagement. Information disclosure will be done by various means of communication such as mass media (FM radio, Newspaper etc.), meeting/workshops and distribution of subproject document. Consultation will be made meaningful to ensure effective public participation in subproject implementation. Mechanism of involvement of local people in subproject monitoring will be developed in consultation with the stakeholders.A strategic engagement strategy shall be developed to engage vulnerable groups, if required.

8.2 GRIEVANCE REDRESS MECHANISM

Stakeholders may have different types of grievances regarding the subproject. So a Grievances Readdress Mechanism (GRM) will be put in place wherein all subproject stakeholders are given a venue to lodge complaints regarding any aspect of issues related to the subproject along with the strategy to inform the local stakeholders about the GRM and its functioning procedures through stakeholder consultations. ESMF document (Environmental and Social Management Framework for Nepal: Private Sector-led Mini-grid Energy Access Project) has already proposed four tiers of GRM system. Based on this document, GRM will be established as such or modified to address subproject specific issues.

CHAPTER 9: INSTITUTIONAL ARRANGEMENT

Environmental and Social Institutional Arrangement will be made within the institutional structure of the developer of the subproject. It will clearly spell out the roles and responsibilities of each position for the implementation of the identified mitigation measures. In addition, it will also lay out a plan to provide training/orientation to the E&S team members once they are hired. It will provide a clear map regarding the human resources and their experience and qualification including capacity building activities, and also identify other responsible and relevant institutions, such as MoEWRI, AEPC, AEPC/MGEAP, Local Government Authorities, World Bank, proponent, Partner Banks, Consulting Firms and Contractor along with their roles and responsibilities to ensure implementation of identified mitigation measures. It should also discuss about internal reporting mechanism within the subproject. Details of the institutional arrangement will be made in ESIA report based on the ESMF for Nepal: Business Models for Private Sector-led Mini-grid Energy Access Project, Similarly the issue of capacity building will be addressed in ESIA report

CHAPTER 10: MONITORING AND REPORTING PLAN

To ensure the effective implementation of EMIMAP, the environmental and social safeguard compliance monitoring will be conducted internally based on the monitoring indicators. The safeguards staffs (E&S) of AEPC and the proponent will be responsible to carry out monitoring during different stages of the project cycle i.e., construction and operational phases of subproject.

10.1 MONNITORING PLAN

'Environmental Monitoring' of the subproject activities will be carried out during construction and operation phases of the subproject implementation. ESIA reports shall contain plans for;

i) Baseline Monitoring: To assess the changes in environmental baseline conditions just prior to commencement of subproject construction with reference to the baseline conditions provided in the ESIA report.

ii) Impact monitoring: To assess the changes (beneficial or adverse) in the various component of the environment in comparison to the baseline conditions. Also, impact monitoring would help to identify impacts those may have been overlooked by the ESIA study.

iii) Compliance Monitoring: To assess compliance activities of the responsible parties (including contractors, employer, consultant and other stakeholders) in complying the environmental protection matters mentioned in the ESIA report.

The baseline and impact monitoring plans shall indicate parameter, indicator, schedule, location, and methods. Compliance monitoring plans shall indicate parameter, indicator, schedule and methods. An end-of-pipe based monitoring plan shall be developed rather than an ambient level monitoring. The cost of monitoring, activities and manpower requirements to carry out the proposed activities and organizational set up to carry out the proposed monitoring activities shall be included in the ESIA report.

The monitoring plan matrix will be as follows in Table 17.

Table 17: Proposed Monitoring Plan Matrix

S.N.	Type	Parameters	Responsible Implementing agency	Verifiable Indicators	Verification Methods	Schedule	Responsible Monitoring Agency

10.2 REPORTING PLAN

The proponent will prepare monthly progress report and shares with AEPC. AEPC will prepare quarterly reportbased on monthly reports and share with the WB.

CHAPTER 11: ENVIRONMENTAL AND SOCIAL AUDIT

An audit plan will be prepared in order to provide guidelines to the auditing authority in order to assess actual environmental impact, accuracy of prediction, effectiveness of environmental impact mitigation and enhancement measures and functioning of monitoring mechanisms. The Environmental and Social Auditing Plan will outline auditing type (such as Decision Pint Audit, Implementation Audit, Performance Audit, Subproject Impact Audit, Predictive Technique Audit and Environmental Impact Assessment Procedure Audit), auditing procedures (defining parameter, indicator and methods) and timing, human resource requirements with audit costs based on the ESMF for Nepal: Private Sector-led Mini-grid Energy Access Project.

CHAPTER 12: ENVIRONMENTAL AND SOCIAL SAFEGUARD PLAN

Environmental and Social Safeguard Plans (ESSP) will be developed to ensure the implementation of environmental and social protection measures and make subproject environmental friendly and sustainable. It will include aspects that should be implemented during construction and operation phases of the subproject detailing (i) what to implement, (ii) when to implement, (iii) where to implement, (iv) what technique/method to be employed, and (v) who is responsible.

Different alternatives of design and subproject site will be analyzed during detail feasibility study report stage for avoidance and preventive measures for safeguard of environment and society. Steps for necessary co-ordination that is required in implementing Preventive, Avoidance and Mitigation Measures with – local, district and central level institutions – as well as contractors, proponent, and consultant will be proposed. Organization chart of the monitoring unit for implementation of the mitigation measures, with a clear provision of mitigation will be proposed. Those mitigation measures that can be or are part of contractual obligation for subproject construction will be clearly identified; Mechanisms of ensuring implementation of those mitigation measures as compliance of contractors will be proposed.
A written agreement will be signed with the contractor to comply the implementation of proposed preventive, avoidance and mitigation measures as the responsibility of the contractor.

The cost of mitigation and enhancement measures will be provided separately differentiating into Construction Phase and Operation Phase for Physical Environment, Biological Environment and Socio economic and Cultural Environment. Enhancement measure will be proposed for heightening benefits accrued from the subproject. This chapter will propose following mitigation plans;

1. Construction Site and Temporary Facilities Rehabilitation Management Plan,
2. Occupational Health and Safety Plan
3. Community Health and Safety Plan
4. Emergency Response Plan
5. Benefit Sharing Plan
6. Labor Management Plan
7. Traffic (Air) Management Plan
8. Stakeholder Engagement Plan
9. Gender Equality and Social Inclusion (GESI) Action Plan
10. Public Health Safety Management Plan,
11. Biodiversity Management Plan
12. COVID Pandemic Management Plan and SoPs etc.

The study will incorporate the cost estimates of all management plans.

CHAPTER 13: ESIA REPORT TEMPLATE

The ESIA report shall be prepared in the template as provided by AEPC, as follows:

Cover Page
Acronym and Abbreviation
Table of Content
List of Figures
List of Tables

Executive Summary (5 pages max)
This section shall describe the subproject activities, critical environmental and social issues, significant findings and recommended actions.

Chapter 1: Introduction (5 pages max)
1.1 Background of the Subproject
1.2 Objectives of the ESIA Study
1.3 Study Methodology
Methodology for Data Collection of Physical and Chemical Environment, Biological Environment, and Socio-Economic and Cultural Environment

a) Literature Review of Published/unpublished Documents
b) Direct and Indirect Impact Zone
c) Study and Analysis of Location Map
d) Data Collection by using Checklist/Matrix and Questionnaire
e) Field Assessment: observation and photographs, sampling, use checklist and Questionnaire
f) Laboratory Analysis of Collected Sample of Soil, Water etc.
g) Data Analysis
h) Methodology for Impact Identification, Prediction and Ranking
i) Preparation of Draft Report
j) Public Consultation, Discussion, Interaction and Public Hearing, Disclosure of Draft Report
k) Public Notice and Notice Disclosure and Collection of Suggestions
l) Preparation of Final Report Incorporating the Collected Suggestions

Chapter 2: Description of the Subproject (8 pages max)
2.1 General Information on the Subproject
2.2 Subproject Locations and Accessibility

a) Description of the location of the proposed subproject with maps
b) Subproject area of influence
c) Nearby communities and forests, environmentally sensitive areas, and heritage sites (for solar mini grid buffer zone should be at least 1 km)

2.3 Salient Features of the Subproject

2.4 Technical Aspects

a) Description of the subproject components, permanent and temporary facilities
b) Technology to be used (associated/ancillary facility)
c) Project equipment and civil works
d) Project ownership
e) Description of land required for the project
f) Summary of project structures and operating regime
g) Construction, Operation and Maintenance activities
h) Human Resources requirements (including local and migrant workforce)
i) Construction equipment, materials and other supplies (including estimated numbers/quantities)
j) Land filling activities (if any)
k) Power supply arrangements
l) Waste generation and disposal (including estimated quantities)
m) Subproject Implementation Schedule and Construction Work Plan

Chapter 3: Policy, Act, Regulation, Directives, Guidelines, International Conventions relevant to the Subproject (5 pages max)

3.1 Policy and Strategy
3.2 Periodic Plan
3.3 Act
3.4 Rules
3.5 Directives/Guidelines/ Working Policy
3.6 Environmental and other Standards
3.7 International Convention and Treaties

The above-mentioned laws and regulations relevant to the subproject should be discussed briefly in the following format.

Laws and Regulations	**Clause/Rules/Section etc triggered for the implementation of the Subproject**
Policy	
Strategy	
Acts	
Rules	
Directives	
Guideline	
Standards	
International Convention and Treaties	

Chapter 4: Environmental and Social Baseline Assessment(15 pages max)

4.1 Physical Environment

a) Topography
b) Geological Condition
c) Meteorological Condition (Rainfall, Temperature, Humidity, Wind speed)
d) Air Quality
e) Noise Quality
f) Surface and Ground water quality
    i. Surface:(testing of: pH, TDS, DO, COD, BOD)
    ii. Ground:(testing of: pH, Arsenic, TDS, alkalinity, Cl, Fe)
g) Project location from flood level
h) Soil Quality
i) Water resources
j) Agro-ecological zones within project area of influence
k) Seismicity
l) Climate change and natural disasters
    a. Explain in detail about how the project will be affected by the climate change impact
    b. Explain how the project is vulnerable to various natural calamities including flood, earthquake, drought, cyclone and so on

4.2 Biological Environment

a) Forest and vegetation
b) Flora and Fauna
c) Non-timber forest products
d) Terrestrial Ecosystem, Protected areas and red book species
e) Aquatic life

4.3 Socio-economicand Cultural Environment

a) Subproject Load Centre (Beneficiary) and distance from the subproject site
b) Identification and description of subproject Affected Peoples (APs)in the area in terms of family size, religion, age, sex, ethnicity, income, household size, occupational patterns and their relevance with the subproject, poverty
c) Land use and ownership (including traditional use and ownership)
d) Other household property such as physical structure and tress (fruits tress, timber tress and others)
e) Cropping and/or grazing patterns
f) Vulnerability of the Affected Peoples (APs)
g) Education (Literacy rate, Educational institutes etc)
h) Employment pattern
i) Means of sources of livelihood
j) Physical and cultural resources (school, health post/ hospital, college, temple, monasteries etc.) in the subproject area
k) Description of settlements of indigenous people, Dalits and other religious and minorities within the project affected area (If any)

l) Communication facility
m) Local amenities (access road, infrastructures etc)

Chapter 5: Alternative Analysis (10 page max)

At least 2 alternatives for the following parameters should be suggested for Subproject implementation.

Alternative	Beneficial Impact	Adverse Impact
Alternative 1/ Alternative 2/ Alternative 3		
Design		
Project site		
Topography		
Technology		
Operation method		
Work plan		
Raw material		
Use of forest and government land		

No project option, types of project, use of forest area, design of project, site, technology and procedures of operation, time schedule, energy and raw materials to be used, capability to deal with risk

Chapter 6: Impacts and Mitigation Measures (20 pagesmax)

This chapter should focus on risks assessment and mitigation measures. In addition, this chapter demands a high degree of coherent between the identification of possible risks and impacts (of both beneficial and adverse impacts for physical, biological and socio-economic & cultural)) of the subproject and appropriate mitigation measures for each identified risks and impacts. The risks and impacts should be categorized into preparation, construction and operation. This chapter should include Table for Impact Prediction and ranking based on magnitude, extent and duration.

Activity	Impacts	Impact Prediction and ranking							Total
		Direct	Indirect	Beneficial	Adverse	Magnitude	Extent	Duration	
Construction Phase									
Operation Phase									

This chapter should also include Table for Environmental and Social Management Plan in the form of following matrix.

S.No.	E&S	Mitigation	Mitigation	Responsibility	Timeline	Remarks

	Impact	Measures	Cost (NRs)			
Pre-construction Phase						
Construction Phase						
Operation Phase						

Following techniques should be used to mitigate adverse impacts

6.1 Preventive Measures
6.2 Corrective Measures
6.3 Compensatory Measures

If Cumulative Impact Assessment is found required during scoping phase, the analysis should be separately carried out and reported in an independent chapter as per methodology defined in IFC Good Practice Handbook-Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets .

Chapter 7: Stakeholder Engagement and GRM (5 pages max)

This chapter should include mapping of potential stakeholders of the subproject, developing engaging strategy with identified stakeholders and developing strategic engagement with indigenous and vulnerable communities through periodic consultations. Stakeholders may have different types of grievances regarding the subproject, so this chapter should also include best possible approach to ensure an effective Grievance Redress Mechanism (GRM) along with the strategy to communicate the local stakeholders about the GRM and its functioning procedures. It will also contain effective means of disclosing project related information to the stakeholders in a manner appropriate to local culture and practice.

Chapter 8: Institutional Arrangement (4 pagesmax)

This chapter should provide an E&S institutional arrangement within the institutional structure of the ESCO of the subproject. The E&S institutional arrangement should clearly spell out the roles and responsibilities of each positions for the implementation of the identified mitigation measures. It should also talk about required human resources and their experience and qualification including capacity building activities. In addition, it should also identify other responsible and relevant institutions, such as MoEWRI, AEPC, AEPC/MGEAP, Local Government Authorities, World Bank, Partner Banks, Consulting Firms and Contractor along with their roles and responsibilities to ensure implementation of identified mitigation measures. It should also discuss about internal reporting mechanism within the project.

Chapter 9: Monitoring and Reporting Plan (5 pages max)

This chapter should discuss the monitoring and reporting mechanism based on the ESMF. (The monthly reporting will be undertaken by ESCO and share with AEPC. AEPC will be preparing Quarterly Report based on monthly reports and share with the WB). The following types of monitoring should be conducted and reported in the following format.

Type of Monitoring	Monitoring Indicator	Monitoring Method	Location	Time	Cost	Monitoring Authority
Baseline Monitoring						
Impact Monitoring						
Compliance Monitoring						

Chapter 10: Environmental Audit (2 page)
This chapter should include time frame and responsible authority to conduct environmental audit.

Chapter 11: Environmental and Social Safeguard Plans (10 pages max)

This chapter should recommend to prepare any of the following mitigation plans as required.

12.1 Occupational Health and Safety Plan
12.2 Community Health and Safety Plan
12.3 Emergency Response Plan
12.4 Benefit Sharing Plan
12.5 Labor Management Plan
12.6 Traffic Management Plan
12.7 Battery Management Plan, if necessary
12.8 Stakeholder Engagement Plan
12.9 Gender Equality and Social Inclusion (GESI) Action Plan
12.10 Fire Safety Management Plan

Chapter 12: Conclusion and Recommendation

Chapter 13: References

Annexes

a) Topographic, land use, GIS, Google maps
b) Arial photographs of subproject location and load centres
c) Land ownership document
d) Checklist/Questionnaire used for field survey
e) Baseline data of air quality, water quality and noise level
f) Meeting Minutes of public consultations, discussions etc
g) List of stakeholders/people contacted for the study
h) Brief resume of study team member
i) Required GoN approvals

CHAPTER 14: REFERENCES

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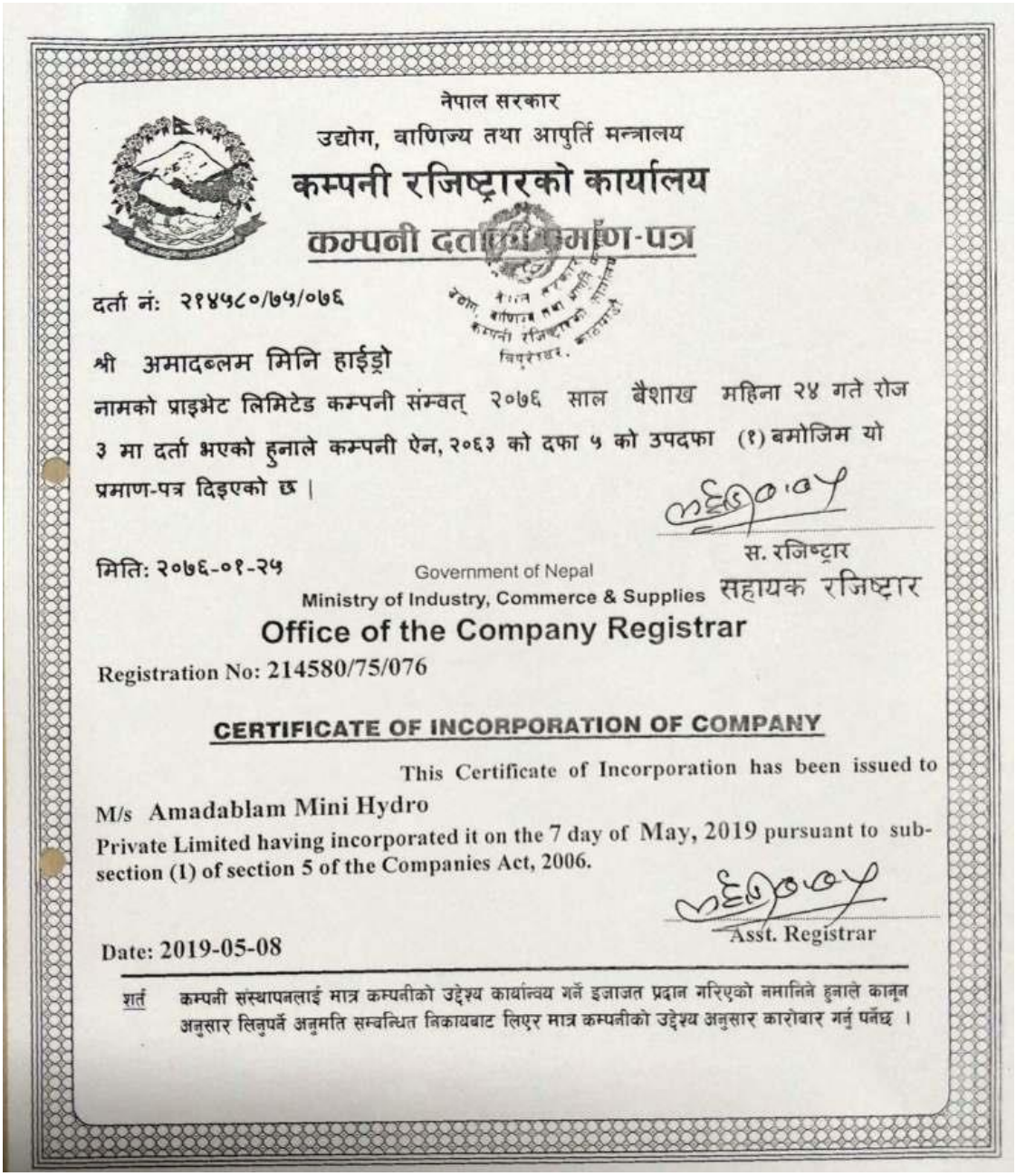
ANNEXES

Annex I: Company Registration Certificate



नेपाल सरकार

उद्योग, वाणिज्य तथा आपुर्ति मन्त्रालय

कम्पनी रजिष्ट्रारको कार्यालय

कम्पनी दर्ता प्रमाण-पत्र

दर्ता नं: २१४५८०/७५/०७६

श्री अमादब्लम मिनि हाईड्रो नामको प्राइभेट लिमिटेड कम्पनी संम्वत् २०७६ साल बैशाख महिना २४ गते रोज ३ मा दर्ता भएको हुनाले कम्पनी ऐन, २०६३ को दफा ५ को उपदफा (१) बमोजिम यो प्रमाण-पत्र दिइएको छ ।

स. रजिष्ट्रार

सहायक रजिष्टार

मिति: २०७६-०१-२५

Government of Nepal

Ministry of Industry, Commerce & Supplies

Office of the Company Registrar

Registration No: 214580/75/076

CERTIFICATE OF INCORPORATION OF COMPANY

This Certificate of Incorporation has been issued to M/s Amadablam Mini Hydro Private Limited having incorporated it on the 7 day of May, 2019 pursuant to sub-section (1) of section 5 of the Companies Act, 2006.

Asst. Registrar

Date: 2019-05-08

शर्त कम्पनी संस्थापनलाई मात्र कम्पनीको उद्देश्य कार्यान्वय गर्ने इजाजत प्रदान गरिएको नमानिने हुनाले कानून अनुसार लिनुपर्ने अनुमति सम्वन्धित निकायबाट लिएर मात्र कम्पनीको उद्देश्य अनुसार कारोबार गर्नु पर्नेछ ।

नेपाल सरकार
अर्थ मन्त्रालय
आन्तरिक राजस्व विभाग

स्थायी लेखा नम्बर (PAN) दर्ता प्रमाण पत्र

कर अधिकृत

दर्ता मिति
आयकर: ०१ | ०३ | २०७६
दिन महिना साल

स्थायी लेखा नम्बर : ६ ० ९ ५ २ ९ ९ २ ६
आन्तरिक राजस्व कार्यालय : आन्तरिक राजस्व कार्यालय बत्तीसपुतली

कारोबारको नाम : अमादब्लम मिनि हाईड्रो प्रा.लि.

करदाताको प्रकार : प्राइभेट लिमिटेड

ठेगाना : वार्ड नं. ८, तिलगंगा
महानगरपालिका: काठमाडौं,
काठमाडौं

व्यवसायका कारोबारहरु : विद्युत उत्पादन तथा वितरण,

करदाताको दस्तखत

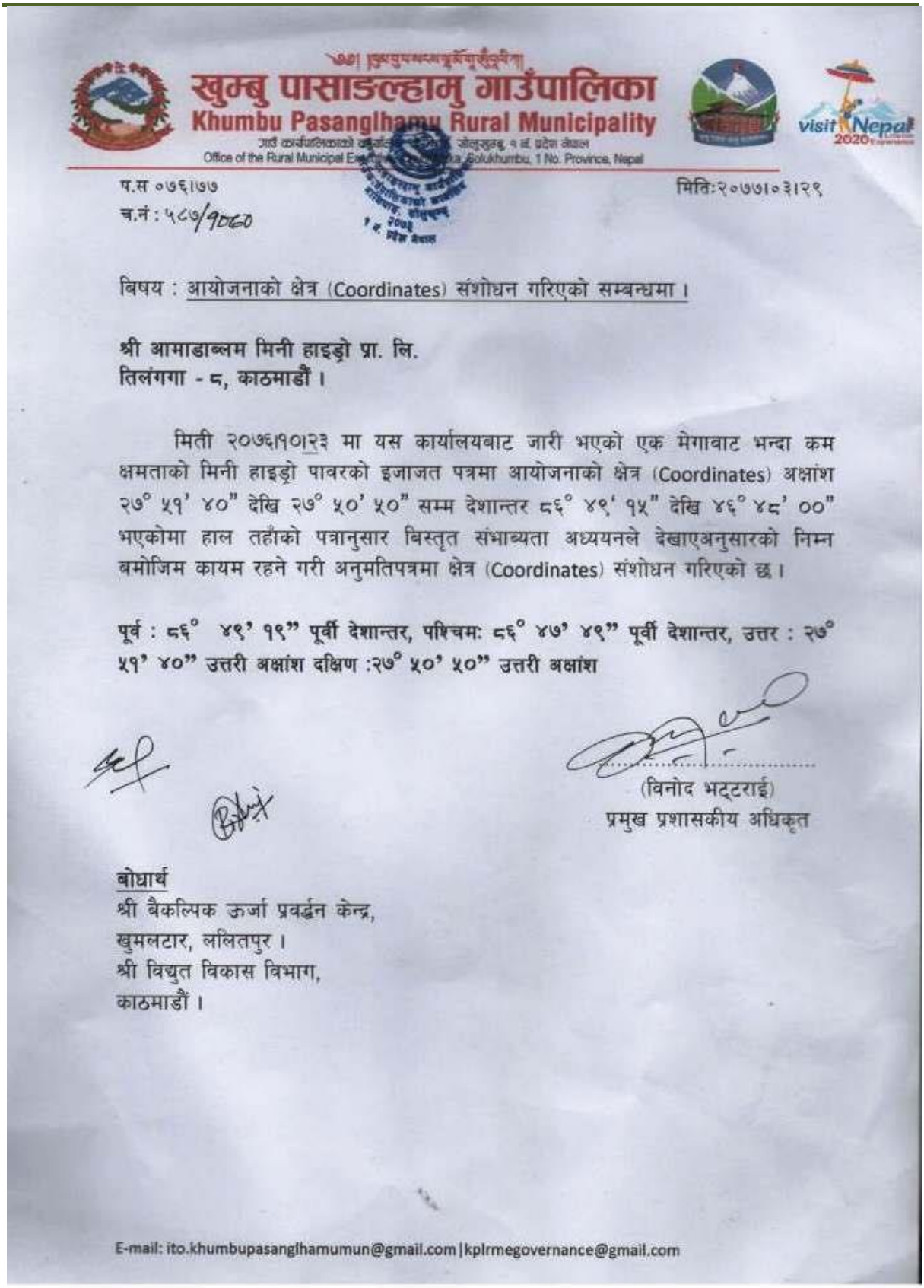
Amadablam Mini Hydro Pvt. Ltd. Kathmandu

कर अधिकृत
कर अधिकृत

करदाताले पालना गर्नुपर्ने कर्तव्यहरु:

- कारोबार गर्दा अनिवार्य रुपमा बिल बिजक जारी गर्नुपर्छ ।
- मू.अ.करमा दर्ता हुनेले प्रत्येक कर अवधि (मासिक वा त्रैमासिक वा चौमासिक) समाप्त भएको २५ दिनभित्र मू.अ.कर विवरण तथा मू.अ.कर रकम बुझाउनु पर्छ ।
- अन्तःशुल्क लाग्ने कारोबार गर्नेले अन्यथा व्यवस्था गरेकोमा बाहेक प्रत्येक महिना समाप्त भएको २५ दिनभित्र मासिकवारी र अन्तःशुल्क रकम बुझाउनु पर्छ ।
- प्रत्येक आर्थिक वर्षका आय विवरण असोज मसान्तभित्र बुझाउनु पर्छ ।
- समयमा विवरण र कर रकम नबुझाएमा ब्याज, शुल्क र जरिवाना लाग्नेछ ।
- यो प्रमाणपत्र देखिने गरी कारोबार स्थल/मुख्य कार्यालयमा राख्नु पर्नेछ ।
- कुनै दिक्कत भएमा कार्यालयमा सम्पर्क राख्नुहोला ।

Annex II: Permission Letter



खुम्बु पासाङल्हामु गाउँपालिका
Khumbu Pasanglhamu Rural Municipality
Office of the Rural Municipal Executive, Solukhumbu, 1 No. Province, Nepal

visit Nepal 2020

प.स ०७६।७७
च.नं : ५८७/१०८०

मितिः२०७७।०३।२९

बिषय : आयोजनाको क्षेत्र (Coordinates) संशोधन गरिएको सम्बन्धमा ।

श्री आमाडाब्लम मिनी हाइड्रो प्रा. लि.
तिलंगगा - ८, काठमाडौं ।

मिती २०७६।१०।२३ मा यस कार्यालयबाट जारी भएको एक मेगावाट भन्दा कम क्षमताको मिनी हाइड्रो पावरको इजाजत पत्रमा आयोजनाको क्षेत्र (Coordinates) अक्षांश २७° ५१' ४०" देखि २७° ५०' ५०" सम्म देशान्तर ८६° ४९' १५" देखि ४६° ४८' ००" भएकोमा हाल तहाँको पत्रानुसार बिस्तृत संभाव्यता अध्ययनले देखाएअनुसारको निम्न बमोजिम कायम रहने गरी अनुमतिपत्रमा क्षेत्र (Coordinates) संशोधन गरिएको छ ।

पूर्व : ८६° ४९' १९" पूर्वी देशान्तर, पश्चिमः ८६° ४७' ४९" पूर्वी देशान्तर, उत्तर : २७° ५१' ४०" उत्तरी अक्षांश दक्षिण :२७° ५०' ५०" उत्तरी अक्षांश

(विनोद भट्टराई)
प्रमुख प्रशासकीय अधिकृत

बोधार्थ
श्री बैकल्पिक ऊर्जा प्रवर्द्धन केन्द्र,
खुमलटार, ललितपुर ।
श्री विद्युत विकास विभाग,
काठमाडौं ।

E-mail: ito.khumbupasanglhamumun@gmail.com | kplrmegovernance@gmail.com

Annex MKMHPIII: Vegetation Survey Form

HERBS

Date: _____ Time: _____

Plot No: _____ Forest Name: _____

Area of the quadrate: _____ Location: _____

SN	Common Name of Species	No. of Saplings	Height	Coverage (%)	Remarks
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Shrubs

Date: _____ Time: _____

Plot No: _____ Forest Name: _____

Area of the quadrate: _____ Location: _____

SN	Common Name of Species	No. of Saplings	Height	Coverage (%)	Remarks
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

TREES

Date: _____ Time: _____

Plot No: _____ Forest Name: _____

Area of the quadrate: _____ Location: _____

SN	Common Name of Species	DBH (cm)	Height (m)	No. Saplings	No. of Seedlings	Crown Coverage (%)	Remarks
1							
2							
3							
4							
5							
6							
7							
8							
9							

Annex IV: Vegetation Characteristics Calculation Formulae

Density:

$Density\ (No./ha) = \frac{I}{AXN} \text{x}\ 100$..... (i)

Where,

I = Total number of individuals

A = Area of each sampling plot

N = Total number of plots

$RelativeDensity\ (\%) = \frac{D}{TD} \text{x} 100$..... (ii)

Where, D = Density of an individual species; TD = Total density of all species

Frequency:

$Frequency\ (\%) = \frac{E}{N} \text{x} 100$ ..... (iii)

Where,

E = Encounter (Total Number of plots in which an individual species occurred)

N = Total number of plots

$RelativeFrequency\ (\%) = \frac{F}{TF} \text{X} 100$..... (iv)

Where, F = Frequency of an individual species; TF = Total frequency of all species

Coverage:

$Coverage\ (\%) = \text{CI}$ ..... (v)

Where,

CI = Coverage of an individual species in a sampling plot

$RelativeCoverage\ (\%) = \frac{TCI}{TC} \text{X} 100$..... (vi)

Where, TCI = Total coverage an individual species; TC = Total coverage of all species

Importance Value Index:

$IVI = \text{RD} + \text{RF} + \text{RBA or RC}$ ..... (vii)

Where,

RD = Relative Density

RF= Relative Frequency

RBA = Relative Basal Area (for tree)

RC= Relative Coverage (for shrubs and herbs)

Basal Area:

$BasalArea(m^2) = \frac{\pi d^2}{4}$ ..... (viii)

Where,

d (m) = diameter at breast height of an individual tree

$RelativeBasalArea\ (\%) = \frac{TIBA}{TBA} \text{X} 100$..... (ix)

Where, TIBA = Total basal area of an individual tree; TBA = Total basal area of all trees

Tree Volume:

Basal area and height were measured for calculation of standing trees trunk volume. This is estimated as

$TreeVolume = \frac{BA \times H}{2}$..... (x)

Where, BA was basal area at 1.3-meter height, which is πr^2, where r is radius (in meter) at 1.3 m height of the tree and H = height (in meter) of the tree (DoF 2061).

Annex V: Vegetation Loss and Valuation

(a) Forest Loss at different project components

SN	Project Structure	Forest Type	Area, ha	Loss of vegetation				Crown Cover (%)	BA (SqM)	Vegetation Type
				Seedlings /ha	Saplings/ ha	No. of Poles	No. of Trees			

(b) Total Loss in terms of Plant Species

Botanical Name	Local Name	Avg. DBH/ Range * (for >= 10 cm dbh)	Loss of vegetation				Standing Wood Volume/ha		Biomass for Standing tree and poles MT (Wet) /ha	Biomass usages
			Loss of Regeneration/ha		Loss of tree					
			Seedlings	Saplings	Pole	Tree	Timber (Cft)	Fuel wood (Chatta)		

(c) Total forest loss

Type of Forest	Area (ha)	Loss of vegetation** /ha				Standing Wood Volume/ha		Biomass for Standing tree and poles MT (Wet) /ha	Biomass usages
		Loss of Regeneration (**/ha)		Loss of tree					
		Seedlings	Saplings	Pole	Tree	Timber (Cft)	Fuel wood (Chatta)		
Government									
Community									
Religious									
Leasehold									
Private									
Total									

(a) Loss of Non-Timber Forest Product (NTFP)

SN	Commercially Important Species	Common Name	Loss of vegetation** /ha			
			Community Forest		Private Forest	
			Seedlings No./ha	Saplings No./ha	Seedlings No./ha	Saplings No./ha

(b) Valuation of Forest Product Loss

SN	Botanical Name	Common Name	Valuation (NPR.)	
			Timber	Fuelwood

Annex VI: Socio-Economic and Cultural Survey Form

बस्तीको जानकारी:

१ ठेगाना: २ बस्तीको नाम:

३. घरधुरी संख्या: ४. जनसंख्या:

५. मुख्य जात जातिहरु:

क्र. सं.	जातजाति	प्रतिशत	कैफियत

६ . पेशा

क्र. सं.	मुख्य पेशा	प्रतिशत	सहायक पेशा	प्रतिशत
	कृषि तथा पशुपालन			
	ज्याला मजदुरी			
	व्यापार			
	घरेलु उधोग			
	सरकारी तथा गैर-सरकारी सेवा			
	बैदेशिक रोजगार			
	अन्य (उल्लेख गर्ने)			

७. जमिन सम्बन्धि जानकारी

	जमिन को क्षेत्रफल							
	भूमिहीन	**१ रोपनी भन्दा कम**	**१-५ रोपनी**	**५-१० रोपनी**	**१०-१५ रोपनी**	**१५-२० रोपनी**	**२०-५० रोपनी**	**>५० रोपनी**
घर धुरी संख्या								

८. खाध्यान्नको अवस्था

	खाध्यान्नको उपलब्धता					
	३ महिना भन्दा कम	**३ महिना सम्म**	**३-६ महिना**	**६-९ महिना**	**९-१२ महिना**	**१ वर्ष भन्दा बढि**
घरधुरी संख्या						

९. मुख्यबाली

अन्न	
नगदेबाली	

१०. बस्तुभाउ (घरपालुवा जनावर)

बस्तुभाउ	संख्या	बस्तुभाउ	संख्या
गाइ		सुँगुर	
गोरु		खरायो	
भैसी		माछापालन (घरधुरी)	
घोंडा		मौरीपालन (घरधुरी)	
बाख्रा		कुखुरा	
भेंडा		अन्य भएमा उल्लेख गर्ने	

११. नजिकैको बजार:

१२. स्थानीयसरकारी, गैर-सरकारी, व्यक्तिगत तथा सेवा प्रदायक संघसस्था तथा पुर्बाधारहरु, धार्मिक, सांस्कृतिक तथा पुरातात्विक सम्पदाहरु र अन्य संस्थाहरु:

क्र.सं.	नाम	ठेगाना	संख्या	कैफियत
१.	**स्वाथ्य**			
१.१	अस्पताल			
१.२	प्राथमिक स्वास्थ्य चौकी			
१.३	स्वास्थ्य चौकी			
१.४	उपस्वास्थ्यचौकी			
२.	**शिक्षा**			
२.१	क्याम्पस			
२.२	उच्च मा. वि.			
२.३	मा. वि.			
२.४	नि. मा. वि.			
२.५	प्रा. बि.			
३.	**संचार**			
३.१	मोबाइल			
३.२	ल्याण्डलाइन			
३.३	स्काई/CDMA			
३.४	हुलाक			
३.५	इन्टरनेट			
४.	**उधोग तथा बाणिज्य**			
४.१	होटल तथा लज			
४.२	रेस्टुरेन्ट तथा चिया पसल			
४.३	खाध्य पसल			
४.४	स्टेशनरी तथा पुस्तक पसल			

क्रमश:

क्र.सं.	नाम	ठेगाना	संख्या	कैफियत
४.५	औषधि पसल			
४.६	अन्य भए उल्लेख गर्ने			
५.	**विधुत्**			

५.१	मिनी/माइक्रो-हाइड्रो			
५.२	राष्ट्रिय प्रसारण			
५.३	सोलार			
५.४	अन्य भएमा उल्लेख गर्ने			
६.	**खानेपानी**			
६.१	धारा			
६.२	कुवा तथा मुहान (संख्या)			
७.	**सिंचाईको अवस्था**			
७.१	सिंचाई भएको जमिन (रोपनी/हे./कट्ठा)			
७.२	सिंचाई नपुगेको जमिन (रोपनी/हे./कट्ठा)			
८.	**अन्य भौतिक पुर्बाधार**			
८.१	माइक्रोहाइड्रो (संख्या तथा क्षमता)			
८.२	पानी मिल (संख्या)			
८.३	झोलुंगे पुल (संख्या)			
८.४	काठे पुल (संख्या)			
८.५	अन्य पुल भएमा उल्लेख गर्ने			
९.	**उद्योग**			
९.१	सिलाई बुनाई			
९.२	अन्न कुटानी पिसानी मिल			
९.३	अन्य उध्योग भएमा उल्लेख गर्ने			
१०.	**आर्थिक कारोबार गर्ने संस्था**			
१०.१	बैंक			
१०.२	सहकारी			
१०.३	फाइनान्स			
११.	**सार्बजनिक सम्पति**			
११.१	घाट			
११.२	खेलमैदान			
११.३	हाट बजार			
११.४	सामुदायीक केन्द्र			
११.५	मन्दिर			
११.६	गुम्बा/मस्जिद/चर्च			
११.६	पुरातत्तिक सम्पदा			
११.७	अन्य केहि भएमा उल्लेख गर्ने			

१३. मुख्य चाडपर्बहरुः

१४. योजनाले प्रत्यक्ष असर पार्ने क्षेत्रहरु

क्षेत्र	ठेगाना	दुरी
घर (संख्या):		

खेतीयोग्य जमिन (क्षे.):		
बन (नाम र क्षे.):		
मन्दिर/गुम्बा/मस्जिद/चर्च (नाम):		
पानीका श्रोत		
झोलुंगे पुल		
कुलो		
अन्य भौतिक पुर्बाधार भएमा उल्लेख गर्ने		

Ethnicity and Social Status

qm=;+	pkef]Qmfsf] gfd	lnË	7]ufgf -6f]n, j8f, ufpFkflnsf_	hft÷ hghflt					ju{*				;fdflhs :t/					zfl//Lscj:yf	
				blnt	hghflt	lqL÷7s'/	d'zndfg	cGo	clt u/La	u/La	dWodau {	;DkGg	Psndlxnf	laklQ lkl8t	nf]kf]Gd 'vhghflt	lk5l8Psf iuf	4Gb lkl8t	zfl//Ls÷ dfgl;sczS ttf	Pr=cfO +{=eL

*__clt u/La__-# dlxgf ;Ddvfgk'Ug_ __u/La__-^ dlxgf ;Ddvfgk'Ug]_ __dWod au{__-^ b'']]]lv (dlxgf ;Ddvfgk'Ug]_ __;DkGg__-Afif{el/ vfgk'Ug]_

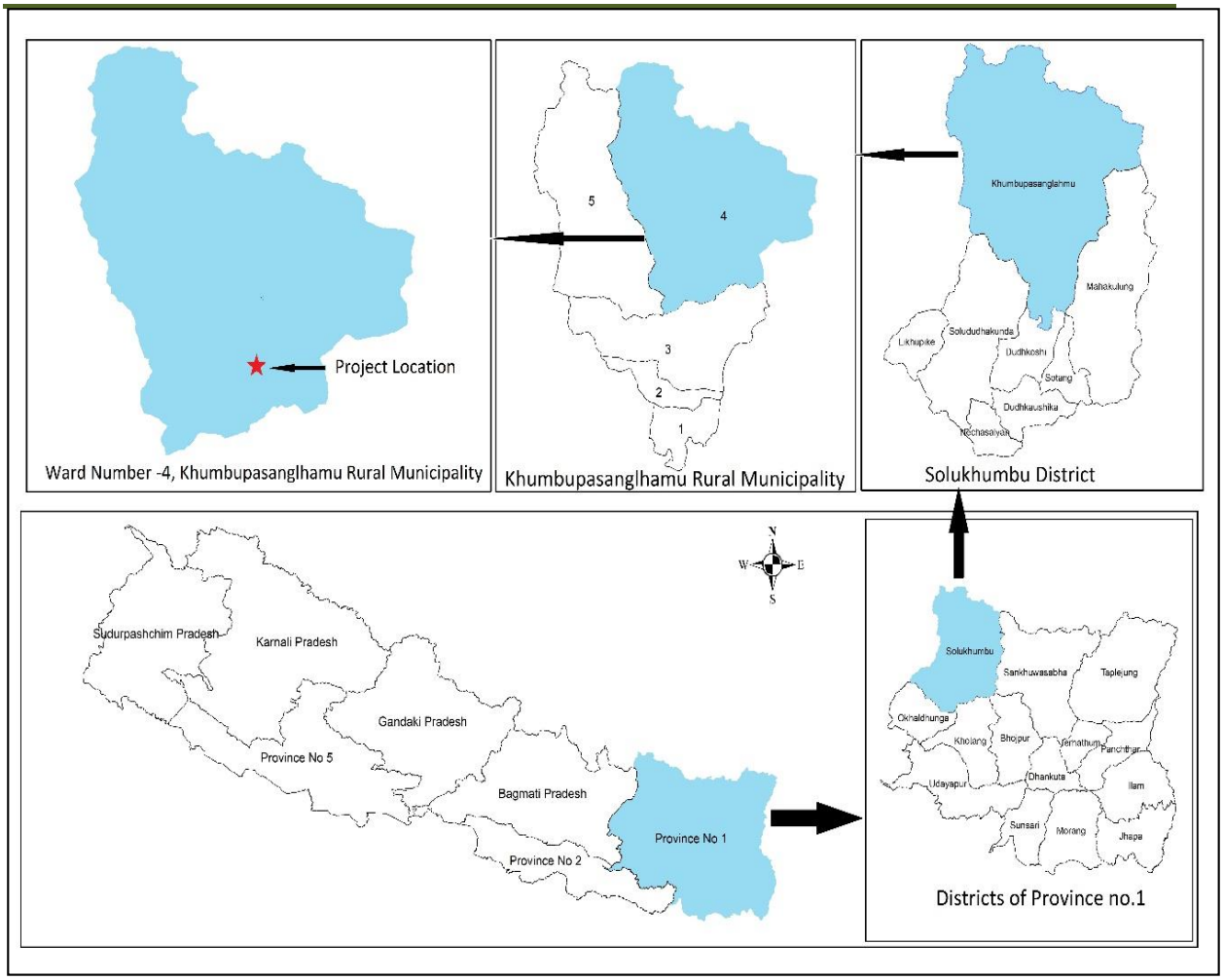
Consumer Details

Ref.No	**Consumer Detail** (Name, Contact no., Owner)	GPS Address (Degree decimal)		No. of Members		No. of Rooms, Dining, Bathroom	Existing Tariff rate per Unit Amount per month Expected Rate/Unit (Nrs.Unit/	Existing Energy Source (solar, MHP, Other)	Lights (No1, Watts)		Television (No, Watts)		Oven/Induction (No, Watts)		Deep Fridge Refrigerator(No, Watts)		Rice Cooker(No, Watts)		AC/ Heater (No, Watts)		Mixer/Grinder (No, Watts)		Water Pump(No, Watts)		Others (No, Watts)	
		Easting	Northing	Male	Female				Existing	Additional	Existing	Additional	Existing	Additional	Existing	Additional	Existing	Additional	Existing	Additional	Existing	Additional	Existing	Additional	Existing	Additional

Operating Hours:

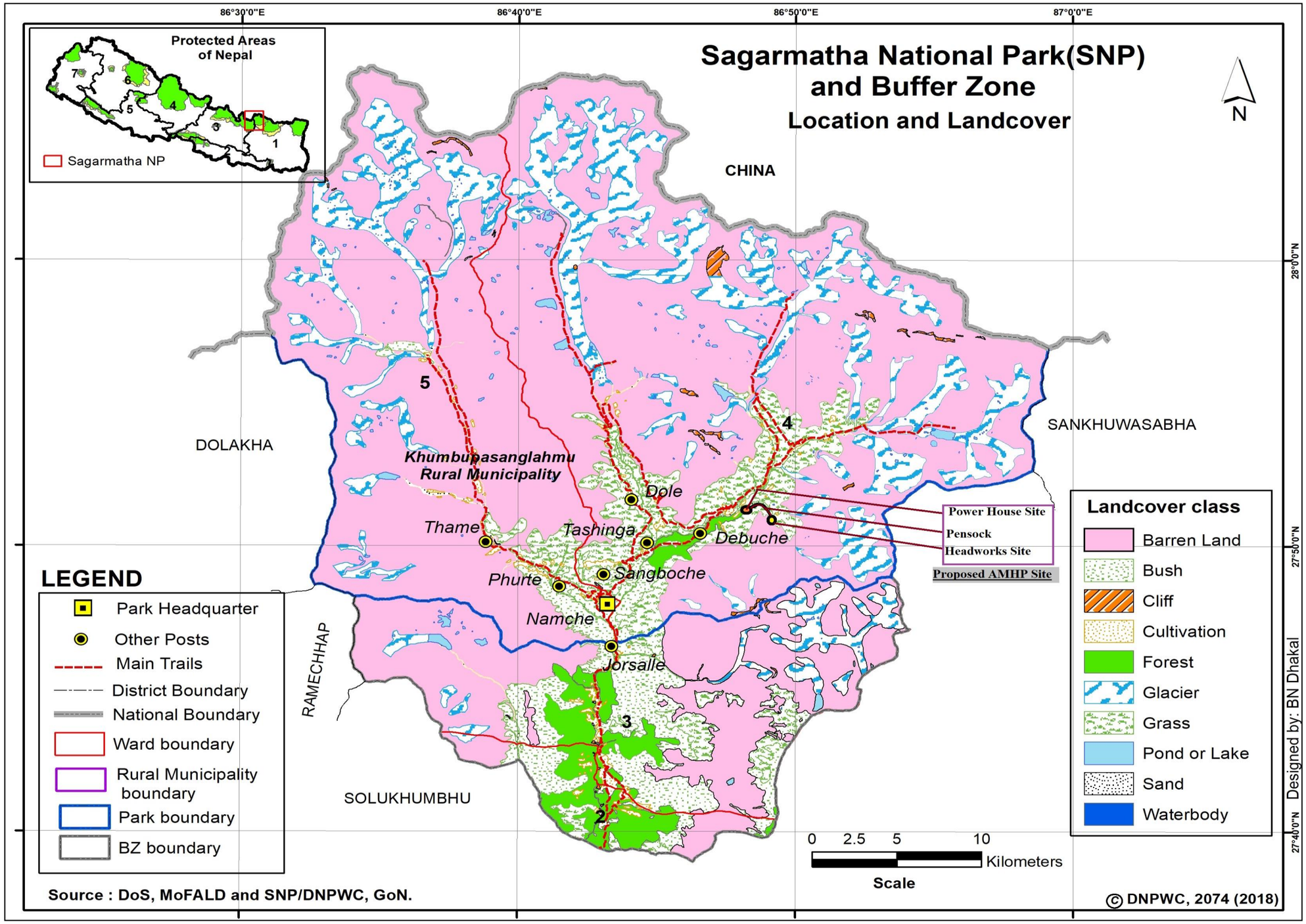
Ref No.	Religion/ Festivals	Mother tongue	Migration (from where When Why)	Occupation (Agri, Job, Remittance, Business, Other)	Education	Land Ownership and area	Major Crops with area and last year production	Domestic animals	Affiliation to local NGOs/INGOs	Source of Energy (Wood/LPG /Kerosene) Per month	Water Source/ Toilet status	Major Illness in past 2 years

Annex VII: Maps of Sub-Project Site

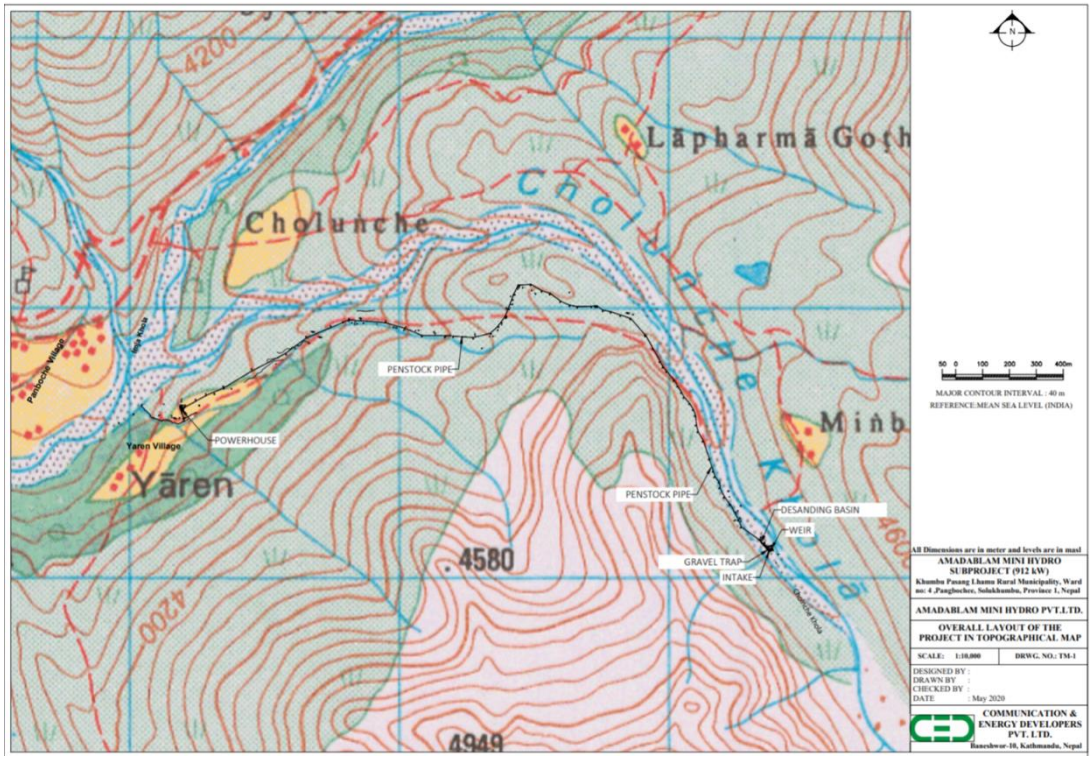


Map 3: Subproject Location in District Map
(Shape file modified by CED)

Map 4: Subproject Location on Google Earth Map
(Map Source: Over lay on Google map, Modified by CED)



Map 5: Subproject Location within Sagarmatha National Park Boundary



Map 6: Subproject Location in Topographic Map

Map 7: Major settlements in Ward No. 4 of Khumbu PasangLhamu RM

Annex VIII: Coordinates of Transmission Lines

DB Name	Latitude	Longitude	Service Wire Length (m)
D1	27 50 45.8	86 44 47.2	23
	27 50 45.8	86 44 46.4	10
	27 50 44.2	86 44 45.7	65
	27 50 43.7	86 44 45.7	82
	27 50 47.8	86 44 47.9	100
D2	27 50 44.4	86 44 51.6	79
	27 50 44.3	86 44 50.4	47
	27 50 45.5	86 44 49.5	10
	27 50 47	86 44 49.9	60
D3	27 50 45.9	86 44 52.7	10
	27 50 45.9	86 44 52.7	10
	27 50 45.1	86 44 52.6	29
	27 50 47.1	86 44 52.6	70
	27 50 45.8	86 44 53.8	35
	27 50 46.6	86 44 53.7	35
	27 50 45.14	86 44 54.56	65
D4	27 50 47.7	86 44 51.1	40
	27 50 48.1	86 44 51.8	10
	27 50 49.02	86 44 52.13	40
	27 50 49.49	86 44 52.90	65
	27 50 49.09	86 44 53.58	88
D5	27 50 44	86 44 55	10
	27 50 43.4	86 44 56.2	35
	27 50 43.4	86 44 56.2	35
	27 50 44	86 44 55	10
	27 50 44	86 44 57	64
D6	27 50 47.58	86 44 56.84	47
	27 50 47.29	86 44 55.33	10
	27 50 46.42	86 44 55.88	30
	27 50 45.98	86 44 56.57	55
	27 50 49.24	86 44 55.60	71
	27 50 49.89	86 44 56.25	100
	27 50 49	86 44 57	100
	27 50 49	86 44 57	100
	27 50 45	86 44 57	86
D7	27 50 48	86 44 59.9	75
	27 50 47.4	86 44 59.6	95
	27 50 49	86 44 59.6	44
	27 50 50	86 45 0.2	10
	27 50 50.5	86 44 59.4	51

DB Name	Latitude	Longitude	Service Wire Length (m)
	27 50 50.8	86 45 0.3	25
D8	27 50 49.8	86 45 1.4	71
	27 50 49.8	86 45 1.4	71
	27 50 54.3	86 45 5.8	46
	27 50 52.8	86 44 59.4	53
	27 50 53.4	86 44 59.1	74
	27 50 52.6	86 45 1.3	34
	27 50 52.4	86 45 1.8	34
	27 50 52.4	86 45 2.5	77
	27 50 51.8	86 45 0.8	10
	27 50 50.6	86 45 1.4	46
D9	27 50 46.3	86 45 2	10
	27 50 48.5	86 45 1.2	80
	27 50 45.1	86 45 2.7	46
	27 50 54.9	86 45 5.3	58
	27 50 46.9	86 45 3.6	58
D10	27 50 45.27	86 44 59.72	37
	27 50 44.08	86 45 0.52	32
	27 50 45	86 45 1	10
	27 50 43.8	86 45 1.9	55
	27 50 43.8	86 45 1.9	45
	27 50 41.4	86 45 3	90
D11	27 50 44.4	86 45 3.9	84
	27 50 45	86 45 4.9	43
	27 50 43.8	86 45 5.5	10
	27 50 44.1	86 45 7.7	84
	27 50 45.2	86 45 7.7	100
D12	27 50 56.1	86 44 57.7	81
	27 50 55.7	86 44 57.1	56
	27 50 55.7	86 44 57.1	56
	27 50 55.4	86 44 56.6	38
	27 50 54.5	86 44 57.5	10
	27 50 54.7	86 44 56.5	43
	27 50 53.7	86 44 55.6	100
	27 50 54.5	86 44 56	76
	27 50 53.9	86 44 56.6	100
	27 50 53.7	86 44 57.7	30
D13	27 50 58.7	86 44 59	77
	27 50 58.3	86 44 59.2	61
	27 50 58.1	86 44 59	41
	27 50 58.1	86 44 59	41
	27 50 57.6	86 45 00	73
	27 50 57.5	86 44 59.1	10
	27 50 56	86 45 0.5	93

DB Name	Latitude	Longitude	Service Wire Length (m)
	27 50 56.4	86 44 59.1	46
	27 50 56.7	86 44 58.7	36
D14	27 51 0.1	86 45 0.6	10
	27 50 59.9	86 45 1	13
	27 50 59.9	86 45 1	18
	27 50 59.2	86 45 1.7	53
	27 50 59.2	86 45 0.1	50
	27 50 58.6	86 44 59.8	85
	27 50 58.6	86 44 59.7	90
	27 50 58.1	86 45 0.2	100
D15	27 50 58.2	86 45 4.1	66
	27 51 0.7	86 45 5.2	100
	27 50 59.9	86 45 2.9	10
	27 51 0.4	86 45 1.3	52
D16	27 50 47.9	86 45 5.9	60
	27 50 49.6	86 45 6.9	51
	27 50 49.5	86 45 4.8	10
	27 50 52.6	86 45 3.8	100
D17	27 50 53.9	86 45 3.6	73
	27 50 53.6	86 45 4.5	40
	27 50 52.8	86 45 5.3	10
	27 50 55.6	86 45 5.2	100
D18	27 51 0.2808	86 44 39.16	10
D19	27 50 50.7336	86 44 34.181	10
	27 50 50.2764	86 44 33.68	10
D20	27 51 9.7632	86 44 28.77	10
D21	27 51 20.4	86 47 25.1	46
	27 51 20.4	86 47 25.1	46
	27 51 21	86 47 27.5	22
	27 51 21.3	86 47 28.7	60
	27 51 20.7	86 47 26.7	10
	27 51 19.9	86 47 27.5	32
D22	27 51 19.3	86 47 31.9	85
	27 51 19.7	86 47 32.2	70
	27 51 19.7	86 47 32.2	70
	27 51 20.2	86 47 32.6	50
	27 51 20.8	86 47 31.9	20
	27 51 20.8	86 47 30.7	10
	27 51 21.4	86 47 32	30
	27 51 22.5	86 47 32.3	70
D23	27 51 22	86 47 33	50
	27 51 22	86 47 33	50
	27 51 21.7	86 47 33.6	30
	27 51 21.6	86 47 34.4	10

DB Name	Latitude	Longitude	Service Wire Length (m)
	27 51 21.4	86 47 35	20
	27 51 21.9	86 47 33.8	20
	27 51 21.9	86 47 33.8	20
	27 51 21.9	86 47 33.8	20
	27 51 22.6	86 47 34.6	40
D24	27 51 26	86 47 37.3	35
	27 51 26	86 47 37.3	35
	27 51 26.4	86 47 38.3	10
	27 51 26.4	86 47 38.3	10
	27 51 26.1	86 47 39.4	36
D25	27 51 18.9	86 47 29.2	35
	27 51 18.9	86 47 29.2	35
	27 51 18.9	86 47 29.2	35
	27 51 18.9	86 47 29.2	35
	27 51 19.2	86 47 30.7	30
	27 51 19.7	86 47 30.3	10
	27 51 19.7	86 47 30.3	10
	27 51 19.7	86 47 30.8	15
D26	27 51 15.4	86 47 24.9	53
	27 51 15.8	86 47 25.7	26
	27 51 15.9	86 47 26.9	10
	27 51 15.9	86 47 26.9	10
	27 51 17.4	86 47 27.2	56
D27	27 51 13.1	86 47 21.1	84
	27 51 14.3	86 47 21.4	41
	27 51 13.8	86 47 23.3	40
	27 51 14.9	86 47 22.7	10
	27 51 15.1	86 47 24.1	40
	27 51 15.1	86 47 24.1	40
	27 51 15.1	86 47 24.1	40
D28	27 51 15.8	86 47 16.7	85
	27 51 19.5	86 47 20.8	85
D29	27 51 14.06	86 47 10.74	70
	27 51 14.06	86 47 10.74	70
	27 51 14.92	86 47 6.39	76
	27 51 17.72	86 47 10.12	100
	27 51 17.72	86 47 10.12	100
D30	27 51 18.5	86 47 16.8	10
	27 51 18.5	86 47 15.2	50
	27 51 21	86 47 18.6	90
	27 51 21	86 47 18.6	90
	27 51 21.8	86 47 20	65
D31	27 51 23.8	86 47 18.6	40

DB Name	Latitude	Longitude	Service Wire Length (m)
	27 51 23.5	86 47 21.5	70
	27 51 22.8	86 47 18.9	10
	27 51 22.8	86 47 18.9	10
	27 51 22.8	86 47 18.9	10
D32	27 51 25.9	86 47 20.8	40
	27 51 25	86 47 20.9	10
	27 51 24.6	86 47 20.5	20
	27 51 24.6	86 47 20.5	20
D33	27 51 25.3	86 47 17.4	12
	27 51 24.8	86 47 16.8	36
	27 51 24.8	86 47 16.8	36
	27 51 24.1	86 47 16.5	61
	27 51 23.3	86 47 15.8	96
	27 51 22.7	86 47 16.5	95
	27 51 23.9	86 47 17.2	51
	27 51 23.9	86 47 17.2	51
	27 51 24.4	86 47 17.1	27
	27 51 25.6	86 47 18.7	38
	27 51 26	86 47 18.9	54
	27 51 25.8	86 47 18.8	46
	27 51 26	86 47 18.9	54
	27 51 25.1	86 47 17.6	10
	27 51 25.6	86 47 18.7	38
D34	27 51 26.8	86 47 19.8	55
	27 51 26.8	86 47 19.8	55
	27 51 27.7	86 47 20.4	20
	27 51 28.9	86 47 24.1	80
D35	27 51 25.7	86 47 14.5	54
	27 51 25.7	86 47 14.9	64
	27 51 25.9	86 47 15.3	77
	27 51 26.2	86 47 15.5	87
	27 51 25	86 47 14.3	30
	27 51 24.1	86 47 13.4	30
	27 51 24.2	86 47 14.5	10
	27 51 23.4	86 47 14.3	27
	27 51 23.4	86 47 14.3	27
	27 51 24.4	86 47 15.7	39
	27 51 24.7	86 47 16.1	56
	27 51 24.7	86 47 16.1	56
D36	27 51 28.5	86 47 11.8	61
	27 51 27	86 47 13.1	10
D37	27 49 54.7	86 44 47.6	20
	27 49 54.7	86 44 47.6	20
	27 49 54.7	86 44 47.6	20

DB Name	Latitude	Longitude	Service Wire Length (m)
	27 49 54.7	86 44 47.6	20
	27 49 54.7	86 44 47.6	20
D38	27 49 55	86 44 42	10
	27 49 55.6	86 44 42	30
	27 49 54	86 44 41	42
	27 49 54	86 44 41	42
D39	27 49 53.06	86 44 27.41	20
	27 49 53.06	86 44 27.41	20
	27 49 53.06	86 44 27.41	20
D40	27 49 48	86 44 21	10
	27 49 48	86 44 21	10
	27 49 47	86 44 20	50
	27 49 47	86 44 20	50
	27 49 47	86 44 20	50
	27 49 47	86 44 20	50
	27 49 47	86 44 20	50
	27 49 47	86 44 20	50
D41	27 53 27.6	86 49 43.3	69
	27 53 29	86 49 45	10
	27 53 29.5	86 49 45.5	20
	27 53 30.5	86 49 46.1	55
	27 53 30.9	86 49 46.7	77
	27 53 27.6	86 49 48.6	100
	27 53 27.7	86 49 43.3	64
D42	27 53 25.4	86 49 39.8	97
	27 53 24.9	86 49 40.9	80
	27 53 25.2	86 49 40.6	69
	27 53 25.5	86 49 41.3	47
	27 53 26	86 49 41.5	30
	27 53 26.4	86 49 42.4	10
	27 53 27.6	86 49 41	55
	27 53 27	86 49 42.8	22
D43	27 53 20.2	86 49 36.8	61
	27 53 21.5	86 49 36.06	100
	27 53 22.1	86 49 38.1	20
	27 53 22.6	86 49 39.2	80
	27 53 23.4	86 49 38.9	50
	27 53 24.5	86 49 39.8	85
D44	27 53 29.9	86 49 41.1	50
	27 53 31.6	86 49 41.4	37
	27 53 31.2	86 49 41.6	24
	27 53 31.2	86 49 42.3	10
	27 53 32.1	86 49 43	35
	27 53 33.2	86 49 44.4	85

DB Name	Latitude	Longitude	Service Wire Length (m)
	27 53 29.9	86 49 41.1	50
D45	27 53 35.5	86 49 46.4	87
	27 53 35.9	86 49 47	67
	27 53 37.2	86 49 49	10
	27 53 36.9	86 49 49.8	20
	27 53 36.1	86 49 49.3	47
D46	27 53 31.56	86 49 47.25	100
	27 53 32.2	86 49 46.5	90
	27 53 32.2	86 49 46.5	90
	27 53 32.3	86 49 47.4	84
	27 53 33.7	86 49 51.7	53
	27 53 33.7	86 49 51.7	53
	27 53 32.5	86 49 50.4	10
	27 53 32.5	86 49 50.4	10
D47	27 53 34.4	86 49 52.3	10
	27 53 33.4	86 49 52.3	33
	27 53 35.8	86 49 50.7	64
	27 53 35.8	86 49 50.7	64
	27 53 34.8	86 49 51	41
	27 53 35.8	86 49 50.7	64
	27 53 36.31	86 49 53.04	65
D48	27 53 37.9	86 49 54.1	25
	27 53 37.7	86 49 55	50
	27 53 38.92	86 49 53.81	65
	27 53 38.92	86 49 53.81	65
	27 53 38.92	86 49 53.81	65
	27 53 37.6	86 49 53.29	10
	27 53 37.71	86 49 51.06	50
	27 53 37.59	86 49 52.03	34
	27 53 37.59	86 49 52.03	34
D49	27 53 41.66	86 50 1.79	83
	27 53 41.66	86 50 1.79	83
	27 53 41.66	86 50 1.79	83
	27 53 39.38	86 50 0.25	10
	27 53 40.87	86 49 58.74	60
	27 53 40.87	86 49 58.74	65
	27 53 39.86	86 49 58.24	100
D50	27 53 36.48	86 49 59.85	100
	27 53 35.77	86 49 57.55	45
	27 53 35.29	86 49 58.81	53
	27 53 34.38	86 49 57.28	10
	27 53 33.43	86 49 55.77	61
D51	27 53 40.29	86 50 4.36	10
	27 53 40.29	86 50 4.36	5

DB Name	Latitude	Longitude	Service Wire Length (m)
	27 53 38.89	86 50 3.34	54
	27 53 37.68	86 50 1.84	100
	27 53 41.58	86 50 4.75	52
	27 53 41.58	86 50 4.75	52
	27 53 41.58	86 50 4.75	52
D52	27 53 43.94	86 50 5.93	40
	27 53 43.34	86 50 9.48	61
	27 53 43.34	86 50 9.48	61
	27 53 44.37	86 50 8.6	87
	27 53 43.34	86 50 9.48	61
	27 53 42.84	86 50 7.29	19
	27 53 42.94	86 50 6.69	10
	27 53 42.94	86 50 6.69	10
	27 53 42	86 50 6.19	32
	27 53 42	86 50 6.19	32
D53	27 52 1.1	86 43 45.35	100
	27 52 1.91	86 43 53.09	100
	27 51 58.806	86 43 53.245	90
	27 51 59.53	86 43 51.68	40
	27 51 59.53	86 43 51.68	40
	27 51 59.53	86 43 51.68	40
	27 51 59.53	86 43 51.68	20
	27 51 59.53	86 43 51.68	20
	27 51 59.53	86 43 51.68	10
	27 51 59.53	86 43 51.68	10
	27 51 59.53	86 43 51.68	20
	27 51 59.53	86 43 51.68	20
D54	27 52 5.02	86 43 50.42	40
	27 52 4.53	86 43 47.32	10
D55	27 54 11.1672	86 43 0.487	94
	27 54 11.9736	86 42 58.511	34
	27 54 11.9736	86 42 58.511	34
	27 54 11.9736	86 42 58.511	34
	27 54 11.83	86 42 54.98	95
	27 54 11.196	86 42 56.779	20
	27 54 11.196	86 42 56.779	20
D56	27 54 7.25	86 42 55.18	77
	27 54 7.2324	86 42 55.516	65
	27 54 6.4116	86 42 58.727	40
	27 54 5.83	86 43 0.81	100
	27 54 7.2036	86 42 56.455	40
D57	27 53 36.39	86 43 9.03	17
	27 53 33.14	86 43 6.35	80
	27 53 35.81	86 43 9.57	40

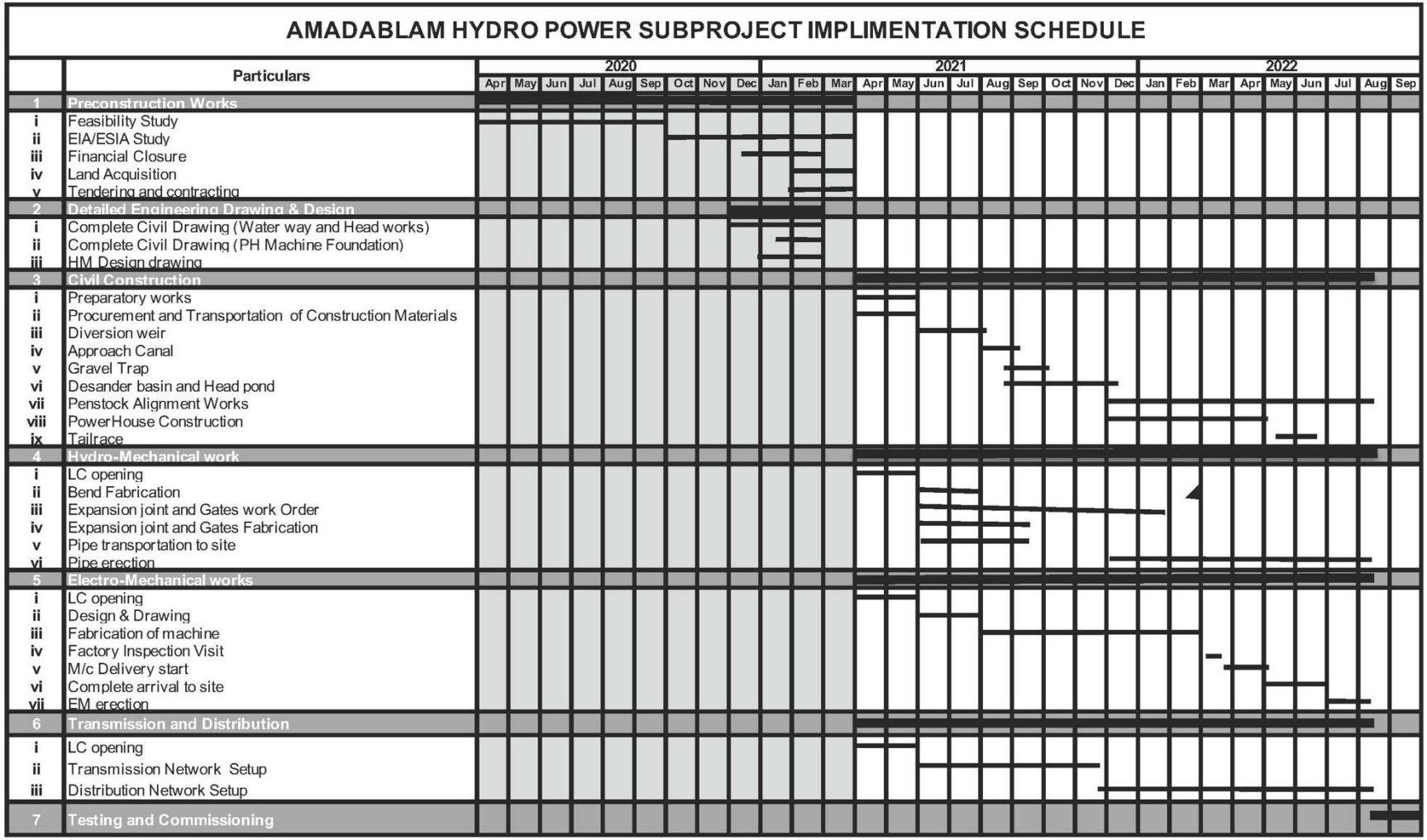
DB Name	Latitude	Longitude	Service Wire Length (m)
D58	27 54 15.5	86 52 17	86
	27 54 15.6	86 52 15.1	40
	27 54 16.5	86 52 15.3	45
	27 54 17.3	86 52 15.6	72
	27 54 15.5	86 52 14.3	10
D59	27 54 15	86 52 18.1	50
	27 54 17.1	86 52 19.2	41
	27 54 17.67	86 52 20.21	71
	27 54 16.2	86 52 18.4	10
	27 54 17.8	86 52 18.5	71
	27 54 17.8	86 52 17.7	94
	27 54 16.5	86 52 19.1	22
D60	27 56 55.2	86 48 36.4	90
	27 56 54.55	86 48 35.62	60
	27 56 52.8	86 48 36.4	10
	27 56 49.8	86 48 37.3	100
	27 56 51.7	86 48 36.6	37
D61	27 56 55.3	86 48 36.4	64
	27 56 55.54	86 48 38.37	54
	27 56 54.1	86 48 37.3	10
	27 56 53.00	86 48 37.85	77
	27 56 52.6	86 48 38.1	92
	27 56 53.1	86 48 37.3	50
D62	27 57 28.00	86 48 47.69	10
D63	27 55 24.9	86 48 19.5	10
	27 55 24.9	86 48 20.3	20
D64	27 53 34	86 49 12.0	93
	27 53 33.2	86 49 12.1	68
	27 53 31.2	86 49 12.1	10
	27 53 30	86 49 14.4	66
	27 53 33.22	86 49 11.9	63
	27 53 33.8	86 49 11.78	83
	27 53 32.92	86 49 11.89	53
	27 53 30.51	86 49 11.82	24
D65	27 53 37.8	86 49 11.8	20
	27 53 37.8	86 49 11.8	20
	27 53 37.4	86 49 14.9	70
	27 53 37.8	86 49 13.4	46
	27 53 37.3	86 49 13.4	31
	27 53 37.3	86 49 12.3	10
	27 53 35.7	86 49 11.7	54
D66	27 53 40.3	86 49 13.5	54
	27 53 39.8	86 49 14.7	10
	27 53 38.7	86 49 14.6	33

DB Name	Latitude	Longitude	Service Wire Length (m)
D67	27 53 45.5	86 49 13.3	45
	27 53 44.3	86 49 14.1	10
	27 53 43.6	86 49 13.6	36
	27 53 42.7	86 49 14.1	68
	27 53 42.2	86 49 13.5	92
D68	27 53 47.8	86 49 9.8	100
	27 53 49.4	86 49 9.9	60
	27 53 50	86 49 10.1	40
	27 53 50.8	86 49 10.4	66
	27 53 48	86 49 12.4	50
	27 53 47.7	86 49 13	83
D69	27 53 40	86 49 11.4	69
	27 53 41.2	86 49 11.5	29
	27 53 42.1	86 49 11.5	10
	27 53 43.1	86 49 11.9	31
	27 53 43.7	86 49 10.3	81
D70	27 53 23.73	86 49 10.62	10
D71	27 52 2.5	86 48 15.9	40
	27 52 3.0	86 48 17.2	40
	27 52 3.7	86 48 17.3	23
	27 52 3.6	86 48 17.6	34
	27 52 3.1	86 48 18.3	35
	27 52 3.8	86 48 18	49
	27 52 3.8	86 48 18	49
	27 52 3.8	86 48 18.7	71
D72	27 52 4.6	86 48 19.2	62
	27 52 4.24	86 48 19.95	35
	27 52 3.5	86 48 20.9	10
	27 52 3.8	86 48 21.2	17
	27 52 3.8	86 48 21.2	17
	27 52 4.4	86 48 21	40
	27 52 4.4	86 48 21	40
	27 52 4.8	86 48 21.6	67
	27 52 4.8	86 48 21.6	67
D73	27 52 6.2	86 48 28.9	10
D74	27 52 15.1	86 48 43.5	10
D75	27 51 56.16	86 48 7.61	10
D76	27 50 22.48	86 46 12.3	35
	27 50 21.73	86 46 13.48	10
	27 50 22.58	86 46 15.34	60
D77	27 50 10.8	86 45 54.6	58
	27 50 10.8	86 45 54.6	58
	27 50 11.5	86 45 54.5	81
	27 50 11.5	86 45 54.5	81

DB Name	Latitude	Longitude	Service Wire Length (m)
	27 50 9	86 45 51.8	42
	27 50 10.8	86 45 54.6	58
	27 50 7.3	86 45 51.8	100
D78	27 50 28.17	86 46 23.07	50
	27 50 27.99	86 46 21.89	87
	27 50 30.68	86 46 25.66	80
D79	27 50 40.45	86 46 38.67	10
	27 50 40.45	86 46 38.67	20
D80	27 50 49.24	86 46 40.44	

Annex IX: Construction Schedule of Sub-Project

AMADABLAM HYDRO POWER SUBPROJECT IMPLIMENTATION SCHEDULE



Annex X: Photographs

Figure 1: Cholunche River

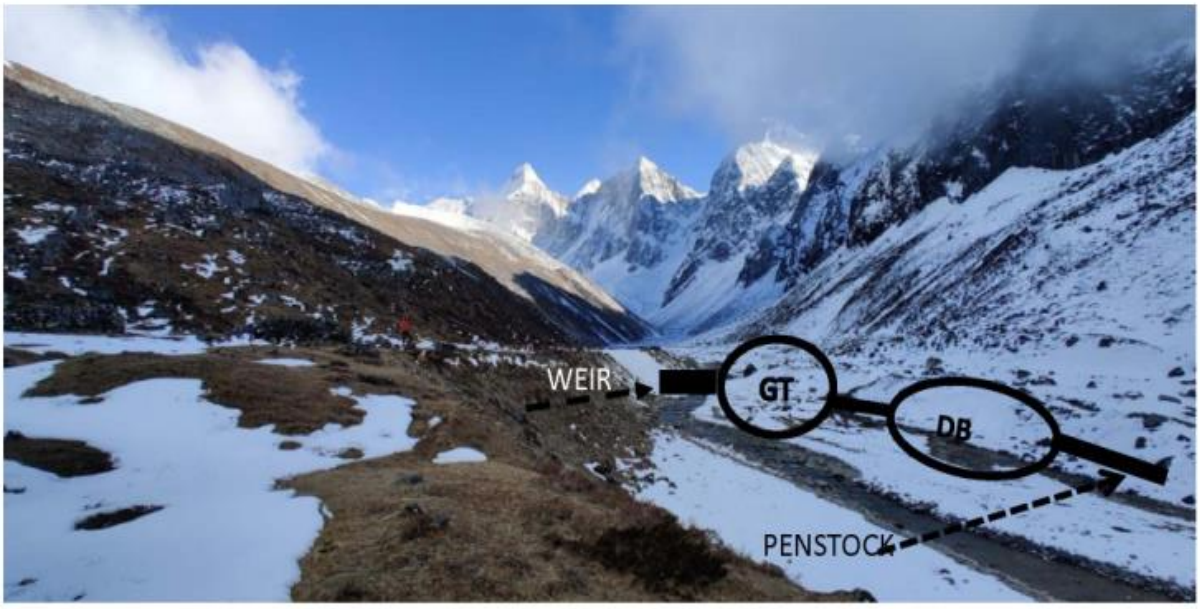


Figure 2: Weir, Gravel Trap (GT) and Desilting Basin(DB) Location

Figure 3: Penstock Route

Figure 4 : Penstock Route

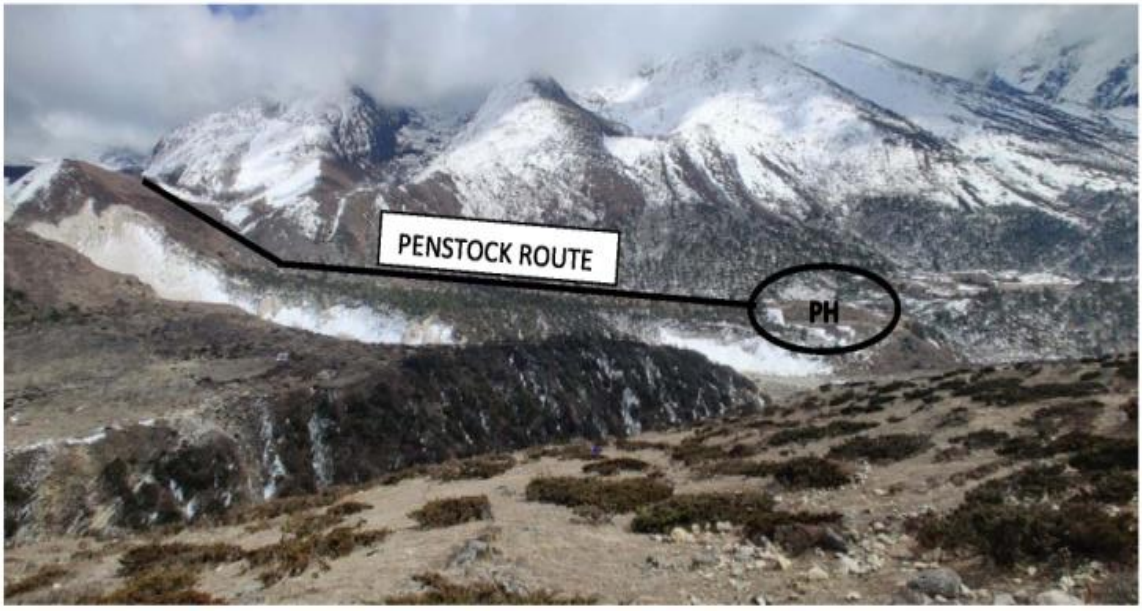


Figure 5: Penstock Route and Powerhouse (PH)

Figure 6: Load Center

Figure 7 : Survey Team

Figure 8 : Community Interaction