ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY
of
AMADABLAM MINI HYDRO SUBPROJECT (911 kW)

Submitted To

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

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ABBREVIATIONS

AC	Alternate Current
ACSR	Aluminum Conductor Steel Reinforced
AEPC	Alternative Energy Promotion Centre
AMHSP	Amadablam Mini Hydro Subproject
amsl	Above Mean Sea Level
B	Breath
BA	Basal Area
BOD	Biological Oxygen Demand
BS	Bikram Sambat
BZ	Buffer Zone
CBD	Convention on Biological Diversity
CBO	Community Based Organization
CBS	Central Bureau of Statistics
CDO	Chief District Officer
CFUG	Community Forest User Groups
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
cm	Centimeter
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
DFS	Detailed Feasibility Study
DHM	Department of Hydrology and Meteorology
DIA	Direct Impact Area
dia.	Diameter
DNPWC	Department of National Park and Wildlife Conservation
DO	Dissolved Oxygen
DoED	Department of Electricity Development
E	East
E&S	Environmental and Social
EA	Environmental Assessment
EIA	Environmental Impact Assessment
El	Elevation
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
FGD	Focus Group Discussion
GIS	Geographical Information System

GLOF	Glacier Lake Outburst Flood
GoN	Government of Nepal
GRM	Grievance Redress Mechanism
GWh	Giga Watt hour
Ha	Hectare
HHs	Households
Hz	Hertz
IBAT	Integrated Biodiversity Assessment Tool
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IIA	Indirect Impact Area
INGO	International Non-Government Organization
INPS	Integrated Nepal Power System
IUCN	International Union for Conservation of Nature
IVI	Important Value Index
KII	Key Informant Interview
Km	Kilometer
KPLRM	Khumbu Pasang Lhamu Rural Municipality
kV	Kilovolt
kVA	Kilovolt Ampere
kW	Kilo Watt
L	Length
L/C	Letter of Credit
lps	liter per second
m	Meter
MAPs	Medicinal and Aromatic Plants
MGEAP	Mini Grid Energy Access Project
mm	millimeter
MoEWRI	Ministry of Energy, Water Resources and Irrigation
MoFE	Ministry of Forest and Environment
MoST	Ministry of Science and Technology
mVA	Milli Volt Ampere
MW	Mega Watt
N	North
NGO	Non Governmental Organization
No.	Number
NRs	Nepalese Rupees
NTFPs	Non-Timber Forest Products
ONAN	Oil Natural Air Natural
OPs	Operation Plans
pH	Potential of Hydrogen
PID	Proportional Integrative Derivative
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
s	Second
SNP	Sagarmatha National Park
SPIA	Subproject Impact Area
TDS	Total Dissolved Solids
ToR	Terms of Reference
TV	Television
VCBs	Vacuum Circuit Breakers
WB	World Bank
WECS	Water and Energy Commission Secretariat

Executive Summary

Alternative Energy Promotion Centre (AEPC) is the apex government body under the Ministry of Energy, Water Resources and Irrigation (MoEWRI), established to promote the use of renewable energy technologies to meet the energy needs in Nepal. AEPC is implementing "The Nepal: Private Sector-Led Mini-Grid Energy Access Project (MGEAP)" supported by Government of Nepal (GoN) and the World Bank (WB). The objective of the Project 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) in selected areas in socially acceptable and environmentally sustainable manner. AEPC/MGEAP has carried out Environmental and Social Screening of the Amadablam Mini Hydro Subproject (AMHP) and categorized the subproject as High Risk. As per the provision for high risk subproject in ESMF of AEPC/MGEAP and World Bank's Operational Policies - Amadablam Mini Hydro Pvt. Ltd is preparing the Environmental and Social Impact Assessment (ESIA) of this subproject.

Energy Service Company (ESCO)

The Amadablam Mini Hydro Pvt. Ltd. is an Energy Service Company (ESCO) which aims to develop Amadablam Mini Hydro Subproject (AMHP), located in Khumbu Pasanglhamu Rural Municipality (KPLRM), Ward No: 4, Solukhumbu district, Province No1. The address of the ESCO is as follows:

Address of the ESCO

Amadablam Mini Hydro Pvt. Ltd.
Kathmandu-8, Tilganga,
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Relevancy of the ESIA Study

The primary objective of the proposed subproject is to generate 911 kW electricity from Cholunche Khola and supply energy to meet electricity demand of 451 household for cooking and space heating in Chukhung, Debuche, Dingboche, Dole, Lawi-Schyasa, Mongla, Lobuche, Luza, Milingo, Mingbo, Mochhermo, Pangboche, Pheriche, Phortse, PhortseTenga, Mongla, Fhungi Tenga, Shomare, Thukla, Tyangboche and Worshyo and other settlements of Ward No. 4. At present, existing 3 micro hydro plants and small solar home systems are source of electricity which can only fulfill mere lighting demand of the households. As most of these households lies on Everest base camp trekking trail, one of the most popular trails worldwide, demand for energy is huge. To meet the demand, they are mostly dependent on high priced LPGs, kerosene and scarce fuelwood. The cost of petroleum fuel increases by 200-300% in these regions compared to general market rates due to remoteness of location. Therefore, to present a feasible alternative to these high-priced fuels with locally generated power, Amadablam Mini Hydro Subproject has been proposed.

Cheap and reliable electricity provided by the subproject will allow local tourism business to provide better facilities to the visiting tourists. Opportunities such as space heating using air conditioning, indoor cooking using electricity, electric geysers, cinema halls, etc. can be realized, further boosting tourism in the region.

Majority of residents of these settlements are indigenous people. The load centers of the subproject are not accessible by national grid. As the proposed subproject lies in Sagarmatha National Park (SNP), which is considered as ecologically sensitive area, Environmental and Social Impact Assessment (ESIA) is required safeguard instrument as per World Bank's Operational Policies (OPs)[1] to identify potential environmental and social (E&S) risks and impacts associated with the subproject.

Objective

The main objective of this study is to conduct ESIA and prepare ESIA and Environmental and Social Management Plan (ESMP) to ensure safeguard compliance during implementation and operation of the proposed AMHP (911 kW).

Methodology

This ESIA for Amadablam Mini Hydro Subproject has been conducted in accordance with the methodology described in the Terms of Reference (ToR) cleared by the World Bank (Annex- V).

Subproject Description

The proposed subproject is a run-off-river scheme and uses water from Cholunche Khola, a perennial river and tributary of Imja Khola. Water will be diverted at elevation of 4423 m amsl and intake will be made at elevation of 4422 m amsl. Diverted water will be streamed down to powerhouse located at 3951.18 m amsl through 2930 m long penstock pipe. The gross head will be of 471.87 m with design discharge 0.25 m^3/s at $Q_{80\%}$. Two units of turbines with the rated output of 485 kW will be coupled with two 650 kVA synchronous generators which will be used to generate total electrical power of 911 kW. Generated electricity will be transmitted through 11 kVA transmission lines and distributed through 1.1 kVA distribution lines to 451 households in Chukhung, Debuche, Dingboche, Dole, Lawi-Schyasa, Lobuche, Luza, Milingo, Mingbo, Mochhermo, Pangboche, Pheriche, Phortse, PhortseTenga, Mongla, Fhungi Tenga, Shomare, Thukla, Tyangboche and Worshyo and other settlements of ward number 4 of Khumbu Pasanglhamu Rural Municipality (KPLRM) where National grid has not reached. All the settlements lie in Sagarmatha National Park. The total subproject cost is NPR 618,901,638.89

Existing Environmental Condition

Physical Environment

The proposed subproject area is located in northeastern mountain region of Nepal. The subproject area geologically lies on the Higher Himalayan Crystalline Zone in the eastern part of Nepal. The subproject area possesses the high-grade metamorphic rocks. The subproject area has gneisses, schists and marbles of the Higher Himalayan Zone and Tethyan sediments (limestone, shale, sandstone etc.) belonging to the Tibetan-Tethys Zone. Most of the area is exposed bedrock with thin colluvial soil cover. The colluvial soil comprises boulders, gravels, cobble and pebbles of gneiss with sand. The elevation of diversion weir is 4423 m while the powerhouse will be at 3951.18 m. The elevation of transmission and distribution lines ranges from 3315 to 5000 m. The subproject area lies in subalpine to alpine

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

climatic zone. The average annual rainfall is 1524 mm. January is the coldest month and July is the warmest month of the subproject area. The minimum temperature of Pangboche area goes down below 0°C about 7 months of a year

The current land use pattern of Ward No. 4 is dominated with glacier (52.40%), followed by barren land (20.86%), grassland (14.52%), shrub land (8.02%), forest (2.83%), water body (0.67%), built up (0.45%) and agriculture (0.0.25%). The weir will be in river while penstock pipe lies in grassland. Powerhouse will be constructed in grassland. Transmission and distribution lines pass through tourist trekking routes.

The Cholunche Khola starts from Nare Glacier and flows from northeast to south west direction. It then merges with Imja Khola at Pangboche village. It is a snow fed perennial river with maximum catchment elevation of 6543 m while minimum elevation of catchment being 4423 m. The total catchment area is 27.58 km^2. Out of the total catchment 74.73% of the catchment lies in permanent snowline above 5000 m. The analysis of air, water and sound quality showed that the standards are within the limit of national guidelines. No source of pollution is observed.

Biological Environment

The subproject area lies in Sagarmatha National Park (SNP). The SNP is additionally recognized by UNESCO as the world heritage site under criterion (vii) 'contains superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance'. The intake and powerhouse area lies in Alpine pastureland where there are no trees, however, penstock alignment lies in Juniper Scrublands in the vegetation zone of Moist Alpine Scrubs. Transmission and Distribution (T&D) lines also pass-through Alpine pasture land, Juniper Scrublands and Birch-Rhododendron Forest with sub-alpine juniper forest. All the T&D lines have been designed to be underground passing along foot trails except river crossings where it passes along with bridges. The subproject does not require removing any single tree of SNP. According to locals, there are no fish seen in the Choulunche Khola till the date. However, some reptiles and amphibians are recorded in the SNP and its buffer zone (SNP and its Buffer Zone Management Plan 2016-2020).

Socio-Economic and Cultural Environment

The total population in load centers (19 different settlements) of Ward No. 4 of the RM is 1677 in 451 households with average family size of 3.72. The most dominant ethnic group is Sherpa (95.27%). Other Caste are Tamang (2.18%), Magar (0.73%), outcaste (0.73%) and others (1.09%). Majority (99.50%) of people follow Buddhism, whereas, 0.50% people are Hindu. There are 10 Gumbas in the subproject area. Tourism, agriculture, hotels/lodges/restaurants, foreign employment and business are the main occupation. Average land holding per household in load center is 864.85 m^2 (1.70 ropani). Food sufficiency crop diversity is very poor in the area. Potato and buckwheat are major food crops. Majority of HHs have access on electricity (only for lighting purposes) from 3 existing micro hydro plants and some also use solar home system. LPG, Kerosene, dung cake and fuelwood are used for cooking. The literacy rate in subproject area is 73.98%. There are three basic schools and three health institutions in Ward No. 4. All HHs have toilets and also have access on drinking water. Sagarmatha Pollution Control Committee with support from Buffer Zone Management Committee, SNP, locals and Rural Municipality manages the waste along the foot trails. Mobile and internet facilities are available in the subproject area. Similarly, internet facilities are also available in some of the settlements.

Identification/Prediction of Impacts

Beneficial Impacts

The beneficial impact from the subproject during construction phase is employment opportunities for the local people. Approximately 200 unskilled and 80 skilled human resources will be employed during construction period. Other advantages are opportunity to improve technical skills, increase in economic activities and exposure of locals to new technologies. At least 5 people will be employed for the operation and maintenance of the mini hydro subproject during operation. There will be generation of 911 kW electrical energy and demand of energy of locals will be met.

Adverse Impacts

Physical Environment

Change in land use, topography, soil erosion, sedimentation in river water, spoil generation, impact on hydrology and river morphology and loss of topsoil are major adverse impacts on physical environment during construction. The river stretch of about 3.5 km between the proposed intake and confluence between Imja Khola and Cholunche Khola site can be classified as a dewatered zone. The water in this segment of river is not used for irrigation, drinking and not any livelihood purposes by local communities as there is not any human settlement exist in dewatered zone. During operation, change in microclimate, change in river water flow and quality, noise and vibration at powerhouse, soil erosion due to discharge from tailrace and impact on downstream due to sediment flushing are major impacts.

Biological Impacts

Approx. 0.626 ha of natural grassland area will be required for long term use to construct various subproject components which is managed by SNP. Pressure on forest for fuelwood, impact on wildlife movement, aquatic flora and fauna, NTFPs, forest fire, wildlife hunting and poaching and increase in human wildlife conflict are identified as adverse impacts during construction. Impacts due to reduced water flow, disturbance to wildlife due to resident workers, possible forest fire and pressure on forest for fuelwood are the impacts during operation.

Socio-economic and Cultural Impacts

Approx. 5.711 hectares (ha) of land is planned to be acquired in short term and long-term lease for construction of the subproject. All the land required for the subproject is of SNP. Land will be acquired according to GoN regulations.

Pressure on existing facilities, services and resources of subproject area, health and sanitation and public safety, occupational health and safety, socio-cultural conflicts between locals and migrant workforce, possible unsocial activities like gambling, alcoholism, girl trafficking and prostitution, gender-based violence, issues related to disturbances to community, COVID-19 and child labour issues are some of the identified potential impacts during construction.

Occupational health and safety of workers, public safety, impacts due to sudden release of water to downstream, issues of benefit sharing, issues of electricity tariff and management of existing 3 micro hydro in subproject areas are some of the identified potential impacts during operation.

SNP and Outstanding Universal Value (OUV)

The proposed subproject is located in the SNP and might have impact on scenic beauty to some extent. There will be negligible impact on local social and cultural integrity as locals are already exposed to diverse group of people since last 75 years. (https://whc.unesco.org/en/compendium/action=list&id_faq_themes=1528).

Similarly, there is no possibility of electrocution to bird and wild animals due to underground T&D[2] with armored cables.

Cumulative impacts

There is no existing/planned hydropower and irrigation project in Cholunche Khola. It is decided during the screening that cumulative impact analysis is not necessary.

Benefit Augmentation/Adverse impact Mitigation Measures

Benefit Augmentation Measures

Priority for employment during construction and operation phase will be given to locals. Tariff rate for electricity will be fixed in consultation with community. In addition, 10% of shares will be provided to locals.

Mitigation Measures

Physical Environment

Land clearance will be minimized to the extent possible to check erosion and landslide. Excavated materials will be used for land reclamation and rehabilitation. Trenches, quarry sites and disposal sites will be rehabilitated immediately. Spoils will be stored in designated area. People will be made aware about early warning system and emergency preparedness plan.

Biological Environment

Community people, school children, and subproject workers will be sensitized on conservation of environment, biodiversity and wildlife. Unnecessarily visit and smoking in forest area will be prohibited to construction workers to reduce possible risk of forest fire, hunting and poaching. A minimum environmental flow of 50% of the mean monthly flow will be maintained during operation to sustain the aquatic life of Cholunche Khola. All the workers and subproject staffs will be provided with LPG for cooking to reduce the pressure in the forest.

Socio-economic and Cultural Environment

All the workers and staffs will be provided with insurance and the use of PPEs will be ensured. Trenches especially made for underground T&D lines will be reclaimed immediately to avoid accidents. To reduce the conflict between workers and locals, code of conduct including SEA/SH will be strictly implemented. All the staff and construction workers will be oriented about the GBV including SES/SH and consequences that one has to face for involving in any form of GBV. Separate SEA/SH code of conduct will be implemented to avoid the risk of gender-based violence, sexual exploitation and abuse, and sexual harassment.

[2] *Underground cabling is mandatory requirements set out by GoN for National Parks and Conservation areas*

Monitoring and Reporting Plan

The monthly reporting on the implementation of ESMP will be undertaken by ESCO and share with AEPC. AEPC will prepare trimester report based on monthly reports and share with the WB.

Conclusion

Amadablam Mini Hydro Pvt. Ltd. will implement the proposed subproject in the Sagarmantha National Park which will generate 7,225,718.76 kWh of annual average energy. The subproject intends to acquire about 5.711 ha (0.626 ha on long term lease & 5.085 on short term lease) of the government land will be leased for long-term. This ESIA study has identified some adverse and beneficial environmental and social impacts and also proposed mitigation measures for each of identified adverse impacts as well as proposed enhancement measures for the beneficial impacts. ESMP has been prepared and budget has been allocated for the mitigation and enhancement measures. The ESCO will implement the proposed subproject ensuring effective implementation of the ESMP.

CHAPTER 1:INTRODUCTION

1.1 Background of the Subproject

Alternative Energy Promotion Centre (AEPC), a Government institution was established on 3 November 1996 under then 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, AEPC is under the Ministry 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 Government of Nepal (GoN) as subsidy and the World Bank (WB) as loan and grant. 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 subsidy from the GoN and loans from the WB through Partner Banks (PBs).

The proposed subproject, Amadablama Mini Hydro Subproject (911 kW) is being developed under MGEAP. Amadablam Mini Hydro Pvt. Ltd. is a private Energy Service Company (ESCO), registered at Ministry of Industry, Commerce and Supplies, office of company registrar office, Kathmandu on ward number 8, Tilganga (**Annex I**). ESCO has proposed to develop Amadablam Mini Hydro Subproject at Khumbu Pasang Lhamu Rural Municipality, Ward No. 4 of Solukhumbu district in Province No. 1. This subproject will be developed in off grid area. Amadablam Mini Hydro Pvt. Ltd. has received technical clearance from the Department of Electricity Development (DoED) on 12/10/2076 (26 January 2020) (**Annex II**). Khumbu Pasang Lhamu Rural Municipality has provided license on 23/10/2076 (6 February 2020) (**Annex III**). Since this subproject is located within the Sagarmatha National Park (SNP) which is ecologically sensitive area and is listed as World Heritage Site by the United Nations Educational, Scientific, and Cultural Organization (UNESCO), it requires detailed environmental assessment of the subproject. Thus, Environmental and Social Impact Assessment (ESIA) is mandatory as per World Bank's Operational Policies (OPs)[3] to identify potential environmental and social (E&S) risks and impacts associated with the subproject. The Terms of Reference (ToR) of ESIA has already been cleared by WB on 05/06/2078 (12 September 2021) In addition, Environmental Impact Assessment (EIA) is mandatory as per the Environment Protection Act (EPA) 2019 and Environment Protection Rule (EPR) 2020 of GoN. The Ministry of Forest and Environment (MoFE) has already provided consent letter to conduct EIA study on 24/06/2078 (10 October 2021) (**Annex IV)** and ToR & Scoping Document have been approved on 15/08/2079 (1 December 2022).

The proposed subproject is a run-off-river and uses water from Cholunche Khola (also known as Nare Khola), which is a perennial river and is a tributary of the Imja River. The ESCO

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

plans to develop mini hydro subproject with 911 kW capacity to provide electricity to 451 households in Chukhung, Debuche, Dingboche, Dole, Lawi-Schyasa, Mongla, Lobuche, Luza, Milingo, Mingbo, Mochhermo, Pangboche, Pheriche, Phortse, PhortseTenga, Fhungi Tenga, Shomare, Thukla, Tyangboche and Worshyo villages of Ward No. 4, where majority of residents are indigenous people. The electricity supply to hotels and restaurants of these villages will support to boost the sustainability of tourism.

1.2 Objectives of the ESIA Study

The main objective of the study is to conduct ESIA and prepare Environmental and Social Management Plan (ESMP) to ensure safeguard compliance during implementation and operation of the proposed Amadablam Mini Hydro Subproject (911 kW). The specific objectives of the study are:

- To provide baseline information on the existing environmental and social setting of the subproject area;
- 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 during preparation, construction and operation of the subproject;
- To propose suitable, practical and time-bound 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 carry out Alternative Analysis and compare options in terms of locations, technology, social and environmental consequences during project planning and design. Options may include solar, extension of rural electrification program, alternative sites (including of components), construction technologies, and a 'no option';
- To determine the eligibility of the subproject for financing under the subproject considering country's legal provisions & requirements including GoN EPA/EPR, Nepal Rastra Bank guidelines, 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 impact on critical natural habitats;
- To define and prepare an ESMP as well as effective monitoring, reporting and auditing plan for the subproject;
- To define institutional framework required for the execution of monitoring and management program;
- To prepare (i) Occupational Health and Safety Plan, (ii) Emergency Preparedness Plan, (iii) Labour Management Plan, (iv) Gender Development Plan, (v) Transport Management Plan, (vi) Stakeholder Engagement Plan and (vii) Benefit Sharing Plan;
- To identify relevant subproject 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.

1.3 Study Methodology

This ESIA for Amadablam Mini Hydro Subproject has been conducted in accordance with the methodology described in the Terms of Reference cleared by the WB on 04/06/2078 (20

September 2021). The following methodologies have been applied to collect baseline information and impact prediction:

1.3.1 Literature Review

The literature review process started at the beginning of the ESIA study and periodically carried out during the study period till at the stage of draft ESIA report preparation. At the beginning, the approved ToR document for ESIA of Amadablam Mini Hydro Subproject is thoroughly studied and reviewed. The Detailed Feasibility Study including Detail Engineering Design Report 2022 prepared by Communication and Energy Developers (CED) Pvt. Ltd. (reviewed and updated by third party independent consulting firm, ERMC Pvt. Ltd.) is reviewed and consulted for technical information related to the subproject. Available published literature, documents and maps (GON's topographic map with scales 1: 50,000, land use maps, aerial photographs, cadastral survey maps, Google maps etc.) related to the subproject area were reviewed. Previously studied environmental assessment reports of hydropower projects and other related subprojects (EIA of Dudhkoshi 4 and 5) were reviewed. Solukhumbu District Profile, 2072 BS, Rural Municipality Profile of Khumbu Pasanglhamu 2076 BS, reports published by Central Bureau of Statistics (CBS) etc. were used for collecting existing rural municipality and district level information on physical, biological and socio-economic environment. Climate related data were sourced from Department of Hydrology and Meteorology (DHM). Other information was obtained from SNP Office, Department of National Parks and Wildlife Conservation (DNPWC), UNESCO, RAMSAR, Birdlife International, WWF, IUCN, ICIMOD, other line agencies, related NGOs and so on.

Topographic and Geological maps of the subproject area were reviewed to collect information about land use, topography, geology and other features. Study of climate of the subproject area was done by analyzing the data of the nearest meteorological station and monitoring station at Namche Bazar. Similarly, remaining climate data were obtained from meteoblue.com. Other information such as Hydrology and Sedimentation, Geology and Seismicity, Watershed etc. were collected from the secondary sources such as topographic, geological and seismic hazard maps and subproject technical reports and database of DHM etc.

The information on forest and wildlife were obtained from the MoFE, SNP, DNPWC, other institutions and research papers. District/Rural Municipality level socio-economic and cultural information such as population of affected RM, household size, male-female ratio, infrastructures, ethnicity, schools, development activities in the subproject area were collected from Central Bureau of Statistics (CBS), RM profile, district profile and other available literatures.

Relevant laws, acts, rules & regulation, policies, guidelines, strategies were reviewed in order to avoid any form of non-compliance. The published literatures on the biomass, flora and fauna, rare/endangered /protected species in and around the subproject area were reviewed. To justify to the local concerns and local information available in the secondary literatures, officials of the local and district level, particularly Rural Municipality, District Coordination Committee, Sagarmatha National Park and Buffer Zone Community Forest User Groups were also consulted to seek site-specific information of the subproject area. Furthermore, the local and national institutions working in the subproject area were consulted to verify the subproject specific information related to environmental and social aspects.

1.3.2 Data Collection by using Checklist/Matrix and Questionnaire

Data on settlement information, wildlife and non-timber forest products (NTFPs) were collected through checklist and semi-structure questionnaires (**Annex V**).

1.3.3 Field Assessment: Observation, Photographs and Sampling

1.3.3.1 Physical Environment

In order to collect baseline information on the physical environment, field investigation along the proposed subproject area was carried out. The information on land use patterns, topography and soil erosion were collected through consultation, direct observation and field mapping.

Water sample was taken from the two location of the subproject area—one from the Cholunche Khola (Intake Area) and another from drinking water supply located at Pangboche on 29/07/2078 (15 November 2021). The water quality analysis was conducted for sixteen different parameters (6 - physical, 9 - Chemical and 1- microbial parameters) in the Nepal Academy of Science and Technology (NAST), (**Annex-X**). The RT-911A Mini Sound Level Meter was used to measure the sound pressure level at two locations (headworks and powerhouse). In addition, the air quality was assessed based on direct observation. The slope stability and landslides, fan deposits and rock fall within the subproject area were studied through site observation by geologist during DFS and on-site delineation in maps, which is reviewed and verified by third party independent Geological Specialist. Moreover, the information on flooding events (using HYDEST method), glacier lake outburst flood (GLOF) events, seismic history, landslide events and locations and land degradation process etc. were collected through discussion with the local communities.

1.3.3.2 Biological Environment

The information on fauna and flora, protected, rare and endangered species and sensitive habitats in the subproject areas were collected through site visit and transect walk survey. Existing situation and possible impacts on wild fauna were studied in relation to risk of subproject implementation. Forest inventory was done through purposive sampling with nested quadrate methods within the subproject area to estimate number of tree and volume of timber to be cleared. Altogether 40 sampling points were selected as shown in **Figure 1**. The SNP, Buffer Zone User Committee (BZUC) and local people of the subproject impact area were consulted on use and management of forest resources including availability and use of NTFPs as well as MAPs, ethno-botanical importance of the plant species, problems encountered in use and management of forest resources and the possible impacts of the subproject on the local flora.

Periodic consultations were done with SNP officials (Chief Conservation Officer and Assistant Conservation Officer), representatives of RM and BZMC, and locals about presence of fish in the Cholunche Khola. SNP management plans, annual report of SNP and other literatures were also referred for information on fisheries. Based on the reporting indicating absence of fish, which might be due to high slope gradient, altitude and extreme cold water, sampling was not done for the presence of fish.

Agro-biodiversity of the subproject area is recorded in a data sheet (**Annex VI**) through consultations with local informants. Information on availability of fauna was also collected in consultation with local informants, members of forest user groups and other knowledgeable locals. Interaction with local people and consultation with relevant government organizations

such as MoEWRI, MoFE, DNPWC, SNP, BZUC, RM was done for wildlife diversity and terrestrial as well as aquatic flora and fauna. The loss of protected, rare and endangered species based on the CITES Appendix, IUCN Red Data and Government of Nepal protected lists were enumerated in the field throughout the subproject area.

Figure 1: Sampling points

Forest and Vegetation

As there is no forest cover area in the power generation sites, forest inventory was not relevant. Sampling plots were laid down only for herbs with the size of 1x1m^2 square plots one each in 3 sites - i) intake and headwork site, ii) Penstock Alignment and iii) Tailrace Area

Plot Design:

Square plots of 1x1m^2 were laid down for herbs and grasses, at the centre of 20x20m^2 of tree plots. Thus 3 plots were laid down in each sampling points. Altogether 40 sampling points were laid down. Thus, a total area of 40 m^2 for herbs/grasses was surveyed.

Calculation of Importance Value Index

The dominancy of any species in an area is estimated with respect to its importance value which is the combined effect of relative density, relative frequency and relative coverage.

$IVI = RD + RF + RC$ …… (i)

Where,

RD = Relative Density

RF= Relative Frequency

RC= Relative Coverage

Density:

Shrub/Herb density is calculated as follows;

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

Where,
I = Total number of individuals
A = Area of each sampling plot
N = Total number of plots

$Relative\ Density\ (\%) = \frac{D}{TD} x100$……... (viii)

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

Frequency:

$Frequency\ (\%) = \frac{E}{N} x100$ ……. (ix)

Where,
E = Encounter (Total Number of plots in which an individual species occurred)
N = Total number of plots

$RelativeFrequency\ (\%) = \frac{F}{TF} X100$……. (x)

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

Coverage:

$Coverage\ (\%) = CI$ …….. (xi)

Where,
CI = Coverage of an individual species in a sampling plot

$Relative\ Coverage\ (\%) = \frac{TCI}{TC} X100$…… (xii)

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

Wildlife and Avian Fauna

Information on wildlife (including mammalian and avian fauna) of the subproject area was gathered using both direct and indirect methods. According to locals and the SNP, fishes and reptiles are absent in the area. The transect walk method was used for wildlife study in the subproject area. Animals and birds spotted along the route and information on the habitat where such observations were found were recorded. Moreover, identification of pug marks/footprints, droppings/pellets, ground digging and marking, animal remains such as skin, fur, feathers, and carcasses, dwellings such as nests, holes and burrows etc. were used in order to document presence of particular wild animals and birds. Calls and singings of birds were recorded as far as identified. The collection of the wildlife specimens was carried out whenever possible and photographs were taken of uncollected items for the purpose of identification of specimens. Such information was also validated by means of consultation with local informants. Special faunal record data sheets were prepared and used to record faunal presence, their abundance and other associated features in the subproject area (**Annex VII**). Additional information on animal presence, movements issues and conflicts were obtained by using indirect methods i.e. discussions with a range of stakeholders that included local people, BZUCs etc.

Fish

The water bodies have cold temperature and low nutrients. This prevents the high elevation lakes, streams and rivers from supporting a high diversity of aquatic life (SNP, 2016). The snow-fed Dudhkoshi originating from the Himalaya is the main aquatic habitat in the Khumbu region. However, there is no evidence of fish in Dudhkoshi River system in

Khumbu region due to icy-cold temperature (SNP, 2016). The representatives from SNP, Buffer Zone Management Committee, RM and local people were also consulted regarding availability of fishes in Cholunche Khola and the existence of fish was not reported. No primary data was collected on fishes based on the reporting of non-presence of fish.

1.3.3.3 Socio-economic and Cultural Environment

Data on socio-economic status and cultural aspects were collected from direct and indirect impact areas. The methods utilized for collection of socio-economic data from the primary sources include followings:

Household survey: Household (HH) survey were conducted in direct impact zone and indirect impact zone of the subproject by using structured questionnaires to obtain baseline information on demographic and educational status, land ownership patterns and farm practices, energy sources, basic health conditions, common diseases, etc. (**Annex VIII**). The information on socio-economic and cultural activities as well as customs & tradition of the subproject area was collected by conducting Focus Group Discussion (FGD) with relevant stakeholders such as BZUC, ward office of RM, women groups etc. In addition, Key Informant Interview (KII) was conducted to collect the information on Settlements (**Annex IX**).

1.3.4 Laboratory Analysis for Water Quality

Water samples were collected from the two locations of the subproject area—one from the Cholunche Khola (Intake Area) and another from drinking water supply located at Pangboche on 29/07/2078 (15 November 2021) to establish the baseline on water quality. The water quality analysis was conducted for sixteen different parameters (6 - physical, 9 - Chemical and 1- microbial parameters) in the Environment and Climate Study Laboratory of NAST (**Annex-X**).

1.3.5 Methodology for Impact Identification, Prediction and Ranking

The information collected from different sources was processed and analyzed according to the physical, biological, socio-economic and cultural environment within the Zone of Influence (ZoI). The secondary data collected were used as the major source for validation of primary data during the field survey. The generated information from the primary source was analyzed and tabulated. The likely impacts were assessed covering both adverse and beneficial ones.

Based on identification of the impacts, their predictions were done to forecast the changes in local environment. The various methods, such as trend analysis, cause and effect relationship, expert judgment, etc were used for impact prediction. The environmental impacts were evaluated on the basis of guidelines given in the National EIA Guidelines (1993), based on the magnitude, extent and duration of the impact. Experts' judgments and experiences from the similar projects were adopted for the quantification of the impacts. If the impact lasts up to 3 years it is termed as short term (ST), if it continues for 3 to 20 years it is termed as medium term (MT) and if it lasts beyond 20 years it is considered as long term (LT). The impact which occurs within the subproject area is termed as site specific (SS) and which goes up to municipality level is termed as local (Lo) and which goes up to more than two RMs or Municipalities is termed as regional (Ro). Moreover, the impact which is irreversible is termed as high (H), which is in partly recoverable in long run is termed as moderate (M) and which is reversible is termed as low (L). The impact which has direct effect is termed as

direct (D) and which has indirect effect is termed as indirect (I). For the impact evaluation the matrix method with numerical ranking is used for the quantitative ranking of the predicted impacts.

Table 1: Numerical Scales as Proposed in the National EIA Guidelines

Magnitude	Score	Extent	Score	Duration	Score
High/Major	60	Regional	60	Long Term	20
Moderate/Medium	20	Local	20	Medium Term	10
Minor/Low	10	Site-specific	10	Short-Term	05

(Source: National EIA Guidelines, 1993)

The cumulative scores on this analysis have been used to decide the significance of the impacts. **Table 2** depicts the cumulative score of level of significance:

Table 2: Cumulative Scores of Levels of Significance

Total scores	Significance of Impacts
Up to 44	Insignificant
45-74	Significant
Beyond 74	Very significant

(Source: National EIA Guidelines, 1993)

1.3.6 Preparation of ESIA Report

This ESIA report has been prepared based on detailed environmental and social assessment of the subproject and incorporating the comments/opinions/suggestions and feedbacks received during the public hearing and consultation with relevant stakeholders.

1.3.7 Notice Publication, Public Consultation and Interaction

The public notice was published in the national daily newspaper "Arthik Abhiyan" on 18/07/2078 (4 November 2021) to inform the local public and the stakeholders about the subproject and seeking comments/opinions/suggestions and feedbacks as required by the prevailing law (**Annex XI**). The notice was affixed at the public entities and circulated various organizations and institutions of the subproject area to seek their comments/opinions/suggestions and feedbacks on the potential adverse and beneficial environmental and social impacts of the subproject. Deeds of the public notice affixation are presented in **Annex XII**.

Table 3: Summary of the Meeting Minutes during Public Consultations

Date	Location	No. of participation			Issues and Suggestions	Response from ESCO
		Male	Female	Total		
27/07/2078 (13 November 2021)	Phortse, KPLRM-4	20	2	22	1. Management of existing Phortse micro hydro project 2. Low tariff for low income households 3. Consideration of birds, animals and helicopter movement while crossing of streams	• ESCO has done power purchase agreement with the existing micro hydro. • Tariff for electricity will be made in close coordination with community so that all can use the electricity at affordable rate

Date	Location	No. of participation			Issues and Suggestions	Response from ESCO
		Male	Female	Total		
					and rivers by Transmission and Distribution lines 4. Management of Spoils generated during laying of transmission and distribution lines underground as it affects on trails 5. The subproject should be implemented immediately as it benefits to people and forest	• It is technically designed in such a way which won't pose any harm to birds & animal. As the crossing of insulated cable of T& D is at the height of bridge it won't create any disturbance to helicopter as well. • Trenches especially made for undergrounding the penstock pipe and T& D lines will be reclaimed immediately to avoid accidents & People will be well informed about the trail's obstruction with proper signage and route diversion will be arranged, if required. • ESCO has planned to initiate the subproject development once EIA approved from GoN
28/07/2078 (14 November 2021)	Upper Pangboche, KPLRM-4	10	24	34	1. Low impact as the site is far from settlement, out of forest, no tree felling and no need of private land acquisition; 2. Need to implement immediately as it reduces the dependency on forest, LPG and dung 3. Involvement of locals through share provision 4. Construction during low tourist arrival time	• ESCO has planned to allocate at least 10% of share to the beneficiaries of subproject • ESCO will prepare & implement the work schedule in such a way that the subproject development activities won't create any disturbance to tourists

CHAPTER 2: DESCRIPTION OF THE SUBPROJECT

2.1 General information on the Subproject

The Amadablam Mini Hydro Subproject is a Greenfield subproject and is a run-of -river scheme, which will use water from Cholunche Khola. The subproject plans to provide electricity to 451 households in Chukhung, Debuche, Dingboche, Dole, Mongla, Lawi-Schyasa, Mongla, Lobuche, Luza, Milingo, Mingbo, Mochhermo, Pangboche, Pheriche, Phortse, PhortseTenga, FhungiTenga, Shomare, Thukla, Tyangboche and Worshyo villages of Ward No. 4.

The subproject is planned to develop 911 kW capacity releasing 50% of minimum monthly flow as per "**Directive on Physical Infrastructure Construction and Operation in Conservation Areas, 2065"**[4].

2.2 Location and Accessibility

2.2.1 Description of Location

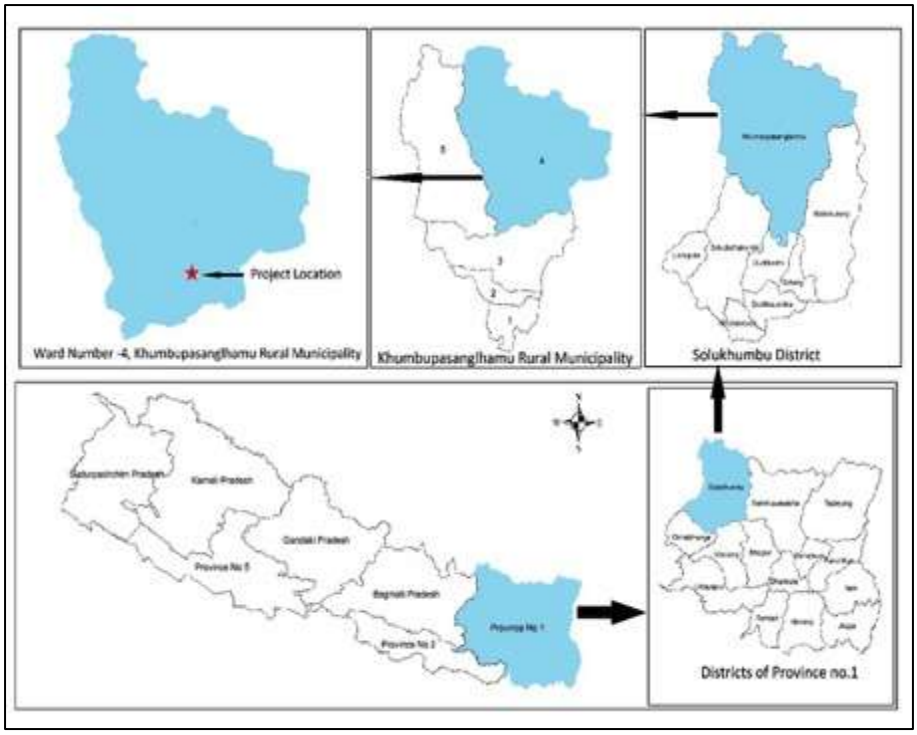
The subproject is proposed to be implemented in Pangboche, Khumbu Pasang Lhamu Rural Municipality, Ward No.4, Solukhumbu district. Geographically, the proposed subproject lies between 27°50'50"N to 27°51'40"N latitude and 86°47'49"E to 86°49'19"E longitude. The elevation within the subproject area varies from 3951.18 m to 4422 m above mean sea level (amsl).

Major subproject components such as headworks (including intake, desanding basin), penstock pipe, powerhouse, switchyard and tailrace are proposed to be located on the left bank of the Cholunche Khola, which is a tributary of Imja Khola.

2.2.2 Accessibility

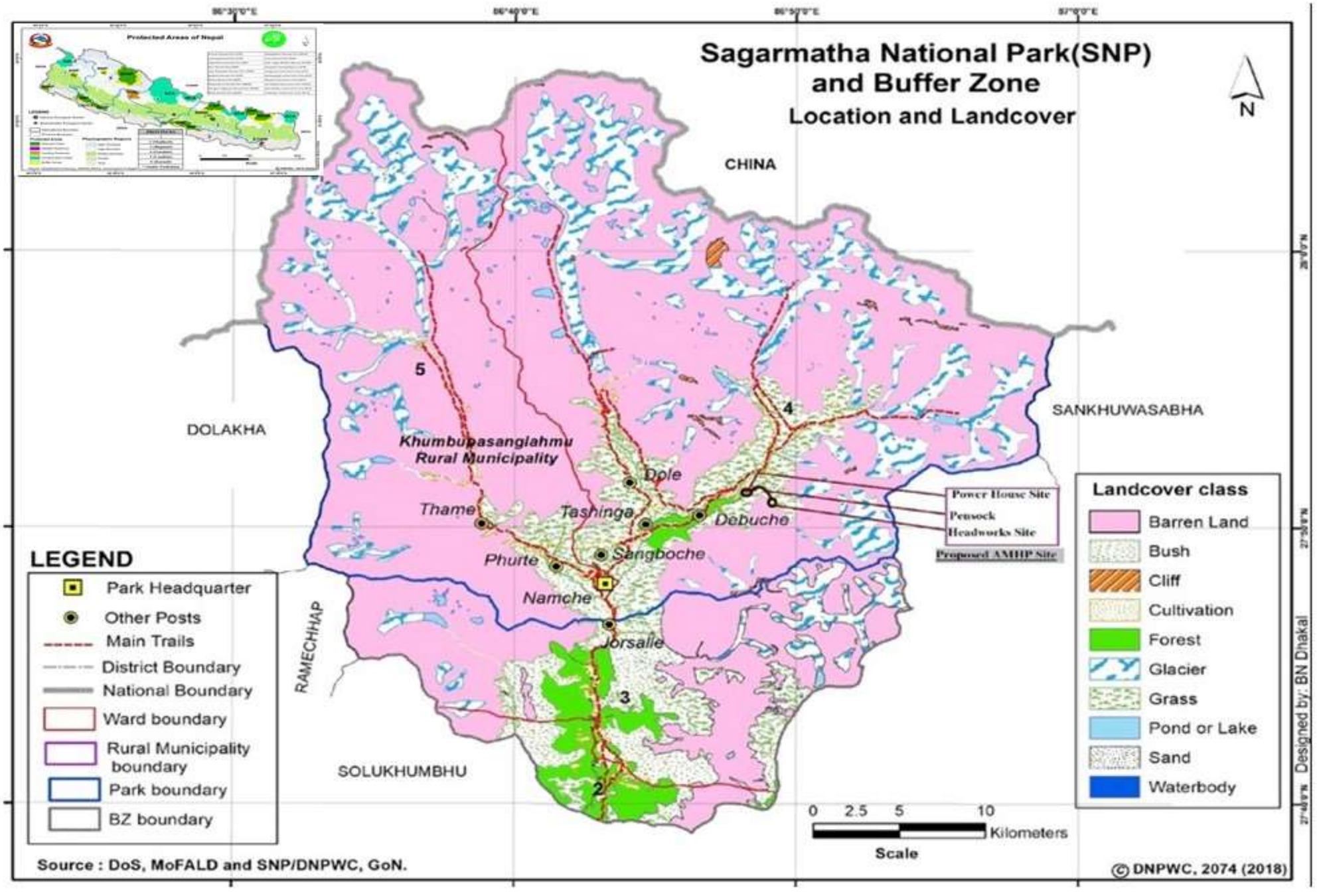
The subproject site can be reached via airplane up to Lukla and then by foot or by helicopter from Kathmandu. Flight from Kathmandu to Lukla takes 30 minutes. Travel from Lukla to Pangboche via Monjo - Namche Bazaar requires three days for a trekker. Construction materials and electromechanical equipment can be transported to the subproject site either by helicopter or mules. Alternatively, the subproject site can be accessible by a blacktopped motorable road up to Salleri bazzar, headquarter of Solukhumbu district. From Salleri bazzar, there is a seasonal road up to Buksa which is 48 km and from Buksa the subproject site is accessible either by helicopter or by foot. Travel distance from road head from Buksa via Lukla to subproject site is approx. 65 km and requires 6 days for a loaded porter. From Lukla to Pangboche, it is approximately 35 km foot trail.

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

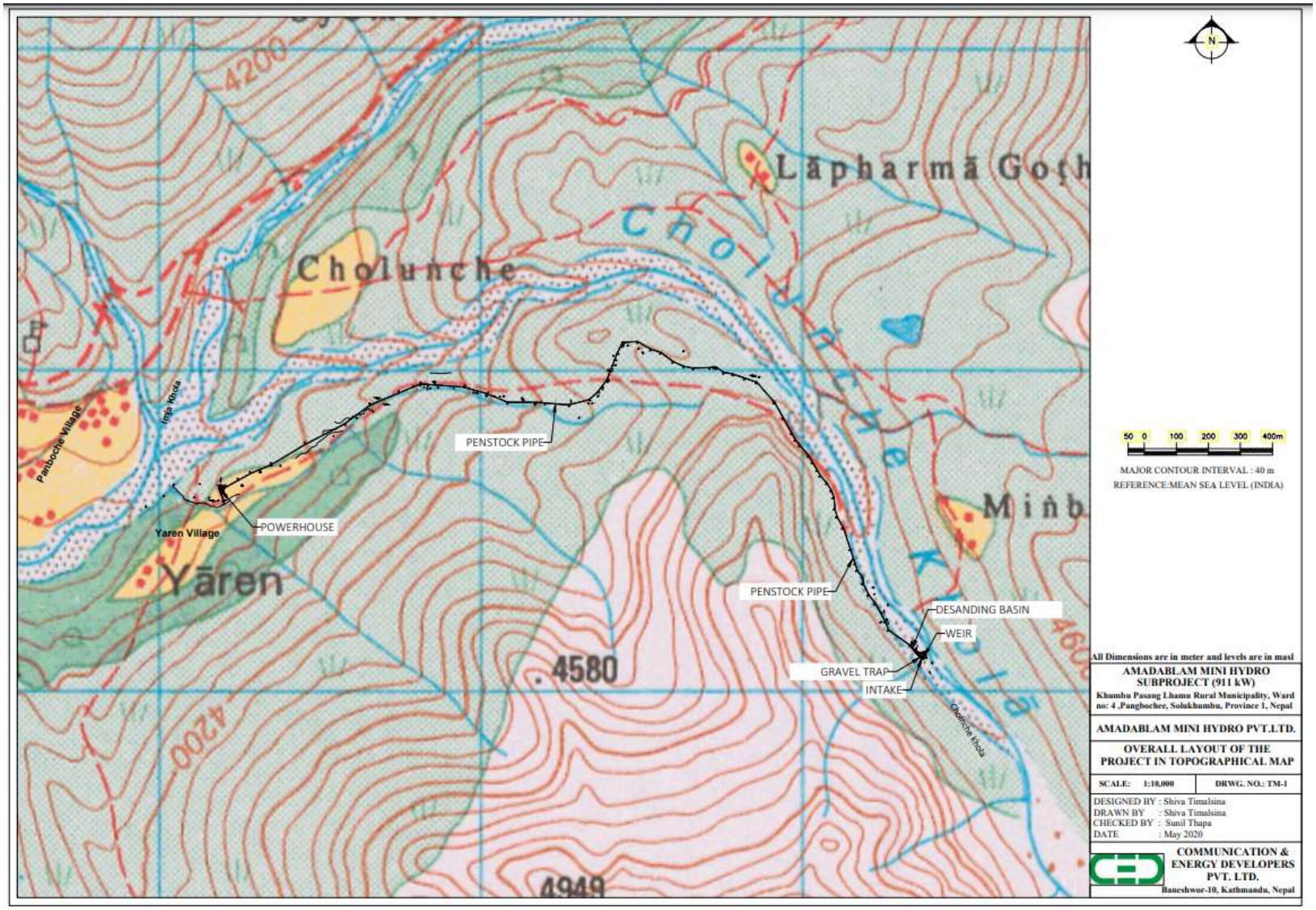


Map 1: Subproject Location in District Map (Shape file modified by CED)

Map 2: Subproject Location on Google Earth Map

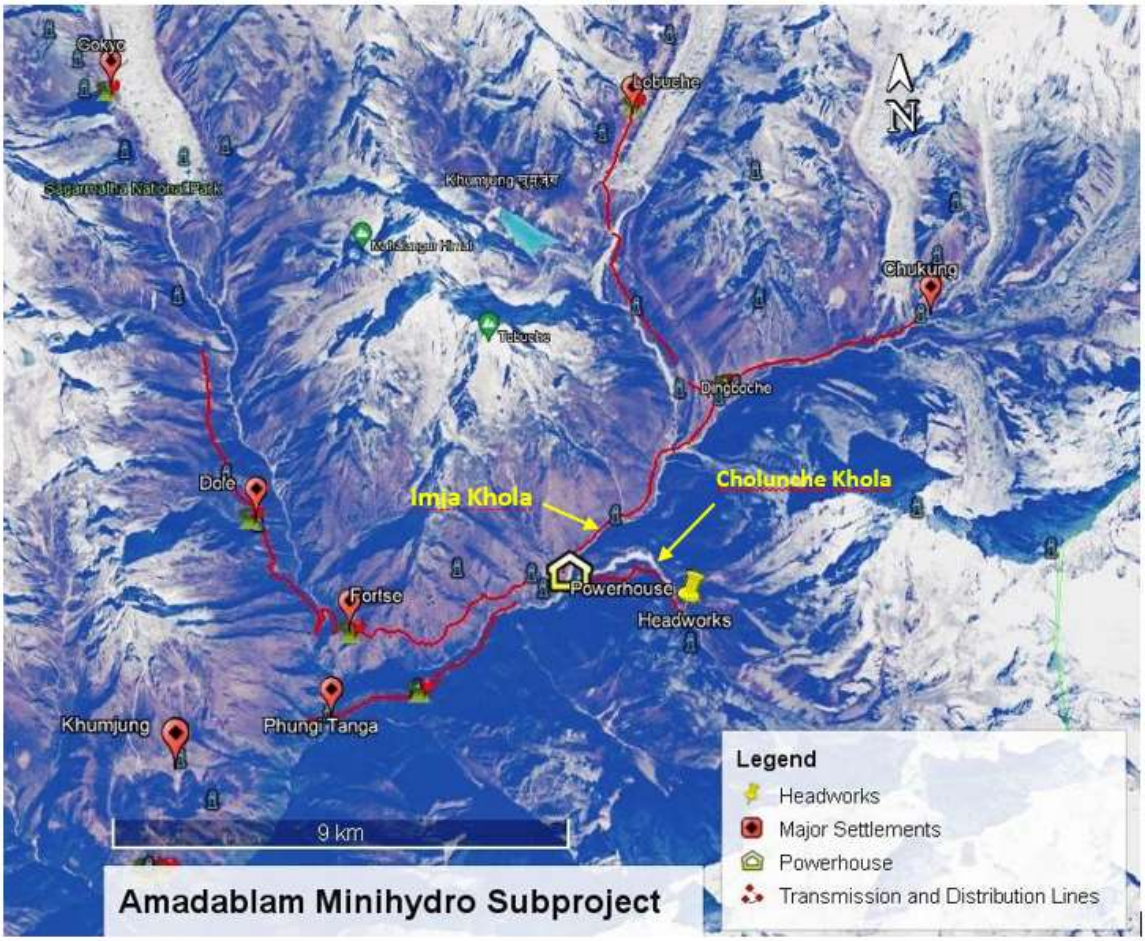


Map 3: Subproject Location within Sagarmatha National Park Boundary



Map 4: Subproject Location in Topographic Map

Map 5: Major Settlements in Ward No. 4 of Khumbu Pasanglhamu RM



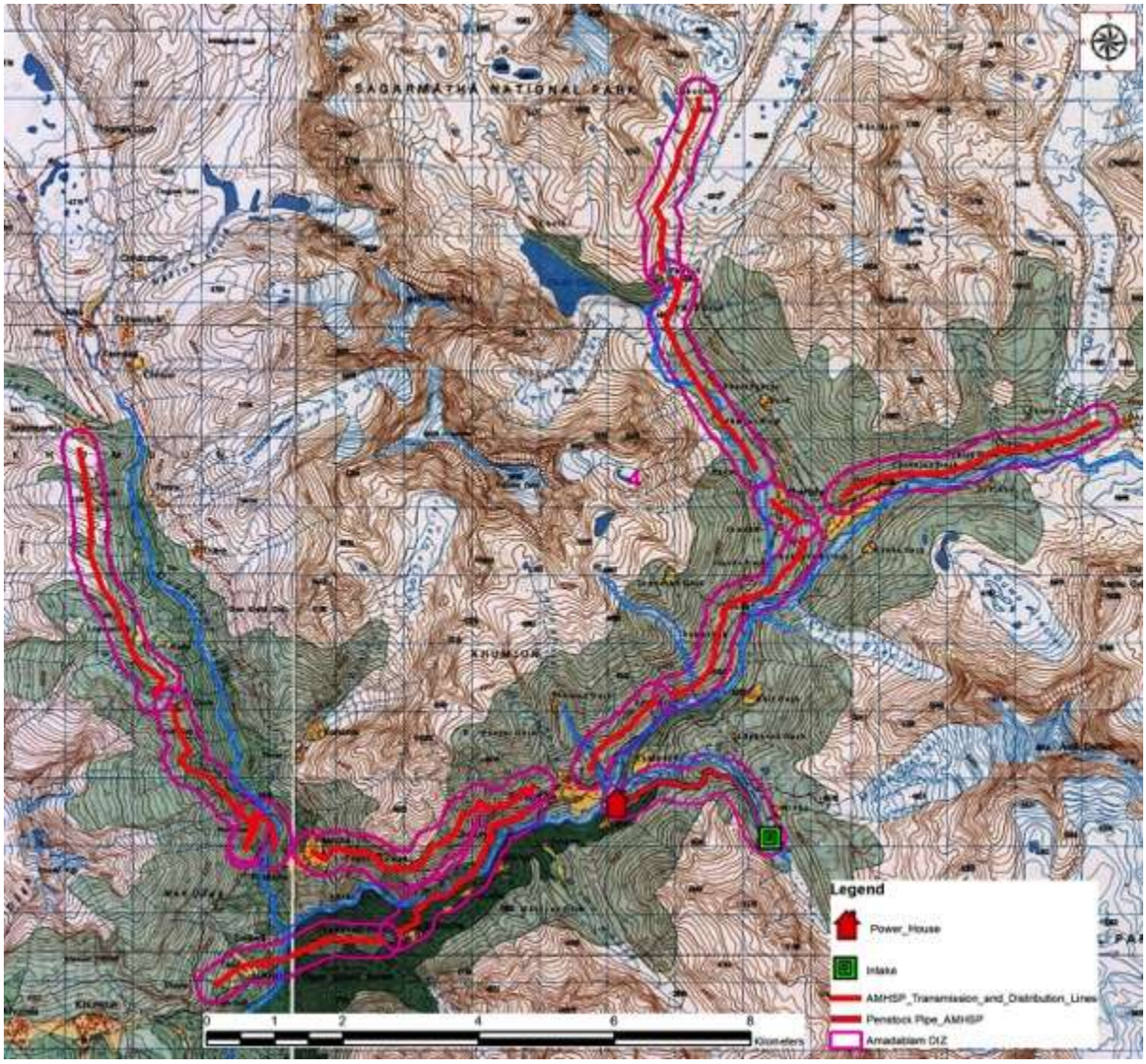
Map 6: Subproject Structure, Transmission and Distribution Lines

2.2.3 Subproject Area of Influence

The subproject area consisting of the subproject site and the area that will be impacted due to the construction and operation activities of the proposed subproject is defined as the Area of Influence (AoI). The AoI is classified into two areas - Direct Impact Zone (DIZ) and Indirect Impact Zone (IIZ) - based on the nature and the extent of the impact of construction and operation of subproject components.

2.2.3.1 Direct Impact Zone (DIZ) Construction & Operation

The DIZ of the Amadablam Mini Hydro Subproject area consists of the subproject structures and facilities that will be directly impacted due to the construction and operation of the subproject such as headworks, reservoir, powerhouse, penstock and T&D line. In terms of headworks and powerhouse, 100 m around the structure and in terms of penstock and T&D line 10 m around the structure will be taken as the Direct Impact Zone, all of which are in Ward No. 4, Map 7. The term "Core Subproject Area" is also used to imply the area fenced off for safeguarding of various structures and facilities as well as the area permanently acquired by the subproject. There is not any settlements and private properties in DIZ area of headworks, powerhouse and Pestock.



Map 7: DIZ of AMHSP

2.2.3.2 Indirect Impact Zone (IIZ)

The Indirect Impact Zone (IIZ) of Amadablam Mini hydro is the surrounding area around the DIZ, up to 10 m beyond the DIZ, where the indirect impact of the construction and operation activities occurs due to the movement of the workers, transportation of construction materials etc. These areas lie within the Ward No. 4 of Khumbu Pasanglhamu RM.

2.2.4 Nearby Communities and Forests, Environmentally Sensitive Areas, and Heritage Sites

The nearest settlement from powerhouse is Pangboche, which is approx.1.5 km away and mostly resided by Sherpa people. The presence of other caste/ethnic groups is negligible. Other settlements where power will be distributed are Chukhung, Debuche, Dingboche, Dole, Lawi-Schyasa, Mongla, Lobuche, Luza, Milingo, Mingbo, Mochhermo, Pangboche, Pheriche, Phortse, PhortseTenga, Mongla, Fhungi Tenga, Shomare, Thukla, Tyangboche and Worshyo. All the settlements lie in Ward No. 4 of Khumbu Pasanglhamu RM. All the areas within the Sagarmatha National Park (SNP), except private registered land, belong to the SNP, which is listed as the World Heritage Site under criteria (vii). There are 9 buffer zone user groups under Khumbihulya Buffer Zone User Committee in the subproject area. The

subproject might have direct impacts on the grassland as all the infrastructures lie in grassland area. The transmission and distribution lines will be underground along the foot trails, except in river crossing areas.

2.3 Salient Features

The salient feature of the proposed subproject is given in **Table 4.**

Table 4: Salient Feature of the Subproject

1	**Location**		
	Province	:	1
	District	:	Solukhumbu
	Rural Municipality	:	Khumbu Pasanglhamu Rural Municipality Ward No. 4
	Geographical Coordinates Latitude Longitude	:	27°50'50"N to 27°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 masl
	Power House	:	27°51'12.98"N, 86°47'49.21"E, elevation 3951.18 masl
	Total Households to be Electrified		451
2	**General**		
	Name of River	:	Cholunche Khola
	Nearest Town	:	Namche Bazaar (13 Km)
	Type of Scheme	:	Run of River
	Gross Head	:	471.87 m
	Net Head		448.86 m
	Installed Capacity	:	911 KW
	Average Annual Energy	:	7,225,781.76 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	:	12 m
	Height	:	2.57 m
	Crest level	:	El. 4423.57 m
5	**Reservoir (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	:	1 No.
	Size of Opening	:	1.5 m (B) x 0.3 m (H)
	Intake Invert Level	:	El. 4422.00 m
	Coarse Trashrack (1.4 m x 1.5 m)	:	0.7 m x 0.37 m (6 Pcs)
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
	Fine Trashrack (2m x 1.5 m)	:	1m x 0.37 m (6 Pcs)
9	**Headrace Pipe**		
	Type	:	Pressurized pipe flow, MS
	Length	:	10 m
	Diameter	:	450 mm
	Thickness	:	6 mm
	Shape	:	Circular
	Type	:	Pressurized pipe flow
10	**Desanding Basin cum forebay**		
	Type	:	Conventional with head pond
	Size (L x B x H)	:	26.50 m x 2.65 m x 2.30 m
	Number of Bay	:	1 No.
	Nominal size of trapped particle	:	0.15 mm
	Fine Trashrack (2.65 m x 1.6 m)		0.82 m x 0.41m (10 Pcs)
11	**Trashrack heating system**	:	Heater 1 at desilting basin 4.5 kW Heater 2 at desilting basin 1.5 kW Heater 3 at gravel trap 3.0 kW
12	**Penstock Pipe**		
	Type	:	Mild Steel Pipe (Buried)
	Internal Diameter	:	400 mm dia
	Thickness	:	6 mm to16 mm
	Branch Pipe	:	MS 200 mm dia, 16 mm thick 16 m long
	Total Length of the pipe	:	2930 m length
	No of Anchor Block	:	58 Nos
12	**Powerhouse**		
	Type of powerhouse	:	Surface Type

	Size (L x B x H)	:	19.95 m x 7.0 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, 6 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	:	0.125 m^3/sec
	Rated Output (Mechanical)	:	485 kW 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**		
	i. Power Transformer		
	Type	:	ONAN Cooling, YNyn0, 3 phase
	Rated capacity	:	630 kVA
	Voltage ratio	:	0.4/11 kV
	Efficiency	:	98%
	No of units	:	2 Nos.
	ii. 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.
			Total 14 Nos.
18	**Transmission & Distribution line**		
	A. Single Line Distribution		64.45 km
	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)	:	1.0 km
	1.1 kV 95 sq.mm. 4 Core XLPE Insulated Unarmoured Aluminium Cable	:	12.45 km
	1.1 kV 35 sq.mm. 4 Core XLPE Insulated Unarmoured Aluminium Cable	:	9.50 km
	1.1 kV 25 sq.mm. 2 Core XLPE Insulated Unarmoured Aluminum Cable	:	1.50 km
	B. Distribution Transformer		
	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 River Crossings		930 m
	Chukung	:	70 m
	Dingboche	:	50 m
	Thukla	:	170 m
	Power House	:	120 m
	Phortse	:	100 m
	Dole	:	70 m
	Luza	:	70 m
	Machhermo	:	80 m
	Milingo	:	100 m
	Fungi Tenga	:	100 m

	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	:	ACSR Conductor (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 °E;Y:27.957777 °N [North most]
	Coordinate of DB (Chukung)	:	X: 86.871694°E;Y: 27.904166°N [North-East Most]
	Coordinate of DB (Machhermo)	:	X: 86.715327°E;Y: 27.902013°N[North-West Most]
	Coordinate of DB (Lawi Schyasa)	:	X: 86.739166°E;Y: 27.830000°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) (451 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	Mingbo	:	13
10	Machhermo	:	102
11	Pangboche	:	35
12	Pheriche	:	106
13	Phortse	:	3
14	PhortseTenga	:	9
15	Shomare	:	19
16	Thukla	:	2
17	Tyangboche	:	7
18	Worshyo	:	1
19	Mongla	:	7
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	:	7,225,781.76 kWh
22	**Subproject Cost Estimate**		
	Total Subproject Cost with VAT and Provisional Sums and IDC	:	NRs. 618,901,638.89
	Subsidy (GoN/AEPC/MGEAP)		NRs. 128,307,000.00 (20.73%)
	Loan (WB/AEPC/MGEAP)		NRs. 366,814,311.11 (59.27%)
	Equity (ESCO)		NRs. 123,780,327.78 (20.00%)
	Cost Per kW	:	NRs. 679,365.14
	Net Present Value (@ 6% discount factor)	:	NRs. 245,613,643.75
	Subproject rate of return	:	11.21 %
	Payback	:	7.68 years
	BC Ratio	:	1.35
23	**Construction Period**	:	18 Months

2.4 Technical aspects

2.4.1 Subproject Components

Water of Cholunche Khola will be diverted by constructing 12 m long and 2.57 m high diversion weir during the construction of headworks to generate annual average energy of about 7,225,781.76 kWh. The major civil components of the subproject are as follows.

2.4.1.1 Headworks

The headworks of the proposed subproject are situated at about 3.5 km upstream from the confluence of Cholunche Khola and Imja Khola 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 masl. The bed level of river at upstream side of weir is 4422.00 masl and at downstream of weir is 4421.00 masl. The high flood level at weir is 4424.33 masl for flood discharge of 15 m^3/s at 100 yrs. return period. The platform level for gates operation is fixed at 4424.83 masl.

ii) Undersluice

The width and height of undersluice provided is 1 m. The bed level of undersluice is fixed at 4421.09 masl. The opening of undersluice is designed to pass 20% of design flood discharge for weir. Sluice gate is provided at undersluice to control the flow of water in river.

iii) Side Intake

The orifice type side intake is located about 5m upstream of weir axis. The width of orifice is 1.5 m and height is 0.3 m. The orifice is capable of diverting 0.30 m^3/s of discharge which is 20% more than the design turbine discharge. A vertical sill of 0.4 m height is provided in front of orifice to prevent entry of bed loads. Sluice gate is provided at intake to control the flow of water in gravel trap.

iv) Gravel Trap

Gravel trap is located just after the intake to trap the gravels and flush it back to the river. The design size of particle to settle is 2 mm. The length of gravel trap is 8 m, width is 1.5 m and depth is 1.3 m. The size of flushing gallery provided at gravel trap is 0.4 m x 0.4 m. The outlet from gravel trap is pressurized headrace pipe to the desanding basin. Fine trash rack is provided at outlet to prevent entry of large gravel particles and other floating particles into the pipe.

v) Headrace Pipe

Headrace pipe of diameter 450 mm and length 10 m 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 of 1.88 m/s in pipe is maintained so that settlement of gravel particles will not occur inside the pipe. The pipe is of mild steel with 6 mm thickness.

vi) Desanding Basin

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

At the end of desanding basin, headpond of length 1.95 m, width 2.65 m and depth 2.05 m is provided to maintain the adequate submergence depth for penstock pipe. Air vent pipe of diameter 100 mm is provided at headpond to release the air entered into the pipe.

2.4.1.2 Penstock Pipe and Supports

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 6 mm to 16 mm. After bifurcation, two manifolds of 8 m length and 200 mm internal diameter and 16 mm thick is provided.

A total 58 numbers 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 7 m interval between two anchor blocks. Powerhouse and tailrace

2.4.1.3 Powerhouse and Tailrace

i. Powerhouse

The powerhouse is located near Pangboche Village on left bank of Imja River. The powerhouse contains two units of turbine and generator, associated electrical and mechanical equipment and a maintenance bay. The powerhouse is surface type and is located at an elevation of 3951.18 m. It contains two units of horizontal shaft Pelton turbine which drives a generator and generates a power of 455.50 kW each, with total installed capacity of 911 kW. The dimension of the powerhouse is 19.95 m x 7.0 m x 5.8 m. Control room of size 3.6 m x 6.3 m is provided for installation of electrical components and an operator's room of size 3.7 m x 3.0 m is also provided.

ii. Tailrace

The water form two units of powerhouse is conveyed to a nearby Kholsi through combination of tailrace canal and pipe. The length of tailrace canal is 18 m and that of pipe is 21m. The diameter of pipe used in tailrace is 400 mm and thickness 6 mm. At outlet portion, gabion and boulder riprap protection are provided to prevent erosion of soil in kholsi.

2.4.1.4 Switchyard Area

An indoor switchyard of 3.55 m X 6.32 m has 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 650 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.

2.4.1.5 Transmission and Distribution Line

The transmission and distribution network are designed considering the following load centers:

Table 5: Transmission and Distribution with Load

SN	Entities	Power Allotted, kW				Total
		1.0	1.5	2.5	4.0	
1	Household	42	161			203
2	Small Hotel		58			58
3	Medium Hotel			71		71

4	Big Hotel				57	57
5	Restaurant		38			38
6	Social Institution				13	13
7	Hospital				2	2
8	Snooker House	3				3
9	Shops	4				4
10	Bakery				2	2
Total Entity		**49**	**257**	**71**	**74**	**451**
Total Allotted Power		**49**	**385.5**	**177.5**	**296**	**908**

(Source: DFS, 2022)

The generated power will be distributed through a 64.38 km long transmission and distribution line. Out of 64.38 km, 40 km is underground 11 kV line, 23.45 km is underground 1.1 kV line and 0.93 km is 11 kV overhead river crossing. The underground distribution cables will terminate on the distribution boards placed inside the PVC box mounted on the stone masonry slab. The distribution box will be of double door system, (L X B X H = 45 cm X 30 cm X 60 cm), capacity of distributing 15 single phase users, including 1 earth fault relay, and necessary MCBs, with all accessories complete will have the necessary arrangements for the termination of distribution cables and the connection of the service wire.

2.4.2 Ancillary Facilities

a) Site Access

Site access shall be provisioned by using existing foot trails from Pangboche Village to reach to various subproject component sites. The details of the access trails are provided in **Table 6** hereunder.

Table 6: Site Access

SN	Description	Length	Width of trail	Remarks
1	Pangboche to Powerhouse	1.60 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 camp for the headworks will be constructed on the left bank of the Cholunche Khola whereas the camp for the powerhouse will be constructed on the left bank of the Imja Khola.

c) Material Storage and Workshop

Material storage and mechanical workshops will be located on the left bank of Cholunche Khola, both at headworks and the powerhouse location.

d) Quarry Site and Burrow Pits

Local construction material requirement will be minimal as depicted in Table 7 below and the sites have been identified based on geological investigation. Hence, the construction material will be collected from the riverbank without disturbing the riverine ecology. Various probable quarry sites have been identified based on geological investigation which is

discussed below in Table 7. The identified sites are temporary and approval for the sites will be taken from the RM before starting the construction work. Rehabilitation plan of the sites will be prepared and reviewed before the start of construction works.

Table 7: Proposed Construction Material 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°47'49.21"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

(Source: DFS, 2022)

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 wastewater management facilities. These will be temporary facilities to be demolished at the end of the construction period.

f) Spoil Volume & Disposal Area

The spoil generated during the execution of the subproject components will be utilized to label the surrounding area of intake and power house. However, remaining spoil will be disposed to the already identified disposal sites located on the left bank of the Cholunche Khola, which will be reinstated after the completion of all construction related activities. These sites are GoN land and needs to be acquired for short term lease and prior approval for the sites will be taken from the RM before starting the construction work. Rehabilitation plan of the sites will be prepared and reviewed before the start of construction works.

Table 8: Proposed Spoil Disposal Sites for AMHP

SN	Location	Coordinate		Ownership
		N	E	
1	Intake	27°50'56.52"	86°49'6.15"	GoN Land
2	Powerhouse	27°51'12.98"	86°49'49.21"	GoN Land

(Source: DFS, 2022)

g) Materials and Equipment Transportation

The construction materials and electromechanical equipment will be transported to the subproject site by appropriate means of transportation. As most of the external materials and equipment will be bought from the factory (away from the Solukhumbu), they will be transported up to Buksa by vehicle and then air lifted to the subproject site.

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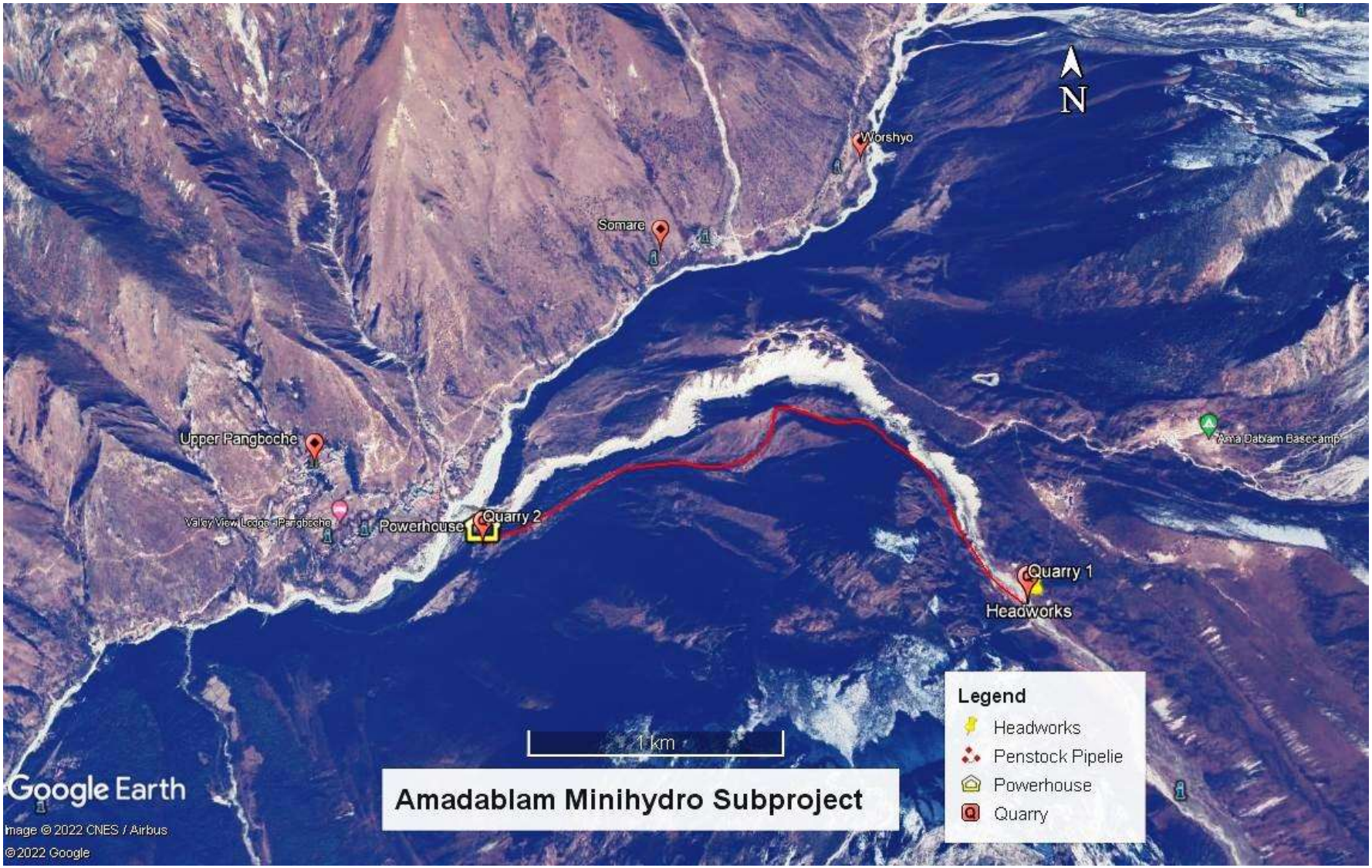


Map 8: Quarry Sites

2.4.3 Subproject Equipment and Civil Works

Subproject Mechanical equipment such as penstock pipe, turbine, governor, gate, valves, racetrack etc. and the electrical equipment such as generators, transformers, transmission and distribution lines, Distribution box, switchyard will be used for the subproject. The civil works include construction of diversion weir, intake, gravel trap, approach canal, desanding basin cum forebay, anchor blocks and powerhouse (Table 4).

2.4.4 Subproject Ownership

The subproject is in the ownership of a private sector Energy Service Company (ESCO), Amadablam Mini Hydro Pvt. Ltd., Kathmandu-8, Tilganga, Bagmati Province, Nepal.

2.4.5 Description of Land Required for the Subproject

Approx. 5.711 ha public land is required for the construction of the subproject civil components and provisioning for subproject facilities (**Table 9**). About 0.626 ha land will be acquired by leasing for long term and 5.085 ha land will be acquired by leasing for short term from the GoN.

Table 9: Estimated Land Requirement and Ownership for AMHP

SN	Component	Long term/Land Area (Ha)	Short term/ Land Area (Ha)
1	Headworks	0.097	
2	Office, Powerhouse, Switchyard and Tailrace	0.085	
3	Penstock	0.400	
4	Electric pole at river crossings	0.008	
5	Reservoir	0.036	
6	Underground Transmission/ Distribution Lines		4.550
7	Spoil Disposal Sites		0.025
8	Quarry and Borrow Sites		0.38
9	Workshop and Material Storage		0.08
10	Subproject camps		0.05
	Total	**0.626**	**5.085**

(Source: DFS, 2022)

2.4.6 Summary of Subproject Structures and Operating Regime

Basically, there will be two types of structures - power generation and distribution. Generation structures are confined from intake to powerhouse. Generation structures will be located nearby Lower Pangboche village while distribution line will spread from Pangboche to Lobuche in North, Chukung in East, Machermo in west and Lawi Schyasa in South.

Table 10: Subproject Operating Regime

1	Subproject Location		
	Province	:	1
	District	:	Solukhumbu
	Municipality/Rural Municipality	:	Khumbu Pasanglhamu Rural Municipality Ward No. 4
	Subproject Boundary	:	27°50'50"N to27°51'40"N latitude and 86°47'49"E to 86°49'19"E longitude
2	**Structure**		

	Intake	:	27°50'56.52"N and 86°49'6.15"E, elevation 4422 amsl
	Power House	:	27°51'12.98"N, 86°47'49.21"E, elevation 3951.18 amsl
	Transmission and Distribution Lines	:	27°57'28.20"N, 86°48'47.39"E (Northward-Lobuche); 27°49'44.66"N, 86°44'17.22"E (Southward-Lawi Schyasa); 27°54'17.65"N, 86°52'20.19"E (Eastward- Chukung); 27°54'7.40"N, 86°42'54.80"E (Westard- Machhermo)

(Source: DFS, 2022)

2.4.7 Construction, Operation and Maintenance Activities

2.4.7.1 Construction Activities

- **Preparatory works:** Land acquisition, Establishment of construction facilities and Arrangement of burrow area of construction materials
- **Civil works:** Construction activities of subproject components i.e. Headworks, intake, desanding basin, powerhouse, tailrace etc.
- **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:** Transportation and installation of electromechanical equipment i.e. generator, governor, switchyard, transformer etc.
- **Transmission Line work:** Transportation equipment and installation of transformer, underground transmission line, dictribution box, service line etc.
- **Commissioning of Power Plant:** Installation of all electromechanical equipment and testing and commissioning of power plant.
- Institutional arrangement to implement EMIMAP and conduct
- ***Continuation of consultations with stakeholders and functioning of GRM***

2.4.7.2 Operation and Maintenance Activities

- Trial Operation/Staff training;
- Defect liability maintenance;
- Adjustments and provisions;
- Final Bills and Completion Certificates;
- Review of output;
- Availability Declarations;
- & M Scheduling;
- ***Continuation of consultations with stakeholders and functioning of GRM***

2.4.8 Human Resources Requirements (including local and migrant workforce)

It is estimated that approx. 200 unskilled and 80 skilled workers will be involved daily during the peak construction period in two shifts. The details of human resources and their type (in terms of skilled, semiskilled and unskilled) are as follows presented in **Table 11**.

Table 11: Details of Human Resources

SN	Category	Number	Remarks (Migrant/Local)
A	**Skilled Manpower**		**Migrant**
1	Site Engineer	2	
2	Overseer	3	
3	Mason	25	
4	Gabion Mistri	12	
5	Welder	4	
6	Iron Worker	5	

7	Mechanics	2	
8	Electrician	2	
9	Supervisor	5	
10	Foreman	10	
11	Painter	5	
12	Carpenter	5	
	Total	80	
B	**Unskilled Manpower**		**Local**
1	Camp Worker		5
2	Survey Helper		2
3	Mechanics helper		10
4	Watchman		2
5	Welder helper		5
6	Staff man		3
7	Tape man		3
8	Labor		170
	Total		200

(Source: DFS, 2022)

Table 12: Tentative Human Resources' Mobilization in Subproject Development Activities in Quarterly Basis

Project Period	**Type of Human Resource**	**Number**	**Total**
Q1	Skilled	50	200
	Unskilled	150	
Q2	Skilled	70	240
	Unskilled	170	
Q3	Skilled	70	240
	Unskilled	170	
Q4	Skilled	70	240
	Unskilled	170	
Q5	Skilled	40	140
	Unskilled	100	
Q6	Skilled	20	70
	Unskilled	50	

Human Resources will be mobilized on daily basis in two shifts during the construction period

2.4.9 Construction Equipment, Materials and Other Supplies (including estimated numbers/quantities)

Details of equipment required for the execution of the proposed subproject are presented in **Table 13**.

Table 13: Construction Equipment

1**SN**	**Equipment**	**Quantity (Number)**
1	Jackhammer	5 Sets
2	Shovel	85 Sets
3	Pick Axe	30 Sets
4	Rammer	20 Sets
5	Sledge Hammer	20 Sets
6	Wheel Barrow	20 Sets

1SN	Equipment	Quantity (Number)
7	Chisel	20 Sets
8	Gloves	200Sets
9	Helmet	300 Sets
10	Rubber Boots	300 Sets
11	Auto Level	3 Sets
12	Measuring Tape (30 m)	10 Sets

(Source: DFS, 2022)

Approx 783.73 m^3 of concrete and 287.53 m^3 stone masonry work o are estimated to be required for the subproject construction. Sand and stones are locally available materials and will be collected from the quarry sites as shown in Map 8. The main construction materials and their estimated quantity are presented in **Table 14**.

Table 14: 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

(Source: DFS, 2022)

2.4.10 Power Supply Arrangements

As there is no National Grid, two diesel generator sets each with 25 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. LPG will be used for cooking. Alternatively, a nearby existing micro hydro of 25 kW (Pangboche MHP) can be used for the required energy.

2.4.11 Waste Generation and Disposal

The spoil generated during the execution of the subproject components will be utilized to label the surrounding area of intake and powerhouse area. However, remaining spoil will be disposed to the already identified areas nearby intake and powerhouse area (**Table 15**), which will be reinstated after the completion of all construction related activities. Prior approval for the sites will be taken from the RM before starting the construction work.

Table 15: Proposed Spoil Disposal Sites for AMHP

SN	Location	Coordinate		Capacity	Ownership
		N	E		
1	Intake	27°50'56.52"	86°49'6.15"	464.83 cu.m	Public Land
2	Powerhouse	27°51'12.98"	86°47'44.21"	507.62 cu.m	Public Land

(Source: DFS, CED, 2022)

2.4.12 Subproject Implementation Schedule and Construction Work Plan

The proposed Amadablam Mini Hydro Subproject will require an estimated time frame of about 18 months for completion from the date of commencement to the date of commercial operation (**Annex XV**).

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 EIA study. The policies, laws, rules and regulations, and other guidelines and directives, which will govern the undertaking of ESIA, include the followings:

Table 16: Relevant Law, Regulations and Policies

SN	Acts/Regulations/ Guidelines	Relevant Details
1	**Constitution of Nepal**	It has ensured the provision of environmental protection and right to live in clean environment. The article 30 (1) of the constitution has granted 'every person shall have the right to live in clean environment' as a fundamental right for the people while the article 51 (f) (2) of the constitution in its Development policy gives priority for under-developed regions for balanced, environment-friendly, qualitative and sustainable physical infrastructure development. Similarly, Article 51 (g) (5) of the constitution in the conservation, management and use of natural resources policy, negative impacts of industrialization and physical development should be minimized for environmental cleanliness and protection. It has also defined the right of working area of Federal, Provincial and Local Government. According to Constitution of Nepal, Local Level has right over small hydropower project (Annex 8, SN. 19 of Constitution of Nepal).
2	**Plans, Policies and Strategy**	
2.1	**Plan**	
2.1.1	Fifteenth Plan (FY 2076/77-2080/81)(2019/20 – 2023/24)	The plan has emphasized for development of micro and small hydropower for alternative energy promotion. It has expected to generate 13 MW electricity through micro and small hydropower development.
2.1.2	Nepal Biodiversity Strategy and Action Plan 2071-2077 (2014-2020)	The overall goal of the strategy and action plan is to enhance the integrity of ecological systems by 2020, thereby contributing to human well-being and sustainable development of the country. It considers that haphazard development activity is becoming a major threat to the biodiversity. Similarly, it has prioritized for the promotion of hydropower energy to reduce the demand of firewood to protect forest. It also urges for the effective implementation of EIA for conservation of biodiversity.
2.1.3	Nepal Environmental Policy and Action Plan, 2050 (1993)	The Nepal Environmental Policy and Action Plan (NEPAP) endorsed in 1993 recognizes that a growing number of people are exposed to pollution from industrial enterprises and development activities. The Action Plan for infrastructure development within NEPAP recommends the finalization of draft EIA guidelines for water resources, the development of EIA guidelines for road construction and the use of EIA when designing hydroelectric projects.
2.2	**Policy**	
2.2.1	National Occupational Safety and Health Policy, 2076	The policy came to exist to ensure for the safety of workers through reduction of risks at works through appropriate occupational health safety gears and better working condition.
2.2.2	National Environmental Policy 2076 (2019)	GoN has endorsed the 'National Environment Policy-2019′ with the goal to control pollution, manage wastes and promote greenery so as to ensure citizens' right to live in a fair and healthy environment. It

SN	Acts/Regulations/ Guidelines	Relevant Details
		has proposed 10 targets with 6 policies with strategies and working policies for the policy. The six policies are I) Pollution Prevention, Control and Minimization, II) Environmental Mainstreaming, III) Environmental Justice. IV) Public Participation, V) Sustainable Development and VI) Good Governance, Research and Capacity Development It has ensured for the participation of all three Governments while preparation of policy, laws, implementation, monitoring and evaluation of environment sector. It targets to lessen and prevent all types of environment pollutions, manage wastes emanated from all sectors including home, industry and service, expand parks and greenery in urban area and ensure environment justice to the pollution affected population. It has mentioned for mainstreaming the environmental concerns in all phases of development works. It has mentioned the issues of adverse and beneficial impacts of development works, and their monitoring and auditing.
2.2.3	Renewable Energy Subsidy Policy,2073 (2016)	The policy has long term goal to achieve universal access to clean, reliable and affordable renewable energy solutions by 2030. It has taken a strategy to encourage public-private sector participation in the renewable energy technology. To promote renewable energy, it has clearly mentioned to provide subsidy in different category as per districts of Nepal.
2.2.4	AEPC Gender Equality and Social Inclusion Policy, 2075 (2018)	The policy came to the existence for the mainstreaming of rural women, poor, marginalized and vulnerable population, and excluded groups in utilization of various technologies of renewable energy to support for the livelihood enhancement.
2.2.5	Public-Private Partnership Policy, 2072 (2015)	The policy was formulated to enhance public-private sector investment on development and operation of public infrastructure services through the adoption of the PPP model for comprehensive socio-economic development.
2.2.6	Land Acquisition, Resettlement and Rehabilitation Policy, 2071 (2015)	With an aim to improve social and economic status of project affected families by providing fair and adequate compensation, appropriate resettlement and rehabilitation assistances/ allowances, the GoN has released Land Acquisition, Rehabilitation and Resettlement Policy in 2015. The Policy mission is to facilitate timely execution (completion) of development projects by minimizing adverse impacts on economic, social and cultural aspects of affected families/people and the project area. The Policy classifies projects on the basis of numbers of families to be displaced such as; i. High risk project: Project that displaces (both physical and economic) 50 or more families in the mountain region, 75 or more families in the hills and 100 or more families in the Terai plains ii. Medium risk project: Project that displaces (both physical and economic) less than 50 families in the mountain region, less than 75 families in the hills and less than 100 families in the Terai plains. iii. Low risk project: Projects with no physical displacement Project with only economic displacement and None of Affected person loose more than 10% of their productive asset Four approaches for land acquisition has to be adopted namely,

SN	Acts/Regulations/ Guidelines	Relevant Details
		voluntary donation, direct negotiation, land development program and expropriation (Use of eminent domain). The proposed AMHSP falls under low risk project as per the categorization of the Policy.
2.2.7	Rural Energy Policy 2063 (2006)	GoN formulated the policy is to contribute to rural poverty reduction and environmental conservation by ensuring access to clean, reliable and appropriate energy in the rural areas. It has taken strategy to encourage local groups and private sector to distribute the electricity by producing the power up to 1000 kW in rural areas.
2.2.8	Hydropower Development Policy, 2058 (2001)	The main objective of Hydropower Development is to generate/produce electric power at low cost by utilizing water resources available within the country. And to supply/extend reliable electricity service nationwide at reasonable price. Other objectives are to develop hydropower as export orientated commodity and also relate electrification with the economic activities of the country. Some of the highlights of Hydropower Development Policy 2001 are as follows: ● Develop small, medium, large and reservoir type projects considering maximum and optimum benefit to the country with minimum environmental consequences. ● Encourage local bodies, co-operatives and private sectors participation with clear, simple and transparent rules and regulation. ● Develop hydropower as an alternative to Bio and Thermal energy with an aim to contribute in the environmental protection. ● Encourage people's participation in hydropower development with a view to dissemination of benefit at local level also. ● Render priority to Nepalese labour, skill and resources in implementation of hydropower projects.
2.2.9	Environmental and Social Safeguard Policy of AEPC, 2018	AEPC has developed its social and environmental safeguard principles to align with the International Finance Corporation's (IFC)Performance Standards (2012) with 7 principles as follows: i. ESS Policy Principle 1: Assessment and management of environmental and social risks and impacts; ii. ESS Policy Principle 2: Biodiversity conservation and sustainable management of living natural resources; iii. ESS Policy Principle 3: Human Rights; iv. ESS Policy Principle 4: Labour and working conditions; v.ESS Policy Principle 5: Community Health Safety and Security; vi. ESS Policy Principle 6: Land acquisition and involuntary resettlement; vii. ESS Policy Principle7: Resource efficiency and pollution prevention It has also provided Environmental and Social Management Frameworks to categorize the project into A, B or C as per its impact on environment and society. The proposed proposal has been considered as A category project.
2.3	**Strategy**	
2.3.1	National Energy Efficiency Strategy, 2075	One of the objective of the strategy is to maintain environmental balance and bring positive improvements in health by efficient use of energy through the strategic intervention of establishment of policy, legal and institutional frameworks for resources management, resources mobilization, infrastructure development and human

SN	Acts/Regulations/ Guidelines	Relevant Details
		resources development required 5 for energy efficiency and develop national standards for energy efficiency based on established international and regional standards as well as to develop equipment and means for measuring energy efficiency.
2.3.2	National Water Resource Strategy, 2058 (2002)	Nepal has adopted National Water Resource Strategy taking a holistic and systematic approach to develop and manage water resources for sustainable use of resources ensuring conservation and protection of the environment. This strategy underscores the interdependencies between water resource development and environment conservation, and has adopted environment principles related, inter alia, to the integration of ecological aspects at every level of hydropower development process, conserve biodiversity, watersheds and adopt ecosystem approach. The NWRS has a target of developing 820 MW of hydropower by 2063/064 to meet the domestic demand at base case scenario including export to the tune of 150 MW and achieve per capita electricity consumption of 100KWh.
3	**Act, Rules and Regulations**	
3.1	**Act**	
3.1.1	Environment Protection Act, 2076 (2019)	Any development project, before implementation, to pass through environmental study report, which may be a Brief Environmental Study, an IEE or an EIA depending upon the location, type and size of the projects. It has made the provision for the approval agency of environmental study report as per prevailing laws It has also made provision for quality assurance of environmental study reports. According to Clause 3-2-GA of Environment Protection Act, 2019, for the development work or proposal falling under the jurisdiction of local level, Brief Environmental Study (BES) or Initial Environmental Examination (IEE) report should be to the concerned body specified by local law and Environmental Impact Assessment (EIA) report should be submitted to provincial government body specified by state law. The proposed proposal falls under the jurisdiction of Local Government.
3.1.2	Province No. 1 Environment Protection Act, 2076 (2020)	This act has been come to exist to address the environmental concerns of development activities under the jurisdiction of Province 1. It has made the provision of environmental assessment for the development works, projects or proposal under the jurisdiction of the province given in Annex I
3.1.3	Forest Act 2076 (2019)	It has recognized the importance of forests in maintaining a healthy environment. And major objective of the Forest Act is the promotion of a healthy environment. It has made the provision for the approved work plan for different categories of forest, i.e. Community Forests, Leasehold Forests, Private Forests and religious forest. Similarly, the act has made the provision for handover of forest area for physical infrastructure development, and also for environmental examination as per prevailing laws and regulations.
3.1.4	Local Government Operation Act, 2074 (2017)	It has been formulated to assist the local governments to make clarification about their working area demarcation. Similarly, Local Government Operation Act, 2074 BS has provided authority for policy, law, standards, planning, implementation, monitoring and regulatory works (परिच्छेद-३, ११ (२), घ). Thus KPLRM has right to

SN	Acts/Regulations/ Guidelines	Relevant Details
		produce a generation license for the proposed proposal.
3.1.5	Intergovernmental Fiscal Arrangement Act, 2074	It came into the existence for the financial sharing among three level of government in Nepal. It has clearly stated the taxes may levy by Federal Government, Provincial Government and Local Government in Schedule 1, 2 and 3. It has also made the provision of distribution of royalty from natural resources in Schedule 4.
3.1.6	Labor Act, 2074 (2017)	The Act has clearly mentioned about minimum salary, working hours, prohibition of discrimination in terms of ground of religion, colour, sex, caste, tribe, origin, language, ideological conviction or any other similar ground; and prohibition of unequal payment for similar works in term of gender. The Act defines working hours in a day and a weekend leave. Clause 68 to 83 under Chapter 12 gives details for occupational health and safety requirement to be maintained for labors. Child labor (below 14 years) is prohibited. It calls for insurance and safety management and other facilities for labors.
3.1.7	Act to Regulate and Control on International Trade in Endangered Species of Wild Fauna and Flora Act, 2074 (2016)	This acts states about the regulation and control of international trade of such endangered flora and fauna species. The species are protected by CITES against over exploitation and they are listed in three CITES Appendices I, II, and III for different levels or types of protection.
3.1.8	Muluki Criminal Code Act, 2074(2017)	This law has been issued to maintain law and order in the economic, social and cultural spheres in interests of the general public in the country through ethics, morality, virtue and goodness. It has the provision of penalty for various criminal activities. It is relevant to the proposed proposal if any kinds of criminal activities are prevalent.
3.1.9	National Civil Code Act, 2074	This is the law that came into force in order to maintain morality, decency, etiquette and convenience as well as economic interest of the public by maintaining law and order in the country and maintain harmonious relationship between various castes, races and communities, by making just provisions in the economic, social and cultural fields. It has described the right of person in different perspectives from marriage to property. It is also relevant in terms of proposed proposal as implementation of the proposal should not violate others' right and vice-versa. Clause 617 states that the tenure of lease contract lasts for forty years for the construction, development and operation of infrastructure like electricity generation. Clause 640 states about the age of person engaging in the manual works. It states that a person under 16 years should not be forced to engage in physically challenging works. Clause 641 states that workers should not be liable to work more than 8 hours a day and 48 hours a week without extra time payments.
3.1.10	Solid Waste Management Act, 2068 (2011)	The Act clearly envisages about management of solid waste and provision of licensing for management. In such case, the article (7) on discharge of solid waste entails about the person, organization that produces hazardous waste or chemical waste shall have to manage such waste as prescribed (sub article 2). It is restricted that nobody shall do or cause to do the work relating to the solid waste management without obtaining license from the Local Body as

SN	Acts/Regulations/ Guidelines	Relevant Details
		prescribed by article 13 of chapter, miscellaneous sub article 1.
3.1.11	Plant Protection Act 2064 (2007)	The preamble of this act explains that it is expedient to make legal provisions for preventing the introduction, establishment, prevalence and spread of pests while importing and exporting plants and plant products, promoting trade in plants and plant products by adopting appropriate measures for their effective control.
3.1.12	Child labor (Prohibition and regularization) Act, 2056 (2000)	The Act has made the provision of prohibition of engagement of child in factory, mining and similar other risky work and to make necessary provision for health. Child's safety and services and facilities while engaging them in other work.
3.1.13	Electricity Act, 2049 (1992)	Electricity Act governs the use of water for hydropower generation, establishes a system of licensing, sets out the power functions and duties of a license holder provides certain financial incentives for the license holder and sets out the powers to the government. It requires any person or corporate bodies to obtain license prior to survey, generation, transmission or distribution of electricity of more than 1000 KW. In article 24 of the Act, it states that "While carrying out electricity generation, transmission or distribution, it shall be carried out in such manner that no substantial adverse effect be made on environment by way of soil erosion, flood, landslide, air pollution etc." Article 33 deals with land acquisition. Licensed individuals can apply the government to acquire land for the purpose of electricity generation, transmission and distribution. The government shall acquire the land for the stated objectives under existing regulations the compensation incurred to acquire land and other property shall be paid by the applicant.
3.1.14	Water Resources Act, 2049 (1992)	Water Resource Act, 1992 is the umbrella Act governing water resource management, which declares the order of priority of water use, vests ownership of water in the State, provides for the formation of water user associations, establishes a system of licensing and prohibits water pollution. Article 19 (1) of the act mentions that the government through notification in the Nepal Gazette prescribe pollution tolerance limits for the water resources. Similarly, article 19 (2) requires any person to abide by the act not to pollute water resources beyond specified limit. Article 20 states that while utilizing water resources, there should not be significant adverse impact on the environment with regard to soil erosion, flood, landslide and other similar cases. Articles 16, 19, 20 of the Act are also related to land acquisition. According to article 16 (3), the government shall, according to existing laws, acquire land for the licensed person or institution and any compensation in this regard shall be paid by the licensed person.
3.1.15	Land Acquisition Act, 2034 (1977)	The Act aims at amending and consolidating current legislation relevant to the acquisition of land. The Government may acquire any land at any place for any public purpose, if it so deems necessary, according to the procedure set out by this Act. To this end it regulates the nomination of an officer responsible for preliminary action in charge of the determination of the land area to be acquired (through a survey, collection of samples of soil, demarcation of land, installation of equipment), the determination of the compensation and the submission of a report to the local officer regarding the findings of preliminary action. After having received the report, the

SN	Acts/Regulations/ Guidelines	Relevant Details
		local officer shall issue a notification containing all the particulars required (e.g. purpose of acquisition, location of the land, terms of acquisition, plot number or boundaries of the land, land area). Further provisions concern the publication of said notice, the decision by the Zonal Commissioner of complaints filed by the landowner, the occupation of the land by the local officer, the criteria for the determination of the compensation which shall be paid either in cash or by allotment of other lands in exchange, if so, required by the landowner.
3.1.16	National Parks and Wildlife Conservation Act, 2029 (1973)	This act governs the various activities inside the protected areas. Schedule 1 relating to section 10 of this act provides the list of protected wildlife, which is prohibited for hunting. According to section 11, no person shall be permitted to hunt wildlife without obtaining license. There will be punishment in terms of fine or imprisonment or both if any person illegally kills or injures wildlife within protected areas.
3.1.17	Aquatic Animal Protection Act, 2017 (1960)	This act mainly focuses on the protection and management of aquatic ecology, aquatic fauna including fish and wetlands. This act prohibits the use of poison or harmful chemicals or materials in the water bodies or explosives to dismantle any embankment with a view to catching or killing aquatic animals including fish. However, there is no specific law for fishing and fisheries management.
3.2	**Rules/Regulations**	
3.2.1	Environment Protection Regulation, 2077 (2020)	This Regulation describes the details of the processes of level and type of environment assessment of different projects as per Schedule 1, 2 and 3. As per EPR 2020, Annex 3, KA-12, it is mandatory conduct EIA for the proposed proposal of construction of hydropower within National Park as the proposed project lies in Sagarmatha National Park.
	Province No. 1 Environment Protection Regulations, 2077 (2020)	This Regulation describes the process of environment assessment of different projects under the jurisdiction of province as per Schedule 1, 2 and 3.
3.2.2	Labor Rules, 2075 (2018)	This regulation is intended to provide the rights, interests and benefits of workers, to develop good labor relations by clearly defining the rights and duties of workers and employers, and to increase the productivity ending all forms of labor exploitation.
3.2.4	Electricity Regulatory Commission Rules, 2075	GoN has made these rules as per Electricity Regulatory Commission Act-2017 to clarify the key functions and duties of the Commission, and provide a more focused list of action points, mandatory requirements and guidance for the Commission on distribution lines, tariff management and electricity quality.
3.2.5	Solid Waste Management Regulation, 2070	Solid waste management rules 2070 BS have been issued by the Government of Nepal using the power conferred by section 50 of the Solid Waste Management Act 2068. Rule 3 of this Rules enforced the segregation and management of the solid waste. Sub rule 1 of this rule stipulates the segregation of solid waste at least organic and inorganic solidwaste at its source under section 6 have to management and segregation of harmful and chemical waste separately. The responsibility of managing of the chemical and harmful solid waste under sub rule1 shall be a concern generator.

SN	Acts/Regulations/ Guidelines	Relevant Details
		Rule 4 of this rules endorsed the discharge the solid waste as comfortable manner for transportation, processing and final discharge by take in to account the possible adverse effect on the public health and environment and the ways of reduction of such effect.
3.2.6	Plant Protection Rules, 2067 (2010 AD)	It prescribes terms and restrictions relating to the trafficking and use of plants and plant products, biological control agents and beneficial organisms.
3.2.7	Child Labor (Prohibition and Regulation) Rules, 2063 BS (2006 AD)	GoN has prepared this rule as per provision of Child Labour (Prohibition and Regulation) Act, 2056 (1999 A.D). It details out various conditional arrangements for child labour use and other legal provisions related with child labour.
3.2.8	Conservation Area Management Rules, 2053	It was promulgated by the GoN pursuant to section 33 of the NPWCA provides institutional framework, systems, mechanisms and processes (management modality) for the management of the Conservation Area. It authorizes National park to establish headquarters for the management and the development of the conservation area (Rule 4), divide the area into different sub-areas (Ilakas) as per the need, and establish Unit Conservation Officers and other staff as necessary. As the project is in National Park, it attracts the rules.
3.2.9	Buffer Zone Management Regulation, 2052	If any actions being operating or to be operated within or outside the buffer zone, have or wit, have the negative impact on the land use, public health, natural environment and natural resources conservation, the warden may on the recommendation of the users' committee give an order to the concerned person or institution to stop such activities immediately or to mitigate the impacts. After necessary investigation on the application tendered under the Sub—Rule (1), the warden may hand over such buffer religious forest as demanded by the applicant, or with necessary amendment to the religious authority, group, or community with a certificate under the Appendix—6. Provision should be made so as not to affect the right of the traditional users while handing over such forest. If the Ministry wishes to operate any services or amenities within the buffer zone through any person according to the Section—6 of the Act, it shall publish a bid tender notice in major newspapers giving at least 35 days' notice with necessary specifications of such services or amenities and the terms and conditions of the operation, and it shall also mention the office or official for the submission, the opening date and time of the bid tender in such a bid notice. Any religious authority, group or community willing to develop, conserve and utilize any religious place situated in the buffer zone from ancient time or the peripheral forest of such place will have to give an application in accordance with Appendix—5 to the warden by describing the area, boundaries and programs to be carried out in such a forest.
3.2.10	Forest Regulations, 2051 (1995)	Rule 65 of the Forest Regulation stipulates that in case the execution of any project having national priority in any forest area causes any loss or harm to any local, individual, or community, the proponents of the project itself shall bear the amount of compensation to be paid. Similarly, the entire expenses required for the harvesting, logging and transporting of the forest products in a forest area will be borne

SN	Acts/Regulations/ Guidelines	Relevant Details
		by the proponents of the projects.
3.2.11	Electricity Rules, 2050 (1993)	Section (छ) of Article 12 and section (छ) of Article 13 of Electricity Regulation 1992 are important from environmental viewpoint. The Environmental Impact Assessment report will address the environmental issues, measures required to mitigate the significant adverse impacts. This regulation has also made provision for the formation of Compensation Fixation Committee for compensation of the land required for the project.
3.2.12	Water Resources Regulations, 2050 (1993)	It is mandatory under Rule 17 (e) of the regulation that any person or corporate body, who desires to obtain a license for utilization of water resources must state in his application that appropriate measures will be taken to lessen the adverse effects due to the project on the overall environment. Measures are to be taken for the conservation of aquatic life and water environment and for mitigating social and economic effects of the project in the concerned area.
3.2.13	Himali National Park Rule, 2036	It explains about the protection and conservation of National Park located in Himalayan region of Nepal. It includes the do and don'ts inside a National Park. Harm to any wildlife animals, birds or fishes as well as trees/plants are not allowed but feeding birds and fishing after permission of the national park is allowed. Any kind of pollution such as solid waste, liquid waste as well as noise pollution is restricted in this area. But, development works can be done taking permission with government.
3.2.14	National Parks and Wildlife Conservation Rules, 2030 (1974)	The rules prohibits any activities inside the protected area without permission from the authorized persons including hunting, damaging any form of wildlife, building or occupying any form of shelter, hut or house, occupying, clearing or cultivating land, pasturing domesticated livestock, damaging, felling or removing any trees, shrubs of forest products and setting of forest fire, mining and removing stone, minerals, creating earth works using explosives, using immunization or poisons, block, diverting river or streams.
4	**Guidelines/manuals /Directives**	
4.1	Directive Relating to Licensing of Power Projects 2075	GoN by virtue of the power conferred by Rule 94A of the Electricity Regulation 2050 (1993) issued the Directive Relating to Licensing of Power Projects 2075 ("Directive") replacing the previous Directives Relating to Licensing of Power Projects 2073 (2017). This directive has set various provisions on survey license of electricity generation, transmission and distribution as well as issuing license of generation, transmission or distribution or license amendment and its cancellation.
4.2	Hydropower Environmental Impact Assessment Manual, 2075 (2018)	Ministry of Forests & Environment has prepared this manual, in line with the National Environmental Impact Assessment Guideline. It has undergone extensive gap analysis of existing Nepali EIA related documents and legislation followed by a series of multi-stakeholder participatory processes in order to assist hydropower companies conduct better EIAs that meet international standards and aid the Government with the review and approval process. The Manual has been designed in a format that is user-friendly and aims to guide practitioners, regulators and developers in the industry understand in detail the importance of several existing gaps like meaningful engagement of stakeholders, adequate definition of areas

SN	Acts/Regulations/ Guidelines	Relevant Details
		of influence and study areas, sufficient identification of baseline studies, knowledge on identifying and quantifying impacts, need of precision on impact predictions, and suitable alternatives analysis.
4.3	Working Policy on constructing and operating physical infrastructures in Protected Area 2065 (2008)	If any activity that has been conducted or to be conducted outside of the National Park or Conservation Area has to release such quantum of water which is higher of either at least ten per cent of the minimum monthly average discharge of the river/stream or the minimum required quantum as identified in the environmental impact assessment study report. Similarly, any activity that has been conducted or to be conducted within to the National Park or Conservation Area has to release such quantum of water which is higher of either at least fifty per cent of the minimum monthly average discharge of the river/stream or the minimum required quantum as identified in the environmental impact assessment study report. Legal provisions shall be made to prevent adverse effects on the availability of water or water right of the projects for which license is not required or being operated after obtaining the license. The view of environment conservation will be required to plant and rectify 25 trees in the form of a single tree cut or removed. The public, public or service within the conservation area will be used without pre-approval of the organization for the purposes of public tree plantation (except for the purpose of planting local species).
4.4	Community Forest Inventory Guidelines, 2061 BS (2003 AD)	The guideline for inventory of community forests advice to classify the forest into timber trees, pole size trees and regeneration on the basis of diameter. It has recommended using 25 m x 20 m size of quadrat for timber trees, 10 m x10 m for shrub and 5 m x 5 m for sapling and 2 m x 5 m for seedling plots in the community forest. Plants having DBH (Diameter at Breast Height, i.e. 1.3 m above ground) greater than 30 cm is considered as trees. Trees having DBH between 10 to 29.9 cm are categorized as poles and plants having less than 10 cm DBH and more than one-meter height belongs to sapling and plants having height of less than one meter categorized as seedlings. The guidelines provided the methods of calculating volume of timber and fuel wood. The guideline also advises to stratify the large areas in the hills and mountains to eliminate variations in slope aspects etc. After stratification, area of each stratum could be calculated.
4.5	National EIA Guidelines, 2050 BS (1993 AD)	The guideline provides clear directions about the process of conducting EIA. This guideline makes EIA in Nepal legally mandatory and contains process for ensuring public involvement during the preparation of EIA report. It calls for information regarding identification of physical, biological, socio-economic and cultural impacts. Impacts ranking method also suggested in this guideline. It stresses the inclusion of mitigation measures to avoid, minimize and mitigate adverse impacts and maximize beneficial impacts resulting from the development project and monitoring & environmental auditing in the EIA report. Its revision in 1997 calls for the ensuring local people's participation, collection of relevant information, identifying major issues of public concerns, evaluate them and establishing priorities for EIA study. These guidelines further provide guidance to project proponent on integrating environmental mitigation measures, particularly on the management

SN	Acts/Regulations/ Guidelines	Relevant Details
		of quarries, borrow pits, stockpiling of materials and spoil disposal, operation of the work camps, earthworks and slope stabilization, location of stone crushing plants, etc.
4.6	Guideline on Environmental &Social Risk Management (ESRM) For Banks And Financial Institutions, May2018	It is the guideline prepared by Nepal Rastra Bank for Banks And Financial Institutions those providing loans for development activities. The guideline helps to assess environmental and social risks and their management. The guideline has the exclusion lists of activities in which banks and financial institutions cannot provide the loan. The guideline is also relevant to the proposed proposal as it has to take loan from the Bank.
5	**Working Procedures/Work Plan**	
5.1	Working Procedure for the Use of National Forest Area for National Priority Project, 2074 BS (2017 AD)	Realizing the need to manage the provision in relation with giving approval to use forest area for operation of national priority projects, Government of Nepal has endorsed this "Working Procedures relating to use of National Forest Area for Projects of National Priority, 2017" under provisions stipulated in Clause 68 (1) of the Forest Act, 1992. This working procedure supersedes the previous "*Working Procedures relating to use of National Forest Area for other purposes, 2006".* Section 3 (1) of this procedure requires Ministry (concerning to specific national priority project) to carry out feasibility study and alternatives of the project avoiding the national forest to the extent possible. However, as per the provision of Section 3 (2), if such study carried out in accordance with Section 3 (1) requires use of forest area, then the alternative requiring minimum forest area or clearance of minimum number of trees and vegetation shall be selected. Section 4 (1) of the Procedures provisions need of preparation of an Initial Environmental Examination or an Environmental Impact Assessment Report relating to environmental impacts of such project which requires forest area for its implementation in accordance with the prevalent Environment Protection Act and Environment Protection Regulation. If the investigation carried out in accordance with Section 4 (2) reveals implementation of the project causes impacts on the environment, then the concerned Ministry shall prepare a report incorporating mitigation measures to minimize such impacts along with environmental management plans for the project. Section 4 (4) requires concerned Ministry to take approval from the Ministry of Forests and Environment prior approval of the IEE or EIA reports in accordance with prevalent law for the projects requiring national forest area. Section 5 (1) describes the procedures to submit application for the use of national forest areas. Section 10 explains provisions relating to compensatory plantation and requires 25 saplings to be planted for loss of a tree. As per Section 11, the project shall pay annual lease amount for temporary occupancy of national forest at the rate fixed for leasehold forests as per Schedule 20 of Forest Regulations, 1993. Section 12 of the Procedure mandates the project to implement mitigation measures mentioned in IEE or EIA report of the project

SN	Acts/Regulations/ Guidelines	Relevant Details
		and the cost for such measures shall be borne by the project itself.
5.2	Renewable Energy Subsidy Delivery Mechanism 2073 BS (2016 AD)	AEPC has prepared the mechanism as per mandate given by Renewable Energy Subsidy Policy 2073 BS. It has spell out the detail mechanism of subsidy delivery mechanism in context of renewable energy provided by GoN. As the proposed proposal is also a program of AEPC under renewable energy, it is certainly relevant to the proposed project.
6	**Standards**	
6.1	National Ambient Air Quality Standard, 2069 BS (2012 AD)	National Ambient Air Quality Standard is established for various parameters such as TSP, PM_{10}, Sulphur Dioxide, Nitrogen Dioxide, Carbon Monoxide, Lead, Benzene, $PM_{2.5}$ and Ozone. The standard states that the maximum concentration stated for averaging time of 24 hours for TSP, PM_{10}, Sulphur Dioxide, Nitrogen Dioxide, and $PM_{2.5}$ and the maximum concentration stated for averaging time of 8 hours for Carbon Monoxide and Ozone should be under standard limit for at least 95% duration for one fiscal year and should not exceed maximum concentration for 18 days in 365 days. No any parameters shall exceed its maximum concentration limit for two consecutive days within one year
6.2	National Noise Quality Standard, 2069 BS (2012 AD)	National Standard for Sound Quality is established as per Rule 15 of Environment Protection Rules, 2054. The maximum limit of sound for city and residential area is 55 decibels for daytime and 50 decibels for night hours. Whereas for the industrial area, the maximum limit of sound is 75 decibels for daytime and 70 decibels for night hours. Further, for the peace zone, the maximum limit of sound is 50 decibels for daytime and 40 decibels for night hours.
6.3	Standards for Emission from in-use and Imported Diesel Generators, 2069 BS (2012 AD)	The MoSTE(now MoFE) introduced in October 2012 the National Diesel Generator Emission Standard (NDGES) for new and in-use diesel generators with a capacity of 8 kW-560 kW (under the 1997 Environment Protection Act). In doing so they followed the Indian standards for construction equipment rather than for diesel gensets. Hence, the Nepal emission standards for new and in-use diesel gensets are less stringent than in India. The emissions standards set for new diesel generator imports is equivalent to Bharat Stage III standards and, for in-use diesel generators, is equivalent to Bharat Stage II. The emissions limits are set for four major pollutants: CO, HC, NOx, and PM. The emissions limit for PM for new DG sets less than 19 kW is 0.80 g/kWh; for 19 to <37 kW, the emissions limit is 0.60 g/kWh; for 37 to <75, it is 0.40 g/kWh; for 75 to <130 kW, it is 0.30 g/kWh; and for 130 to <560 kW, it is 0.20 g/kWh. MoSTE has not yet been able to monitor the compliance of emissions standards for new and in-use DG sets.
6.4	Tolerance Limits for Industrial Effluents to be Discharged into Inland Surface Waters, 2003	The Ministry of Environment has set tolerance limits for the industrial effluents to be discharged into the inland surface water. Since the project is considered as an industry it will have to comply with the tolerance limits set in the standard prior to the discharge of the effluents into the inland surface water during the construction and operation period.
7	**World bank ESS Instruments**	
7.1	**Operation Policy**	
7.1.1	Environmental	The policy is to ensure that Bank financed projects are

SN	Acts/Regulations/ Guidelines	Relevant Details
	Assessment EA (OP 4.01)	environmentally sound and sustainable. As per the policy, an integrated Environmental Screening and Environmental Assessment (EA) with Environmental and Social Management Plan (ESMP) has to be prepared or developed to manage environmental risks and maximize environmental and social benefits wherever applicable.
7.1.2	Natural Habitats (OP 4.04)	The policy is to support the protection, maintenance and rehabilitation of natural habitats in its project financing, as well as policy dialogue and analytical work. The Bank also expects the Borrowers to apply a precautionary approach to natural resources management to ensure environmentally sustainable development. Here the policy is triggered by the Project due to activity requiring land of SNP for implementation of the proposed proposal.
7.1.3	Involuntary Resettlement (OP 4.12)	Objective of this policy is to avoid or minimize involuntary resettlement where feasible, exploring all viable alternative project designs. Furthermore, it intends to assist displaced person in improving their former living standards; community participation in planning and implementing resettlement; and to provide assistance to affected people, regardless of the legality of title of land. This policy may not be attracted as the proposed proposal does not acquire any land displacing the people.
7.1.4	Physical and Cultural Resources (0P 4.11)	This policy is to assist in the preservation of cultural property, historical, religious and unique natural value-this includes remains left by previous human inhabitants and unique environment features, as well as in the protection and enhancement of cultural properties encountered in Bank- financed project. It may be triggered by the project as the proposal has to be implemented in SNP where Sherpa communities reside with their cultural, historical, religious and unique natural value; and SNP has unique environment features.
7.1.5	Indigenous People (0P 4.20)	This policy aims to protect the dignity, right and cultural uniqueness of indigenous people to ensure their participation in project design and implementation, do not suffer from development activities; that they receive social and economic benefits. This policy is relevant to the proposed proposal as SNP is the home of Sherpa Community.
7.2	General Environmental Health and Safety Guidelines	The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines, which provide guidance to users on EHS issues in specific industry sectors. The general EHS guidelines covers four different concerns; Environment, Occupational Health and Safety, Community Health and Safety, and Construction and Decommissioning.
7.3	Environmental Health and Safety Guidelines for Electric Power Transmission and Distribution	This guideline includes information relevant to power transmission between a generation facility and a substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas. The guideline provides a summary of EHS issues associated with electric power transmission and distribution that occur during the construction and operation phases of a facility, along with

SN	Acts/Regulations/ Guidelines	Relevant Details
		recommendations for their management.
8	**International Instruments**	
8.1	The United Nations Declaration on the Rights of Indigenous Peoples, UNDRIP, 2007	It has established a universal framework of minimum standards for the survival, dignity and well-being of the indigenous peoples of the world and it elaborates on existing human rights standards and fundamental freedoms as they apply to the specific situation of indigenous peoples.Significantly, in Article 3 the UNDRIP recognizes Indigenous peoples' right to self-determination, which includes the right "to freely determine their political status and freely pursue their economic, social and cultural development." Article 4 affirms Indigenous peoples' right "to autonomy or self-government in matters relating to their internal and local affairs," and Article 5 protects their right "to maintain and strengthen their distinct political, legal, economic, social and cultural institutions." Article 26 states that "Indigenous peoples have the right to the lands, territories and resources which they have traditionally owned, occupied or otherwise used or acquired," and it directs states to give legal recognition to these territories
8.2	International Labour Organization Convention, 1998	It is the Declaration on Fundamental Principles and Rights at Work in 1998.
8.3	Convention on Biological Diversity (CBD), 1992	Nepal signed the Convention on Biological Diversity (CBD) during the Earth Summit in June 1992; ratified it in the fall of 1993; and it has entered into force since 21 February 1994. Nepal is committed to implementation of the convention. The Forest Act, 1993, Forest Rules, 1995, EPA, 1997 and EPR 1997 are enforced by GoN in response to CBD. As the state is fully committed to conserve its biodiversity, the proposed subproject being an entity of state itself is also full-heartedly committed to conserve biodiversity in and around subproject area.
8.4	Concerning Indigenous and Tribal Peoples in Independent Countries, 1991 Convention (No.169)	Article 7 of the convention provides the right to the indigenous and tribal people to decide their own priorities for the process of development. However, for the national development plans and programs, it mandates consultation with them in the formulation of the plans and programs. Article 12, 13, 14 and 15 safeguards rights of the indigenous people in the land and natural resources in territories traditionally occupied by them. In the event that the state retains the right of the natural resources in their territories, it mandates formulation of special provisions under the state legislation for participation in the decision-making process and resettlement process with full compensation of the resulting loss or injury (Article 16). As Nepal is signatory of the convention will have to comply the provisions stipulated in the conventions, if the subproject is to impact the safeguard rights of the indigenous people.
8.5	World Heritage Convention, 1975	This convention has been adopted to address the threats to the world's cultural and natural heritages by traditional/natural decay and socio-economic changes occurring globally. The Sagarmatha National Park of Nepal parts of which, this subproject will be implemented within has been designated as World Heritage Site based upon the criteria VII (UNESCO, 1979for its superlative natural phenomena or areas of exceptional natural beauty and aesthetic

SN	Acts/Regulations/ Guidelines	Relevant Details
		importance. The convention with total of 38 articles defines and describes World Heritage Sites, responsibilities of parties for protection, conservation and presentation of heritage sites. The convention also addresses study and research, Cooperation and Funding related to World Heritage Sites. The article 1 and 2 define cultural and natural heritage sites. Article 5 urges the parties to adopt a policy which aim to give functional life to community with integration of protection and if required establishment of multiple services that assure conservation. Parties are bound to report periodically the status of world heritage sites including the threats and dangers posed by traditional decays, changing socio-economic status and natural disasters (article 11). Article 17 considers encouraging establishment of national, public or private foundations or associations that could contribute to the efforts of protection and conservation of heritage sites. Article 34 of the convention mentions that if the heritage sites belong to any federal jurisdiction, the role of that state or province towards the heritage site shall equally be that of the nation to which the state belongs. Any project in a world heritage site requires World Heritage Impact Analysis to be integrated in the EIA of the project. The guideline is given as per the IUCN's advice notes (IUCN, 2013 a).
8.6	World Heritage Advice Note: Environmental Assessment (18 Nov 2013): Astep-by-step guidance on environmental assessment for world heritage properties.	IUCN advice notes on EIA for projects occurring in heritage sites (IUCN, 2013a) provides the principles guidance for the assessments that needs to incorporated in the EIA study suggesting additionally incorporation of the CBD's voluntary guidance of biodiversity inclusive impact assessment and Ramsar impact assessment handbook. The IUCN, 2013a focuses on impact on heritage's outstanding universal values that comprise of Values, Integrity and Protection and Management as inscribed for the site. The assessment needs to be assessed for direct, indirect and cumulative impact on environmental and social aspects of the OUVs. Alternative assessment also needs to be done with 'No Project Option' and that mitigation measure should be sought with avoidance and reduction. A separate chapter should be included in the EIA report that concludes the impacts and their mitigation measures and should be summarized too.
8.7	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES),1973	The convention classifies species according to criteria where access or control is important (e.g. I-species threatened with extinction, II-species which could become endangered; III-species that are protected; E- Endangered; V- Vulnerable, R-Rare (CITES 1983)). The subproject will have to minimize impacts to the species as far as possible.

CHAPTER 4: ENVIRONMENTAL AND SOCIAL BASELINE ASSESSMENT

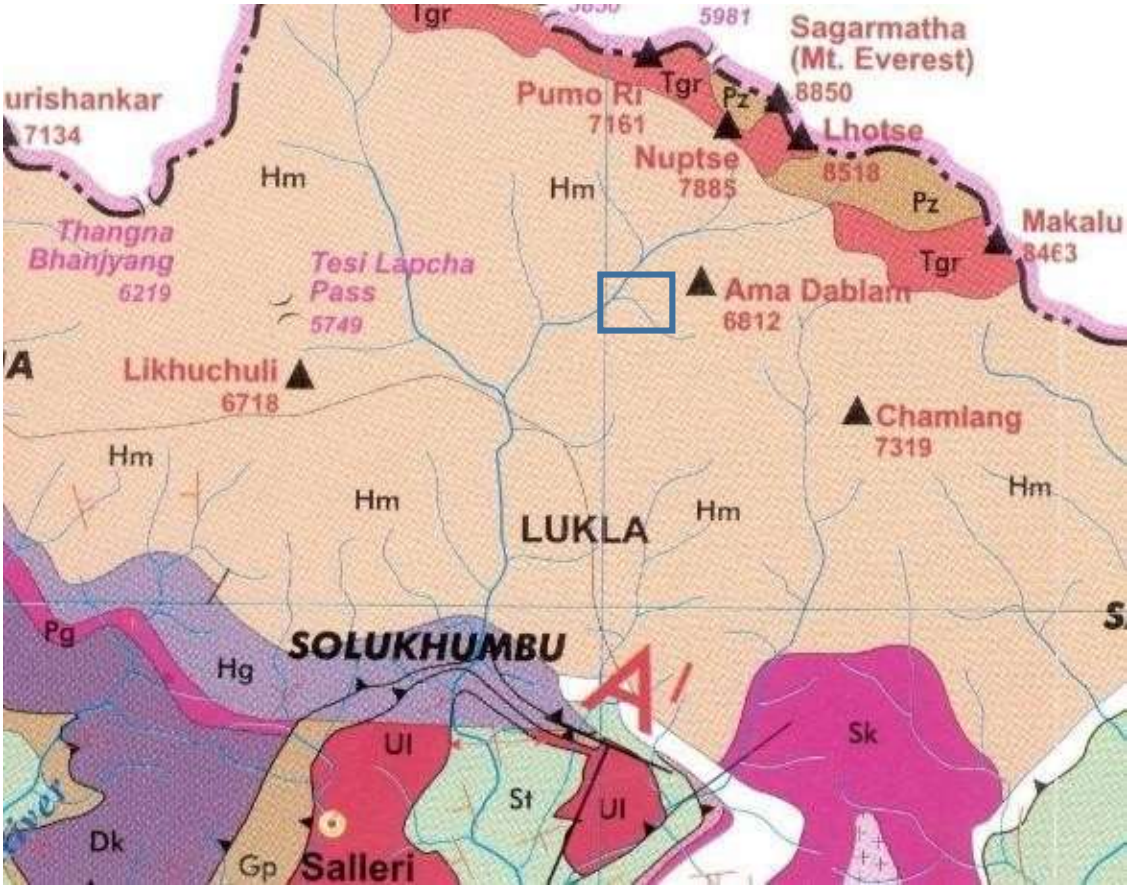
4.1 Physical Environment

4.1.1 Topography

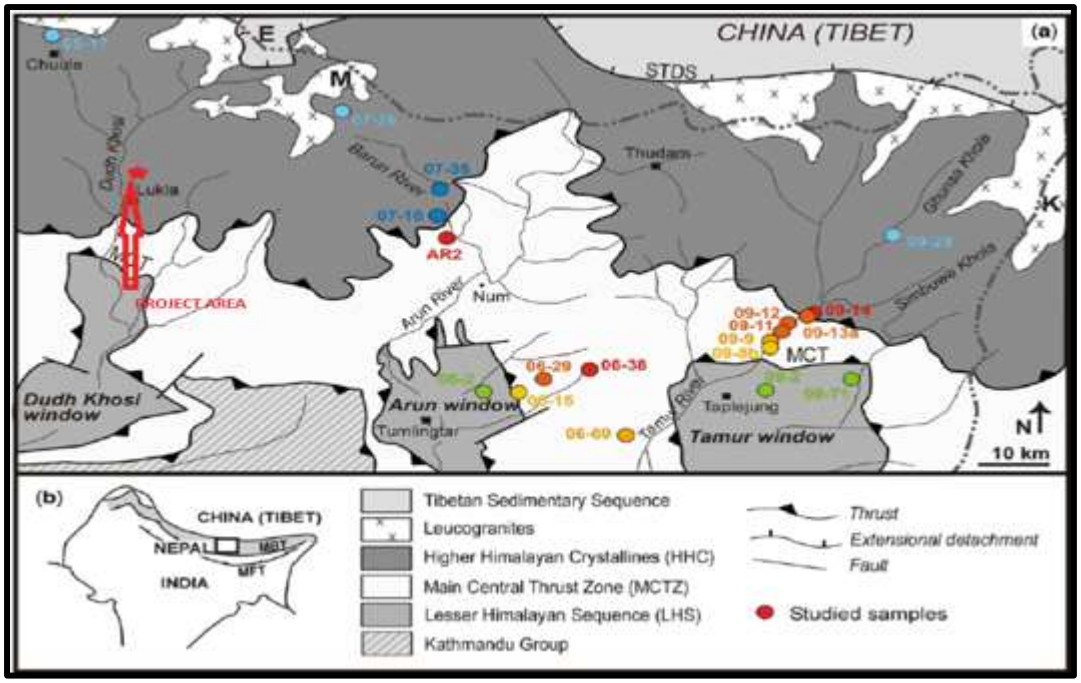
The topography of the subproject area is of gentle to steep. The AMHP is situated in the gentle topography. The river slopes are covered with colluvial soil deposit while the bedrock outcrops are exposed at the slopes. The deposit is moist, and seepage is frequent. The elevation of powerhouse and intake area ranges from 3951.18 masl to 4422 masl. The powerhouse site is at alluvial terrace which is flat.

4.1.2 Geology

The subproject area consists of gneisses rocks of Higher Himalaya (Map 9). The Main Central Thrust (MCT) is the major tectonic boundary which is located about 32 km south of the project which will not create any construction risk for the project development. The Exposed rock nearby the project area consists of fresh to slightly weathered, grey to white, medium to coarse-grained, strong to medium strong, widely foliated gneisses with schist.



Map 9: Geological Map showing the Subroject Site (Published by Himalayan Map house)



Map 10: Simplified Geological Map of Eastern Nepal

(Modified from Goscombe et al. (2006), Groppo et al. (2009), and Mosca et al. (2011)) Red Star indicates study area)

4.1.2.1 Geology of the Headworks Area

The intake site is located in the narrow valley of Cholunche Khola which is approximately 20-25 m wide. There is alluvium soil in the left and right side of proposed headworks and river terrace, loose alluvial deposit with big boulders present at proposed weir axis of the headworks. At downstream and left bank of the dam site, the river terrace is followed by colluvial soil and steep rock cliffs.

The quaternary deposits include alluvium at headworks and desander area, and followed by colluvium and rock cliff in the hill slope. The alluvial soil comprises subrounded to rounded, boulders, gravels, cobble and pebbles of gneiss with sand. Most dominant proportion (about 60%) is of boulder and gravel. The cobble pebble and sand deposit constitute the remaining proportion. According to Unified Soil classification the soil near weir axis and desander lies in GW category that includes well graded gravels with sand. Colluvium soil in the hill slopes in left bank 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 constitute the remaining proportion.

Based on the report submitted by the Independent Geological Specialist, the headworks area is located about 2800m upstream from the confluence of Imja River and Cholunche Khola. Cholunche Khola is around 30-40 m wide in the proposed weir axis area. The area is consisting of alluvial and glacio fluvial deposit of cholunche Khola. The deposit consists of sub rounded to rounded boulders, gravel, sand silt and clay. Bed rock was not observed along the weir axis and settling basin area. Both bank have the moderate slope and no major slides were observed beside minor slide on loose terrace deposits by the river action. Settling basin area lies on the relatively flat area on alluvial deposit.

4.1.2.2 Geology of Water Conveyance

The water conveyance route passes through the barren land at left bank of Cholunche Khola which is covered by colluvial and alluvial deposits. Initially alignment passes through the steep alluvial terrace deposit then it passes flat alluvial terrace and colluvial deposit at left bank of Cholunche Khola. The alluvial soil comprises subrounded to rounded, boulders, gravels, cobble and pebbles of gneiss and sand with some silt, similarly colluvial deposit consists of subangular to angular, boulders, gravels, cobble and pebbles of gneiss with sand.
Based on the report submitted by the Independent Geological Specialist, the pipe alignment passes through slide area around chainage Ch.0+160 to Ch. 0+260m. The alignment passes though just below the crown of the slide on loose alluvial terrace deposit. Some hanging loose blocks were observed near the crown part of slide area. Above the slide area land is flat and relatively stable. Before construction works the slide area should be protected. Initially, the hanging loose blocks must be trimmed and retaining structure shall be constructed from the riverside and after the pipe installation it should be buried. After the slide area the alignment passes through the flat river terrace of Cholunche Khola. There are mostly free blocks laying on the flat terrain which have been transported from uphill slope consisting bed rock of gneiss. It is recommended to avoid these free blocks for the construction of anchor blocks and saddle supports.

Therefore, to minimize the risk, a suitable gabion protection of length 100 m and cross-section area of 6 m^2 will be constructed on landslide area along penstock alignment which has been considered in design and also care should be taken during cutting and excavation. The pipe alignment passes though the hillslope (<60º) up to ridge and to down. Then, runs though ridge to down slope. No any slope instability failure has been observed along the alignment.

4.1.2.3 Geology of the Powerhouse Area and Tailrace

The power house site is located about 60 m upslope from the Imja Khola on old river terrace deposit on the left bank of Imja Khola. The area is relatively flat and consists of alluvial soil composed of ill sorted, loose, sub rounded to rounded, gravel of gneiss with sand and silt. The area is relatively stable. Land use of the area has sparse vegetation consisting bushes and small trees.

4.1.3 Meteorological condition

4.1.3.1 Precipitation

The rainfall at Pangboche is approximately 1524 mm per year. Between the driest and wettest months, the difference in precipitation is 416 mm. The driest month is November, with 12 mm of rainfall. Most of the precipitation falls in July with an average of 428 mm. Monsoon wetness index of the catchment area is taken as 1000 from Isolines in Monsoon Index Map.

Table 17: Monthly Precipitation according to Köppen–Geiger Climate Map (mm)

Locations	Elevation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pangboche	3865 masl	21	29	33	60	111	238	428	344	190	46	12	12

Source: Köppen–Geiger Climate Map, 2020

4.1.3.2 Temperature

The prevailing climate in the Pangboche is called a tundra climate. Even in the warmest month of the year the temperatures are very low. The average annual temperature is -2.9 °C | 26.8 °F in Pangboche. The warmest month of the year is July, with an average temperature of 4.5 °C | 40.1 °F. January is the coldest month, with temperatures averaging -11.7 °C | 11.0 °F.

Table 18: Temperature by Month

Temp. (°C) / Month	**Jan.**	**Feb.**	**March**	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
Avg.	-11.7	-11.2	-8.4	-3.6	0.2	3.8	4.5	4.3	2.7	-2.2	-5.3	-7.7
Min	-16.4	-16	-13.4	-8.8	-4.3	0.6	2.5	2	-0.3	-6.3	-10	-12.2
Max	-6.8	-6.6 °C	-3.8	0.7	3.7	6.6	6.6	6.7	5.2	1.5	-0.6	-2.9

Source: Climate-Data Org, 2020

4.1.3.3 Humidity

As there is no any meteorological station at the subproject site, the humidity of the Namche Bazar is taken as reference. As shown in Figure 1, December has the lowest humidity while July is with the highest humidity. The similar situation is sighted for Pangboche although the figure may vary due to slight variation in geographical location and altitude.

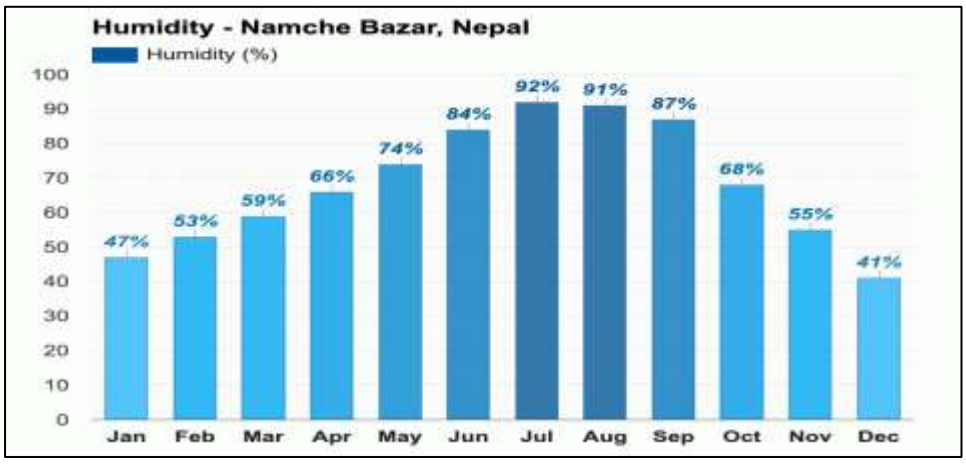


Figure 2: Humidity

(Source: https://www.weather-atlas.com/en/nepal/namche-bazar-climate)

4.1.3.4 Wind Speed

The subproject area is located in relatively wide valley surrounded by towering Snowy Mountain. High wind speed is rarely expected at the subproject site. The highest wind speed seems to be not above 20 km/hr (Figure 2) which occurs during February-April.

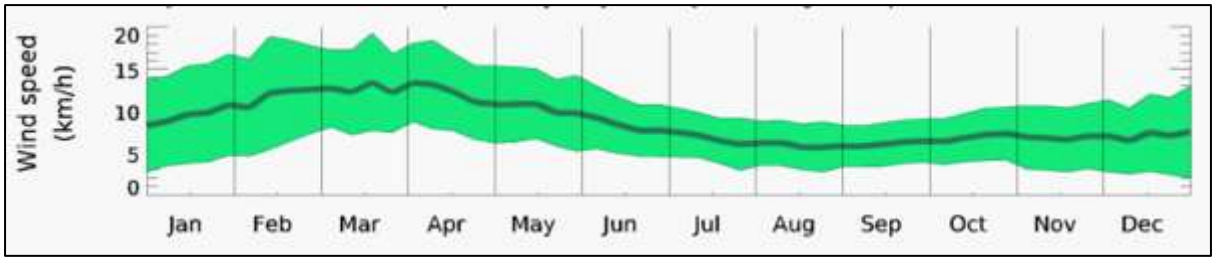


Figure 3: Average Monthly Wind Speed at Pangboche

Source: meteoblue.com

4.1.3.5 Air Quality

The subproject area is in rural setting and there is no industry that causes air pollution. The source of air pollution is only from households and hotels for cooking and heating purposes. Thus air quality of the area seems good. The air quality complies with the national ambient air quality standard PM_{10}; 120 $\mu g/m^3$ in 24 hrs (Figure 3).

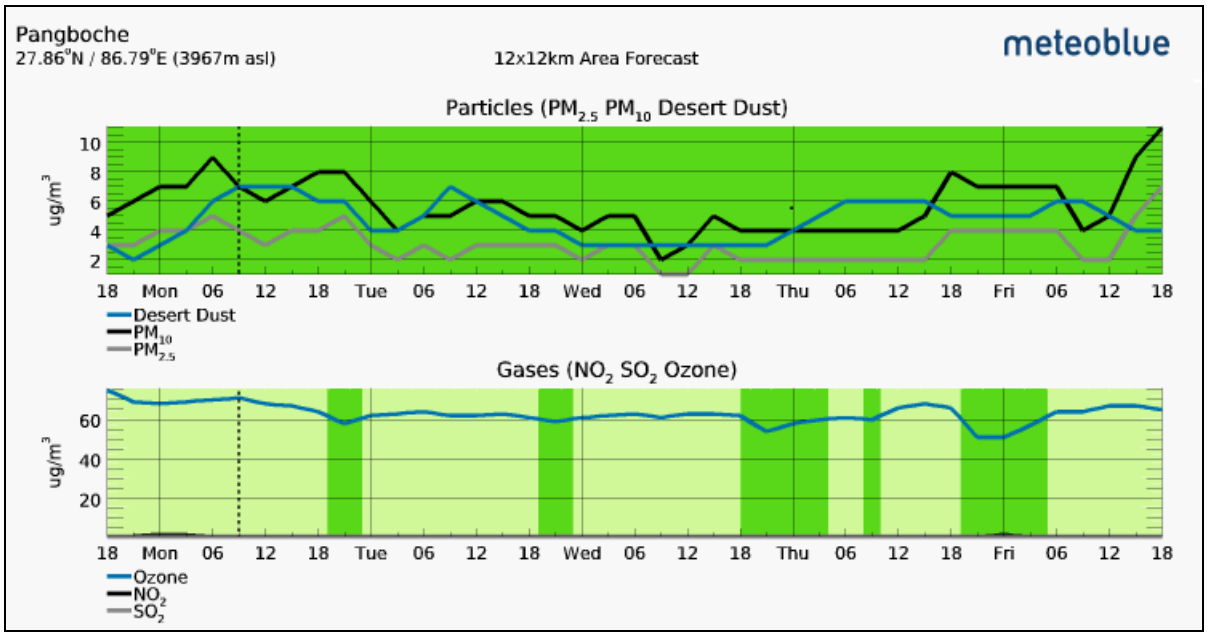


Figure 4: Air Quality Forecast of Pangboche (March 14 to March 16, 2022)

(Source: meteoblue.com)

4.1.4 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. The sound level measured at headwork area was 48 dB while 65dB in powerhouse site at noon.The recorded sound levels were higher than the value for rural residential area of National Ambient Sound Quality Standard, 2012 i.e. 45 dB and 40 dB during day and night respectively. The higher level of sound in the headworks and powerhouse area is due to the sound of flowing water.

4.1.5 Water Quality

The water quality in the subproject area is found to be good as there is no source of contaminants such as sewerage system and industries. Water sample is collected from the Cholunche Khola (Intake Area) to establish the baseline on water quality. The water quality

analysis was conducted for sixteen different parameters (6 - physical, 9 - Chemical and 1-microbial parameters) in the Environment and Climate Study Laboratory of NAST (**Annex-X**). Water quality is suitable for MHP, which will not impact turbine blades, which will be one of the major factors for sustainability of the subproject.

Table 19: Water Quality of Cholunche Khola

SN	Parameters	Sampling Sites	Remarks
		River Water	
Physical			
1	Temperature (°C)	18.5	This temperature is recorded in Kathmandu
2	pH	8.05	
3	Conductivity (μS/CM)	21	
4	Turbidity (NTU)	1.75	
5	Total Dissolved Solids (mg/L)	10.29	
6	Total Suspended Solids (mg/L)	28	
Chemical			
7	Total Hardness (as $CaCO_3$)	12	
8	Chloride Content (mg/L)	2.84	
9	Iron Content (mg/L)	0.1	
10	Arsenic Content (mg/L)	ND	
11	Ammonia Content (mg/L)	ND	
12	Nitrate (mg/L)	2	
13	Dissolved Oxygen (mg/L)	7.6	
14	Biological Oxygen Demand (mg/L)	1.2	
15	Chemical Oxygen Demand (mg/L)	ND	
Microbial Test			
16	Total Coliform Count	20	0/100 mL
# Nepal Drinking Water Quality Standard 2062; ND-Non-Detected; number in brackets () refers the acceptable values when alternatives not available.			

4.1.6 Subproject Location from Flood Level

The headworks/intake area is in flood level. Other structures are away from flood plain areas. The powerhouse site is also higher than the flood level of the Imja Khola. All the structures have been designed above the flood level based on 100 years of return period of floods. (DFS 2022).

4.1.7 Soil Quality

The soil of subproject area comprises of subrounded to rounded boulders, gravels, cobble and pebbles of gneiss with sand. Approximately 60% area of powerhouse, penstock alignment and headworks comprises of boulder and gravel whereas, approximately 40% area constitute of cobble, pebble and sand deposit.

There are colluvial soil deposits in the hill slope that comprises of subangular to angular boulders, gravels, cobble and pebbles of gneiss with sand. The power house site is located at the left bank of Imja Khola, where, there is colluvium 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

The Imja River and Cholunche Khola are the major water resources in the subproject area which are snow fed. These resources are not used for any domestic and irrigation purpose.

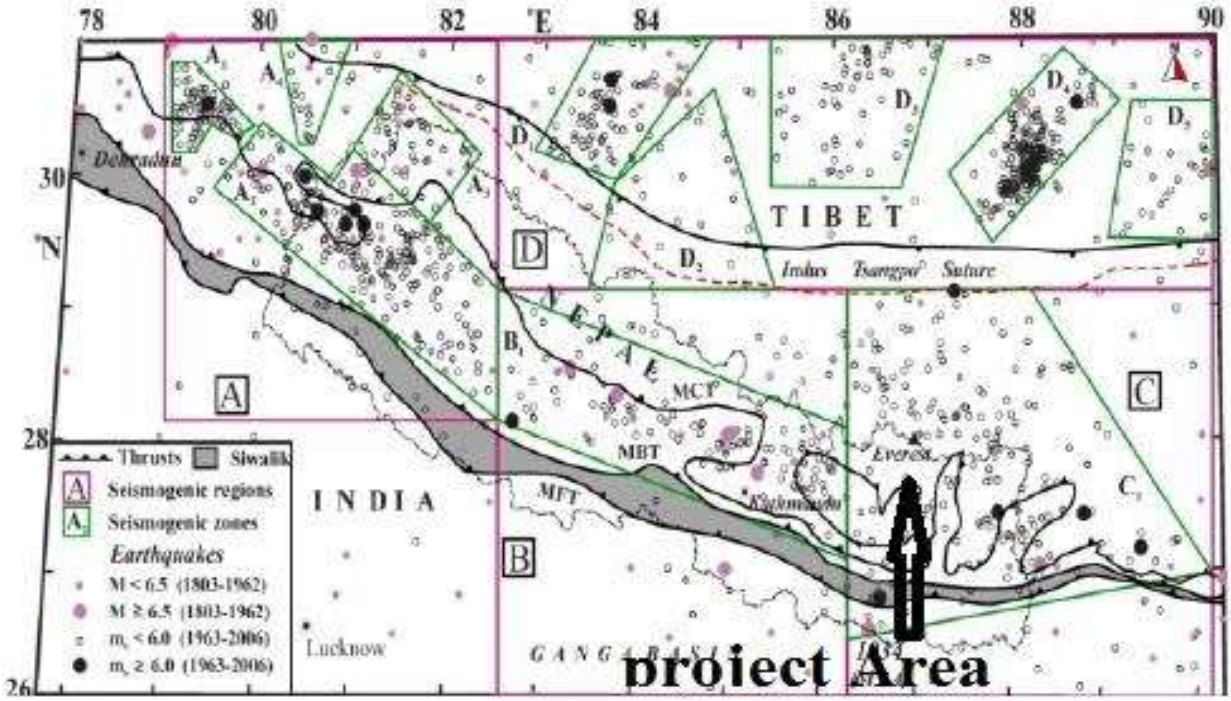
4.1.9 Agro-ecological zones within Subproject Area ofIinfluence

The area of influence falls in hilly (up to 4000 m) and mountain agro-ecological region (>4000 m) of Nepal. The arable land is premium and crop diversity is poor in the area of influence due to steep slope and harsh climatic condition. Potato and buckwheat are major agriculture products and 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 extent 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≥ 6) in Himalayan thrusts occur at deeper levels as compared to the similar magnitude earthquakes at shallowest level in the adjoining Tibet region.

The subproject area falls in the Class (C) having high seismic risk, Map 11. Considering the historical and recent earthquake and design parameter of Upper Karnali project and Arun 3 Hydropower Project, the Seismic coefficient for AMHP 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 subproject and a value of 0.18g may be appropriate as Design Base Earthquake (DBE). Thus, the recommended value for MCE of 0.30g has been considered to be sufficient to use for the detail design purpose.



Map11: 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)

4.1.11 Climate Change and Natural Disasters

4.1.11.1 Climate Change

In Sagarmatha, air temperature has 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 (Khanal et. al. 2012). The trend of mean annual temperature from 1980 to 2020 shows gradual increase of temperature (Figure 4, top graph). Similarly, anomaly strips show warmer years are increasing (Figure 4, lower graph). In Figure 4, solid line of the top graph shows mean annual temperature while blue broken line represents linear temperature change trend; the stripes of lower part of graph shows the warmer strips representing average temperature for a year- blue for cold and red for warm years. On the same way, the trend of mean annual precipitation from 1980 to 2020 shows gradual increase of precipitation (Figure 5, top graph). Similarly, anomaly strips show wet years are increasing (Figure 5, lower graph). In Figure 5, solid line of the top graph shows mean annual precipitation while blue broken line represents linear precipitation change trend. In the lower part the graph shows precipitation stripes representing the total precipitation of a year - green for wetter and brown for drier years.

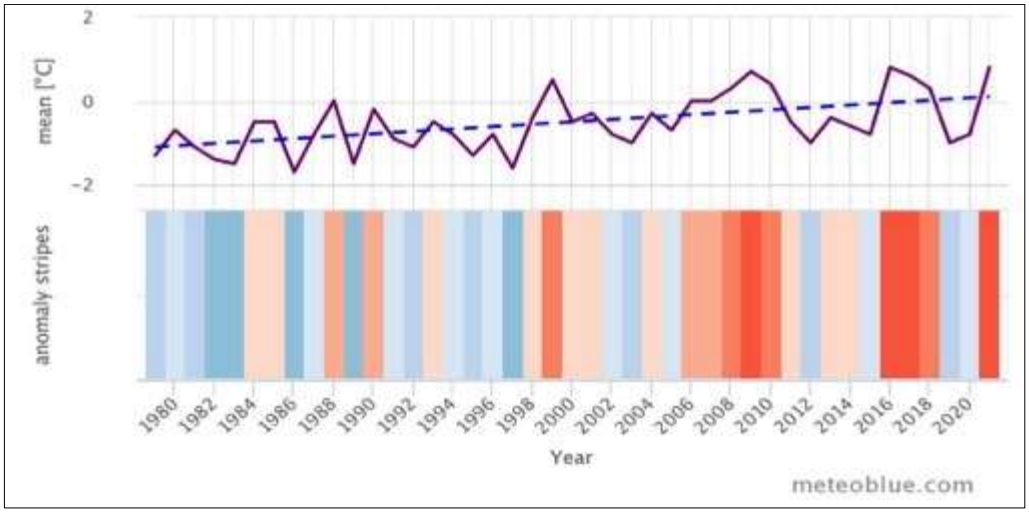


Figure 5: Mean Yearly Temperature, Trend and Anomaly, 1979-2022 at Pangboche

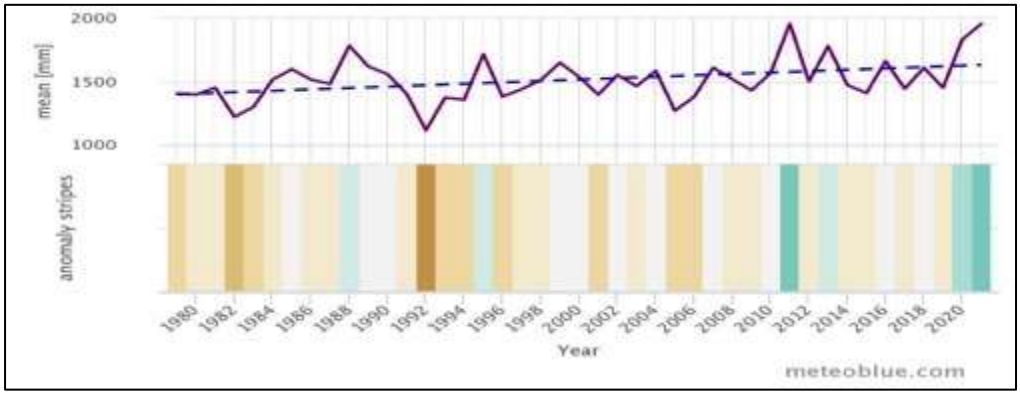


Figure 6: Mean yearly precipitation, trend and anomaly, 1979-2022, at Pangboche

Figure 6 shows monthly anomaly temperature from 1979 to 2022. The red graph in the figure shows the warm months while blue shows cold months. The graph clearly shows that warmer months are in increasing trend, which reflects the global warming associated with climate change. The lower part of graph in figure 6 shows monthly anomaly precipitation from 1979 to 2022. The green graph shows wetter, months whereas the brown line indicates drier months. The anomaly shows wetter months are in increasing trend.

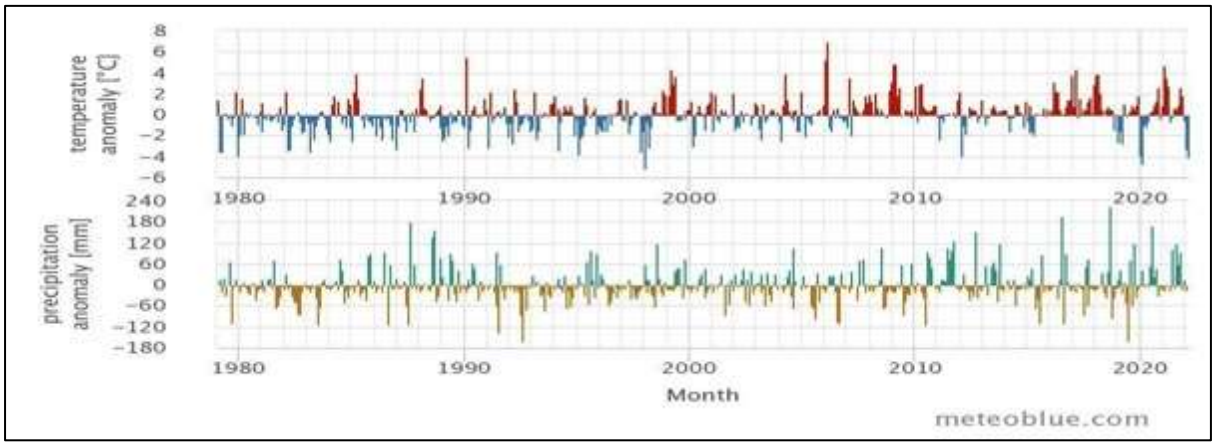


Figure 7: Monthly Anomalies for Temperature and Precipitation in 1979-2021 at Pangboche

4.1.11.2 Natural Disasters

Flood, landslide, forest fire, windstorm, Glacial Lake Outburst Floods (GLOFs), frost, drought, snowfall and avalanche are the major natural disasters in the KPLRM. Affects of forest fire, landslide and flood are in area of influence while windstorm, GLOFs, frost, drought, snowfall and avalanche along with forest fire, landslide and flood are in upper parts of the RM (KPLRM, 2019). Earthquake in 2015 also affected 450 houses in ward no. 4 of the RM.

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. The Dudh Koshi 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 Cholunche Khola 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 burst. The powerhouse of AMHP is located at left bank of Imja Khola with an altitude 3951.50 masl. Elevation difference (3951.50-3911 masl) between the riverside and powerhouse location is 40 m. As the potential GLOF depth at Pangboche is 7.6 m (Bajracharya et al., 2007), the powerhouse location is safe from potential Imja Glacial Lake Outburst Flood (GLOF).

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 where there are no trees, however, penstock alignment lies in Juniper Scrublands in the vegetation zone of Moist Alpine Scrubs. The powerhouse area lies in the vegetation zone of Birch-Rhododendron Forest with subalpine juniper forest. Transmission and distribution lines also pass-through Alpine pastureland, Juniper Scrublands and Birch-Rhododendron Forest with subalpine juniper forest.

4.2.1 Vegetation in Subproject Area

The subproject's components such as headworks and intake lies in Cholunche Khola within Alpine Pasturelands where there are no trees. Some herbaceous and grass species are found in left and right bank of Cholunche Khola. Although the area lies within Juniper Scrub Vegetation Zone, the dominant shrub species of Rhododendron is found on left and right sides of the proposed penstock alignment. The powerhouse area lies in the vegetation zone of Birch-Rhododendron Forest with subalpine juniper forest. Table 19 presents the recorded species of vegetation in the subproject area.

4.2.1.1 Headworks/Intake

Headworks and intake area lies with in Alpine Pasturelands where there are no trees. Some common shrubs observed are *Bistorta vaccinifolia*, *Rhododendron nivale*, Salix sp. etc. Similarly, some common herbs are *Anaphalis triplinervis, Bistorta vivipara, Juncus concinnus, Pedicularis confertiflora, Potentilla coriandrifolia, Ranunculus brotherusii,* Saxifraga sp. *etc.*

4.2.1.2 Penstock Pipe

Penstock pipe lies between the elevations of 3952 m to 4421 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. In lower elevation, some sparse dwarf species of junipers such as *Juniperus indica and J. recurva* are also seen. Some regenerating tree species such as *Betula utilis, Abies spectabilis, R. wightii, and R. fulgens* are also found at lower slope. Other common shrubs are *Berberis angulosa, Cassiope fastigiata, Ephedra gerardiana, Juniperus squamata, Salix lindleyana* etc. Aconitum sp., *Agrostis pilosula,* Anaphilissp., Anemone sp., Aster sp., *Bistorta macrophylla, Juncus leucanthus,* 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 an altitude of 3951.18 m. 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 the proposed powerhouse site. *Berberis wallichiana, Ephedra gerardiana, Juniperus squamata, Potentilla fructicosa, R. campanulatum, R. lepidotum, Spirae abella* etc. are some shrubs found in the area. Similarly, *Aconitum laciniatum, Arisaema jacquemontii, Bergenia purpurascens, Corydalis longipes, Deschampsia caespitosa,* Primula sp., *Swertia racemosa* etc. are some herbs that are found in the area.

4.2.1.4 Transmission & Distribution (T&D) Lines

The T&D lines will be distributed to Lobuche in north and Lawi Schyasa in south, Chukung in East and Machhermo in west. The T&D line will be underground along the foot trails except in river crossings. Along the T&D line, there are four vegetation zones - Alpine Pasture, Juniper Scrub, Sub Alpine Juniper Forest and Upper Temperate Blue Pine Forest. Major plants recorded in the subproject area are presented in **Table 20.**

Table 20: Recorded Species of Vegetation in the Subproject Area

SN	Local Name	Scientific Name	Type	CITES Appendix	IUCN Red List	GoN
1	Gobresalla	*Abies spectabilis*	Tree	NoList	NT	Protected
2	Bhojpatra	*Betula utilis*	Tree	NoList	LC	NoProt
3	Chireyal (Gurans)	*Rhododendron fulgens*	Tree	-		
4	(Gurans)	*R. wightii*	Tree	-		
5	Chutro	*Berberis angulosa*	Shrub	-		
6	Chutro	*B. wallichiana*	Shrub	-		
7	Pulungejhar	*Bistortavaccinifolia*	Shrub	-		
8	Phursan	*Cassiopefastigiata*	Shrub	-		
9	Somalata	*Ephedra gerardiana*	Shrub	-		
10	Dhupi	*Juniperus indica*	Tree/Shrub	NoList	LC	NoProt
11	Dhupi	*J. recurva*	Tree/Shrub	NoList	LC	NoProt
12	Dhupi	*J. squamata*	Shrub	NoList	LC	NoProt

SN	Local Name	Scientific Name	Type	CITES Appendix	IUCN Red List	GoN
13	Chiniya phal	*Potentilla fructicosa*	Shrub	-		
14	Cheriala	*R. campanulatum*	Shrub	-		
15	Bhalesunpate	*R. lepidotum*	Shrub	-		
16	Sunpate	*R. anthopogon*	Shrub	-		
17	*NA*	Salix sp.	Shrub	-		
18	Setokhareto	*Spiraeabella*	Shrub	-		
19	Murula	*Aconitum laciniatum*	Herb	-		
20	*NA*	Aconitum sp	Herb	-		
21	Ghans	*Agrostispilosula*	Herb	-		
22	BukiFul	*Anaphalistriplinervis*	Herb	-		
23	BukiFul	Anaphilis sp.	Herb	-		
24	*NA*	Anemone sp.	Herb	-		
25	*NA*	*Arisaema jacquemontii*	Herb	-		
26	*NA*	Aster sp.	Herb	-		
27	Pakhanbed	*Bergenia purpurascens*	Herb	-		
28	Chawaphul	*Bistorta macrophylla*	Herb	-		
29	Khalti	*Bistorta vivipara*	Herb	-		
30	Ghans	*Deschampsiacaespitosa*	Herb	-		
31	*NA*	*Juncus concinnus*	Herb	-		
32	*NA*	*J. leucanthus*	Herb	-		
33	*NA*	Leontopodium sp.	Herb	-		
34	*NA*	Pedicularis sp.	Herb	-		
35	*NA*	Primula sp.	Herb	-		
36	*NA*	*Ranunculus brotherusii*	Herb	-		
37	*NA*	Saxifraga sp	Herb	-		
38	*NA*	*Swertia racemosa*	Herb	-		
NT: Near Threatened; LC: Least Concern; NoProt: Not Protected; NoList: Not Listed						

4.2.1.5 Non-Timber Forest Products Used (NTFPs) in Subproject Area

There are more than 50 plant species that the local communities use as medicine, food, incense, timber, fuelwood, fodder and decorative item. Some commonly used NTFPs are Aconitum sp., Anaphilis sp., *Arisaema flavum,* Barberis sp., Clematis sp., *Cotoneaster microphyllus,* Drepanostachyum sp., *E. gerardiana, Euphorbia sikkimensis, Gaultheria fragrantissima,* Juniperus sp., *Meconopsis horidula, Michelia champaca, Nardostachys grandiflora, Plantago erosa, Rheum austtrale, R. anthopogon, R. campylocarpum, Rumex nepalensis* etc. In addition, the local people use wild edible mushrooms extensively are *Armillarie llamellea,* Boletus sp., *Hydnum repandum,* Ramaria sp., *Paxillus involutus, Tylopilus eximus* etc.

4.2.2 Fauna (mammalian and avian)

Though the Annual Progress Report of Fiscal Year 2077/78 of Sagarmatha National Park has reported 7 species of amphibian and 11 species of reptile in the national park and its buffer zone, the consultation with SNP and locals reported that reptiles, amphibians and fish are not observed in the subproject area. Therefore, only mammals and birds are discussed as follows.

4.2.2.1 Mammals

14 species of mammal were reported from the subproject areas. Large mammals visit this area in search of food while small mammals such as *Lepus oiostolus* (Wolly Hare), *Ochotana macrotis* (Large-eared Pika) and *Marmota bobak* (Steppe marmot) reside in the rocky areas of the subproject area. *Hemitragus jemlahicus* (Himalayan Tahr), *Canis aureus* (Golden Jackal), *Canis lupus* (Grey Wolf), *Uncia uncia* (Snow Leopard), *Moschus chrysogaster* (Musk Deer), *Alticola strachey* (Strachey's Mountain Vole), *Ursus thibetanus* (Asian Black Bear) etc. are also seen in the area. Table 21 presents the conservation status of mammals.

4.2.2.2 Birds

More than 80 different bird species have been reported in the subproject area. Some common birds are *Aquilla heliacal* (Imperial Eagle), *Buteo buteo* (Common Buzzard)., *Gyps himalayensis* (Himalayan Griffon), *Eremophila alpestris* (Horned Lark), *Collocalia brevirostris* (Himalayan Swiftlet), *Columba leuconota* (Snow Piegon), *Corvus corax* (Common Raven), *Corvus macrorhynchos* (Large-billed Crow), *Clamator jacobinus* (Pied Cuckoo), *Falco tinnunculus* (Common Kestrel), *Carpodacus sp.*, *Delichon dasypus* (Asian House Martin), *Delichon nepalensis* (Nepal House Matin), *Lanius tephronotus* (Grey-backed Shrike), *Luscinia sp.*, *Zoothera dixoni* (Long-tailed Thrush), *Motacilla sp.*, *Montifringilla sp.*, *Passer domesticus* (House Sparrow), *Prunella sp.*, *Lophophorus impejanus (Himalayan Monal), Tragopan satyra* (Satyr Tragopan), *Garrulax ocellatus* (Spotted Laughing Thrush), *Yuhina sp.*, *Upupa epops* (Common Hoop) *etc.* Table 22 presents the conservation status of birds. No migratory birds were reported in the study area.

4.2.2.3 Herpetofauna

The following reptiles and amphibians are present in the SNP and its buffer zone. Himalayan Toad *(Bufo himalayanus),* Liebig's frog *(Paa liebigii),* Eastern keelback *(Amphiesma platyceps),* Himalayan trinkt snake *(Elaphe hodgsonii) and* Himalayan/Glacier skink *(Scincella ladecense himalayanus*), these species are reported in the annual progress report of the SNP. However, these are not categorized as protected species.

Fishes

During consultation with the people living from generations in the subproject area, it was revealed that neither they have seen fishes in Cholunche Khola in their lifetime nor they have heard from their ancestor about it. According to the local people and representatives from the RM, SNP, and BZMC, the nearest place from the subproject site where fishes can be found is Khari Khola located in Ward No 1 of Khumbu Pasanglhamu RM, and is approximately 35 km in south. The local people have not seen any fishes in the tributary rivers of Dudhkoshi which are located in the upper region from the waterfall near to Khari Khola.

A consultation organized by AEPC with the representatives of Khumbu Pasanglhamu RM, SNP, BZMC and ESCO on 18 September 2022 at AEPC Office, Mid Baneshwor (meeting minute in **Annex XVII**) also verified the information. During consultation, a discussion on presence of fishes in Monjo Khola and Cholunche Khola was conducted. As per the discussion, it was concluded that there is no availability of fishes in those rivers due to high

drops and slop gradient, high altitude and cold and freezing water. The Chief Conservation Officer of SNP also mentioned the statement "The snow-fed Dudhkoshi and Imja Khola originating from the Himalayas and the Tibet Autonomous Region (TAR) of China are the main aquatic habitats in the Khumbu region. In addition, there are many glacial lakes that harbor wetland habitats for migratory birds. However, there is no evidence of aquatic life in its river systems and lakes due to icy-cold temperature (SNP, 2016)" published in "Sagarmatha National Park and Its Buffer Zone Management Plan 2016-2020" published by the GON, and highlighted his experience of no evidences of fishes in the river systems around the proposed subproject areas. This statement is also supported by Khatri et al. 2020, with the statement "The presence of fish beyond the tree line in Nepal[5] has not been reported yet. High altitude lakes and rivers are known to be naturally fishless because the elevation acts as a natural physical barrier against fish migration and colonization (Ventura et al., 2017). In Nepal, only three endemic species of Schizothorax have been reported from Lake Rara - a high mountain lake in the western region of the country". AEPC also consulted with ICIMOD and Department of Environmental Science and Engineering, Kathmandu University regarding the study on fish population on those rivers. So, these screening confirmed that there is no existence of fish. In addition, the Chairperson of the RM shared his experience related to COVID-19 pandemic. People had a belief that consuming Himalayan Toad (PAHA) will provide immunity and strength to fight with the disease. So, people conducted a massive search for it in Cholunche Khola and Monjo Khola and other stream in Monjo village. Even during that period, people did not find any fish, though they were able to catch few toad.

4.2.3 Protected Areas

The subproject area lies in the Sagarmatha National Park (SNP), legally protected area of Nepal. Additionally, it is recognized as a World Heritage Site (WHS) by UNESCO upon the criterion (vii). The SNP is identified as an Important Bird Area (IBA) by Birdlife International, which recognizes the important biodiversity value of the area. Ramsar Wetlands of international importance are also located in SNP. Thus, potential impacts of subprojects to the Outstanding Universal Value (OUV) has been assessed during the preparation of this ESIA report.

4.2.4 Terrestrial Ecosystem, Protected Areas and Red Book Species

The conservation status of flora and fauna (mammalian and avian) is presented in **Table 20, 21 and 22**.

Table 21: Conservation Status of Some Flora of Subproject Area

S.N.	Nepali Name	English Name	Scientific Name	CITES Appendix	IUCN Red List	GoN
1	Talispatra	Webb Fir	*Abies spectabilis*	-	NT	Protected
2	Chanp	Mangolia	*Micheliachampaca*	-	LC	Protected

[5]Out of the thirty four species recorded from the study forest (SNP), *A. spectabilis* was the co-dominant species with high species diversity. Total tree density was the highest at 3450 m and the lowest at 3550 m. Elevation appeared to be the important environmental factor that affects the community attributes of the study forest. Nagarkoti et al. 2019, Community structure and regeneration pattern of *Abies spectabilis* in Sagarmatha National Park, Central Himalaya, Nepal, Banko Janakari, Vol 29 No. 1, 2019 Pp 12–24 (https://www.nepjol.info/index.php/BANKO/article/view/25150/21115)

3	Jatamansi, Bhutle	Himalayan Spikenard	*Nardostachysjatamansi (formerly N. grandiflora)*	II	CR	Protected
4	Jhyau	Lichen	*Parmelia sp. & others spp.*	-	-	Protected

(Source: Field Survey 2022)

Table 22: Conservation Status of Mammals potentially occurring in Subproject Area with updates from IBAT

SN	Nepali Name	Common Name	Scientific Name	Conservation Status		
				Nepal Red Data Book (2012)	IUCN Red List	CITES Appendix
1	Sikkime Ghanse Muso	Sikkum Vole	*Pitymys sikimensis*	LC	LC	-
2	Chhuchundro	Brown Toothed Shrew	*Episoriculus caudatus (formerly Soriculus caudatus)*	LC	LC	-
3	Chituwa	Common Leopard	*Panthera pardus*	VU	VU	I
4	Pani Chuchundro	Elegant Water Shrew	*Nectogale elegans*	LC	LC	
5	Chuchundro	Golden Jackal	*Canis aureus*	LC	LC	III
6	Bwasho	Grey Wolf	*Canis lupus*	CR	LC	I
7	Kalo Bhalu	Himalayan Black Bear	*Ursus thibetanus*	EN	VU	I
8	Muse Thutekharayo	Himalayan Mouse-hare	*Ochotona roylei*	DD	LC	-
9	Jharal	Himalayan Thar	*Hemitragus jemlahicus*	NT	NT	-
10	Duhure Ghar Muso	House Mouse	*Mus musculus*	LC	LC	-
11	Ghar Muso	House Rat	*Rattus rattus*	LC	LC	-
12	Dhendu	Langur	*Semnopithecus priam ssp. Thersites* (Formerly *Presbytis entellus)*	LC	VU	I
13	Kasturi	Himalayan Musk Deer	*Moschus leucogaster (formerly M. chrysogaster)*	DD	EN	I
14	Habre	Himalayan Red Panda	*Ailurus fulgens sub sp. fulgens*	EN	EN	I
15	Rato Bandar	Rhesus Macaque Monkey	*Macaca mulatta*	LC	LC	-
16	Saiberiyalimal asapro	Siberian Weasel	*Mustela sibirica*	LC	LC	III
17	Malsapro	Yellow-throated Marten	*Martes flavigula*	LC	LC	III
18	KaloSalak	Chinese Pangolin	*Manis pentadactyla*	EN	CR	I
19	Ban Kukur	Dhole	*Cuonalpinus*	EN	EN	II
20	MandellikoM	Mandelli's	*Myotis sicarius*	VU	VU	-

SN	Nepali Name	Common Name	Scientific Name	Conservation Status		
				Nepal Red Data Book (2012)	IUCN Red List	CITES Appendix
	usakaneChamero	Mouse-eared Myotis (Bat)				
21	Hiun Chituwa	Snow Leopard	*Panthera uncia*	EN	VU	I
22	Thar	Mainland Serow	*Capricornis sumatraensis*	NT	VU	I
23	Bhote Kharayo	Wolly Hare	*Lepus oiostolus*	LC	LC	
24	Lamkaane Thutekharayo	Large-eared Pika	*Ochotona macrotis*	-	LC	
25	Phyaumuso	Bobak Marmot	*Marmota bobak*	-		
26	Sunkanthe Kasturi	Alpine Musk Deer	*Moschus chrysogaster*	EN	EN	I
27	Ghansemuso	Stoliczka's mountain Vole	*Alticola strachey*	-	LC	-

(Source: Field Survey 2022)

Table 23: 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	Cinereous Vulture	*Aegypius monachus*	-	NT	EN
2	Chilime	Blood Pheasant	*Ithaginis cruentus*	II	LC	LC
3	Cheel	Osprey	*Pandion haliaetus*		LC	LC
4	Danphe	Impeyan Pheasant	*Lophophorusim pejanus*	I	LC	NT
5	Tibbati Him-Kukhura	Tibetan Snowcock	*Tetraogallus tiebetanus*	-	LC	-
6	Dadi Bhayeko Giddha	Bearded Vulture	*Gypaetus barbatus*	-	NT	VU
7	Munal	Crimson-horned Pheasant	*Tragopan satyra*	III	NT	VU
8	Shahi Baaj	Peregrine Falcon	*Falco peregrinus*	I	LC	LC

(Source: Field Survey 2022)

4.2.5 Occurrence of Critical Natural Habitat

Critical natural habitat is defined under the World Bank Natural Habitats (OP/BP 4.04) but there is no guidance on how to define the concept. This ESIA therefore recognizes critical natural habitat based on the following criteria adapted from the ESS6 and applicable to the project area of influence:

(a) Occurrence of significant populations of Critically Endangered (CR) and Endangered (EN) species based on the Nepal National Red List Series and the IUCN Red List of Threatened Species;
(b) Occurrence of significant populations of restricted range (endemic) species;
(c) Occurrence of significant populations of migratory/congregatory species;
(d) Highly threatened or unique ecosystems, assessed on a case-by-case basis; and/or
(e) ecological functions or characteristics needed to maintain the viability of the biodiversity values described above in (a) to (d).

Various CR and EN species are however known or expected to occur and there is justification for recognizing critical natural habitats for those species that are likely to be impacted by the subproject. **Table 24** presents a brief analysis of threatened species for which critical natural habitat may be justified. Only three mammals are likely to be impacted, namely Red Panda, Himalayan Musk Deer and Himalayan Black Bear. These species will require mitigation for their protection and are further assessed in the Impact Assessment chapter. No significant populations of restricted range or migratory species are expected in the project area of influence.

Table 24: Assessment of Species for which Critical Natural Habitat are Justified and Species which may require Mitigation for Their Protection

Species	NRDB, NPWC	IUCN Red list	CITES Appendix	Altitude Range (m)	Justification	Potential Impact from the Project
Mammals						
Snow leopard (*Uncia uncia*)	EN, P	VU	I	3500-5600	Included as a WHS OUV	Not impacted as not present at the project altitude
Red Panda (*Ailurus fulgens*)	EN, P	EN	I	2800- 3900	Included as a WHS OUV, reported to be common, used for naming a local BZUG.	Potentially impacted by influx of workers, through illegal hunting or disturbance by their dogs.
Himalayan Musk Deer (*Moschus chrysogaster*)	EN, P	LR/NT	I	Up to 3000	Reported to be common	
Himalayan Black Bear (*Ursus thibetanus*)	VU	VU	I	1000-3000	Known to be present in the SNP	Likely attracted to inappropriately discarded waste, potentially escalating human-wildlife conflict.
Birds						
Eastern Imperial Eagle (*Aquila heliaca*)	CR	VU	I	Up to 3900	Reported to be present	Both species unlikely to be impacted by the project
Himalayan Griffin (*Gyps himalayensis*)	VU	NT	-	1200-5500	Reported to be present	

(Source: Annual Report of SNP 2077/78)

NRDB: Nepal Red Data Book (CR= Critically Endangered, EN= Endangered, P= Protected, VU= Vulnerable)
NPWC: National Park and Wildlife Conservation (NPWC) Act, 1973 (P= Protected)
IUCN Red List Category (VU= Vulnerable, EN= Endangered, LR= Lower Risk, NT= near Threatened

4.3 Socio-economic and Cultural Environment

4.3.1 Subproject Load Centre (Beneficiary) and Distance from the Subproject Site

Altogether 19 settlements with 451 households are identified as load centers (Table 25).

Table 25: Load Centers with Distance

SN	Settlements (Load Centers)	No. of HHs (451 Beneficiary Households)	Distance from Powerhouse (Km)
1.	Chukung	12	11.00
2.	Debuche	6	3.57
3.	Dingboche	86	6.20
4.	Dole	14	11.20
5.	Fungi Tenga	9	6.90
6.	Lawi Schyas	11	7.82
7.	Lobuche	12	13.67
8.	Luza	3	14.50
9.	Milingo	3	2.85
10.	Machhermo	13	16.00
11.	Pangboche	102	1.05
12.	Pheriche	35	7.05
13.	Phortse	106	6.05
14.	PhortseTenga	3	7.50
15.	Shomare	19	2.40
16.	Thukla	2	10.78
17.	Thyangboche	7	4.57
18.	Worshyo	1	3.40
19.	Mongla	7	4.00

(Source: Field Survey, 2022)

The electricity demand varies with the type of entities ranging from 1 kW to 5 kW. The hospitals and bakery have high demand as shown in **Table 26.**

Table 26: Demand as Per Entities

Entities	Power allotted (kW)	Number
Big Hotel	4	57
Medium Hotel	2.5	71
Small Hotel	1.5	58
Restaurant	1.5	38
High Demand House	1.5	161
Low Demand House	1	42
Social Institutions (School, Gumba etc.)	4	13
Snooker House	1	3
Hospitals	4	2
Shop	1	4
Bakery	5	2

(DFS &DED, 2022)

4.3.1.1 Occupation

The total population of Khumbu Pasanglhamu RM is 8989 in 2433 houses with average family size of 3.69 (KPLRM, 2019). The female population (50.02%) is slightly more than male population. The total population in Ward No. 4 where the subproject site lies is 1912 in 551 HHs with average family size of 3.47. 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%). Other Castes are negligible. Base on religion, majority of HHs are Buddhists (78.80%), followed by Hindu (20.63%) and Christian (0.57%).

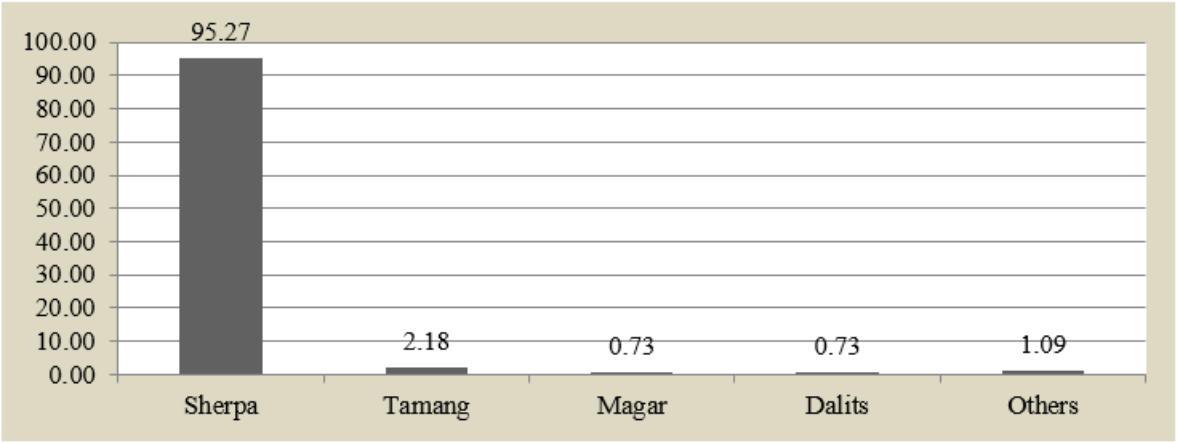


Figure 8: HHs Percentage Based on Caste/Ethnicity in Ward No. 4

(Source: KPLRM, 2019)

The load centers does not include all the settlements Ward No. 4, especially Khumjung and Khunde settlements where electricity has been provided by Khumbu Bijuli Campany.

Table 27: Number of Houses in Affected Settlements

S.N.	Place Name	No. of HHs	Male	Female	Total
1	Chukung	12	22	27	49
2	Debuche	6	2	3	5
3	Dingboche	86	174	147	321
4	Dole	14	26	33	59
5	Fungi Tenga	9	15	11	26
6	LawiSasa	11	12	8	20
7	Lobuche	12	15	9	24
8	Luza	3	0	0	0
9	Milingo	3	10	12	22
10	Mochhermo	13	32	14	46
11	Pangboche	102	197	201	398
12	Pheriche	35	56	55	111
13	Phortse	106	208	201	409
14	PhortsheTenga	3	3	7	10
15	Shomare	19	37	36	73
16	Thukla	2	7	4	11
17	Tyangboche	7	42	14	56
18	Worshyo	1	2	2	4
19	Mongla	7			
	Total	**451**	863	788	1651

(Field Survey 2022)

4.3.2 Land Use and Ownership

The Rural municipality covers 1539.11 Km^2 land, of which 43.93% is covered with snow/glacier, 19.93% is barren land, 15.61% is grass land, 9.98% is covered with forest and 9.30% is shrub land. In addition, 0.67% is agriculture land, 0.005% is built up area and 0.58% is covered with water body.

Out of total area of 702.16 Km^2 in Ward No.4, 52.40% is covered with snow/glacier, 20.86% is barren land, 14.52% is grassland, 8.02% is shrub land, 2.83% is covered with forest 2.83%, 0.67% is covered with water body, 0.45% is built up area and 0.25% agriculture land (KPLRM, 2019).

Traditionally, Sherpas are the custodians of the whole Khumbu area. But after declaration of National Park, the land except registered as private within National Park area is under the jurisdiction of SNP. The land used by local people for settlements and agricultural purposes are private land. The proposed subproject requires 5.711 ha. of public/GoN land (Details in Table 8) where the presence of physical infrastructure does not exist. It is open land used for grazing by locals. Penstock pipe and T&D lines are underground and do not visible during operation whereas, headworks, desilting basin and powerhouse are visible, that requires minimal area of land. Average land holding in different load center has been given in **Table 27.**

Table 28: Average Landholding in Load Centers

S.N.	Settlements	Average of Landholding (Ropani/HH)
1	Chukung	2.04
2	Debuche	1.00
3	Dingboche	1.70
4	Dole	2.46
5	LawiSchyasa	6.33
6	Lobuche	2.00
7	Machhermo	3.64
8	Milingo	1.13
9	Pangboche	0.96
10	Pheriche	1.51
11	Phortse	1.58
12	PhortseTenga	1.83
13	Shomare	0.56
14	Thukla	1.50
15	Worshyo	1.00

(Source: DFS)

4.3.3 Other Household Property such as Physical Structure

Most of the houses in the area are constructed with stone cement masonry wall with wooden wall partition and Corrugated Galvanized Iron (CGI) sheet roof. Traditional practice of building houses with stone and mud has been replaced by cement (Table 29).

Table 29: House Type in Ward No. 4

Type	% of HHs
Stone mud wall	45.93
Stone Cement wall	49.42
Tin and Wood	4.07
Others	0.58

(Source: KPLRM, 2019)

4.3.4 Tree Plantation (fruits trees, timber trees and others)

Some households have planted apple trees in the subproject area, otherwise fruit tree plantation is rare.

4.3.5 Cropping and Grazing Patterns

The RM has diverse climate due to altitudinal variation from 1,543 m amsl to 8,848 m amsl. People residing in Ward No. 1, 2 and 3 grow more crops such as barley, potato and other green vegetables due to comparatively warm climate than in Ward No. 4. These days people have started vegetable cultivation in plastic tunnel.

In the Ward No. 4, most of the HHs rear livestock such as Yak, cow, horse, jyokpo[6] and bull. Open grazing is common in subproject area. Construction activities may impact on grazing of livestock for short time but it does not impact on overall livelihood of locals as abundant of open space is available in subproject area for grazing.

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4.3.6 Vulnerability of People in Subproject area

The households that have disabled, elderly people (elder headed without any other bread winner), single women, female headed, Dalit and indigenous people are considered as vulnerable groups considering the fact that these people are more prone to be impacted by the adverse impacts of development activities as they don't have sufficient resources and knowledge to cope with such adverse situation.

Majority of the people in the subproject area belongs to Sherpa ethnic community followed by Tamang, Rai and Dalit. Nearly 170 women are single while 2 people are disable in the subproject area. The subproject does not have adverse impact to the people directly or indirectly to these identified vulnerable groups. All subproject components will be in public land so nobody will be displaced and land from locals will not be acquired. As almost all people are indigenous Sherpa and the subproject benefits them without any adverse impacts. The subproject provides the energy during operation that can be used for various purposes such as cooking, lighting, heating and many more. Thus, the subproject will benefit people including vulnerable groups of subproject area with beneficial impacts rather than adverse impacts.

[6] *Jyokpo is a cross breed of cow and yak that can adapt in high altitude*

4.3.7 Literacy and Education

Literacy rate in Ward No. 4 is 73.98% while it is 67.7% in the RM.

Table 30: Literacy Rate of Khumbu Pasanglhamu RM

Ward Number	Literate (%)	Illiterate (%)
1	63.26	36.74
2	75.28	24.72
3	70.41	29.59
4	73.98	26.02
5	62.56	37.44
Total	67.72	32.28

(Source: KPLRM, 2019)

There are 15 government schools and one private school in the RM. There are two basic schools at Pangboche and Phorse while one secondary school is in Khumjung (Table 30).

Table 31: Educational Institutions

Ward No.	SN	Name of School	Level	Remarks
1	1	Shree Khari Khola Secondary School, Khari Khola	Secondary	
	2	Shree Mera Adharbhut School, Khari Khola	Basic	
	3	Shree Pankonija Adarbhut School, Khari Khola	Basic	
	4	Shree Buksa Adharbhut School, Khari khola	Basic	
2	5	Shree Lukla Adharbhut School, Lukla	Basic	
	6	Shree Sagarmatha Adharbhut School, Surke	Basic	
	7	Shree Himalayan English Boarding School	Basic	Private
3	8	Shree Mahendra Jyoti Secondary School, Chaurikharka	Secondary	
	9	Shree Pemachholing Adharbhut School, Ghat	Basic	
	10	Shree Jansewa Adharbhut School, Gumela	Basic	
	11	Shree Yuwa Barsha Adharbhut School, Manju	Basic	
4	12	Shree Pangboche Adhabhut School, Pangboche	Basic	
	13	Shree Fortche Adharbhut School, Fortche	Basic	
	14	Shree Khumjung Secondary School, Khumjung	Secondary	
5	15	Shree Himalaya Adharbhut School, Namche	Basic	
	16	Shree Thame Adharbhut School, Thame	Basic	

(Source: KPLRM, 2019 and Field Study 2078)

4.3.8 Occupation/Employment, Income and Expenditure

Tourism activities such as trekking, mountain climbing, hotel and restaurant are the major economic activities of the subproject area. The other sources of economic activities are agriculture and foreign employment. Despite the large number of people in subproject area engaged in tourism related business unemployment rate is found relatively higher in Ward No. 4 comparing to other Wards of the RM.

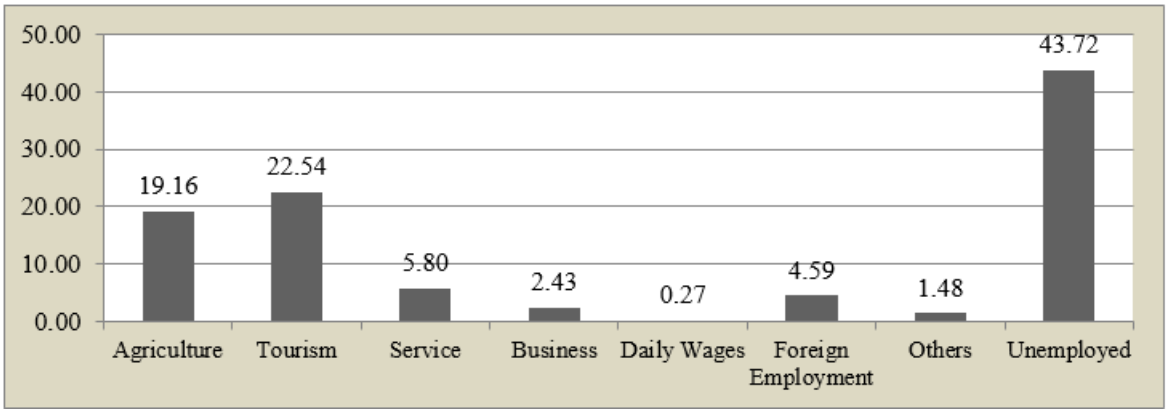

Figure 9: Population Percentage by Occupation in Ward Number 4

(Source: KPLRM, 2019)

Annual or Monthly average income of the majority of people in the subproject area is more than NPR 40,000.00 (Figure 9). Nearly 23% HHs has income upto NPR 10000.00 while 18% HHs in-between NPR10-20 thousand.

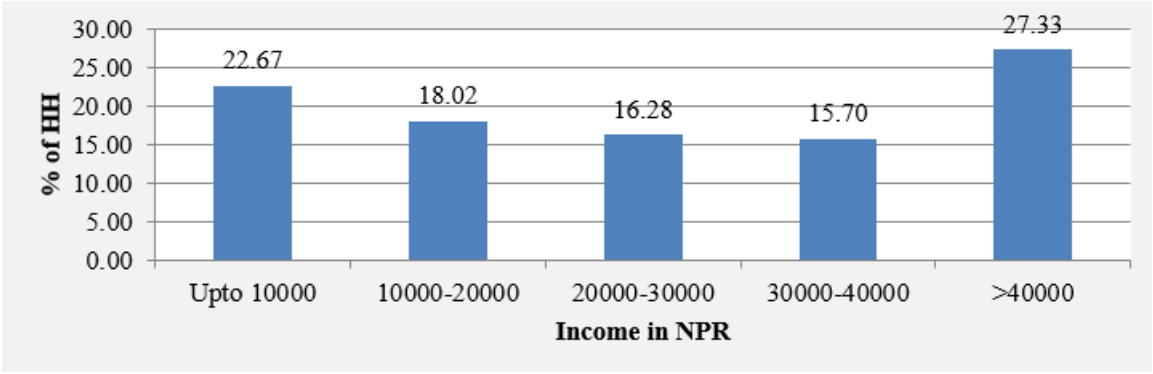

Figure 10: HH Annual Income in Subproject Area

(Source: KPLRM, 2019)

People of the subproject area make their expenses on food, education, health and other utilities as shown in (Figure 10).

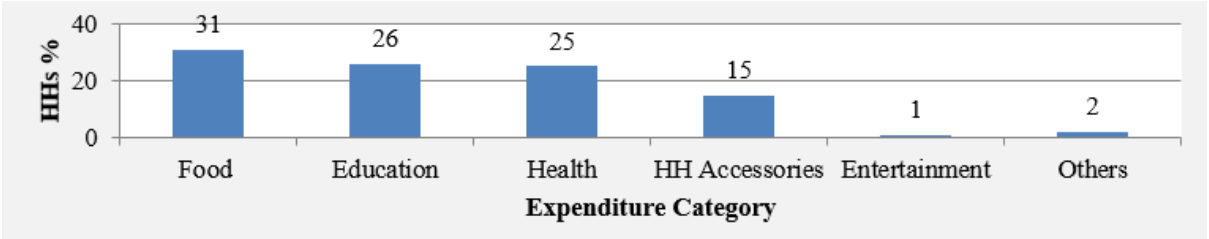

Figure 11: HH Expenses in SubprojectAarea

(Source: KPLRM, 2019)

4.3.9 Accessibility of Electricity in the Subproject Area

The proposed subproject area is in off-grid area. The households in the area are electrified from three micro hydro (Table 31) in Section 4.3.14. The electricity generated from existing micro hydro is used only for lighting purposes due to power deficit. Demand of electricity for space heating and cooking cannot be met by existing micro hydro plants.

4.3.10 Physical and Cultural Resources in the Subproject Area

There are three schools in Ward No. 4; two primary and one secondary school. Similarly, there are three health institutions in the ward which are Khunde Hospital, Khumjung Health Post and Fortse Health Clinic. There are 10 Gumbas in the subproject area. The nearest Gumba is Pangboche Gumba which is approx. out 800 m in west from powerhouse site which is one of the main meeting or gathering place.

4.3.11 Sultural Practices and Festivals in Subproject Area

Buddha Purnima, Mani Rimdu and Dumji are the major festivals and ceremonies that are celebrated in the subproject area. Manirimdu is celebrated for 3 days in November. The first day of festival involves prayers, second day for colorful lama dancing, they wear brocade gown and wonderfully painted papier-mâché masks. Last day is for some humorous dances and chanting prayers. Dumji is celebrated on the occasion of birthday of Guru Rimpoche. The festival serves as a religious and community duty to help bring the villagers together. Every 13 years it falls upon three families to provide food and drink for the entire village for the duration of celebrations, which lasts for 4 days. (Source: https://www.guideinhimalaya.com/)

4.3.12 Description of Settlements of Indigenous People, Dalits and other Religious and Minorities within the Subproject Affected Area

There are more than 20 different settlements with 90% HHs of Sherpa. Tamang, Magar and Dalits are other groups in the area who have migrated in the area for business (Figure 11).

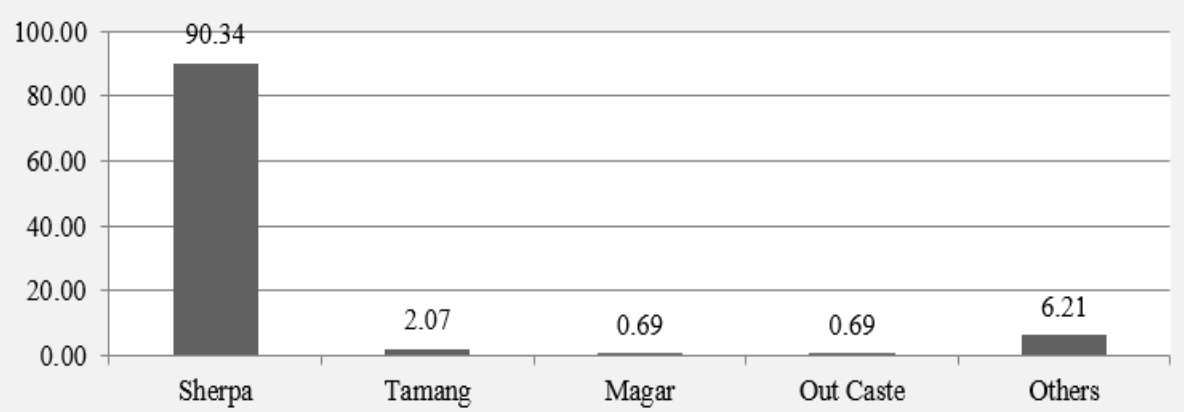

Figure 12: Indigenous Group in SPIA

(Source: KPLRM, 2019)

Nearly all HHs follow Buddhism in subproject impact area (SPIA), only 0.5% HHs follow Hinduism (Field Survey 2021).

4.3.13 Communication Facility

Basically, SPIA has 3G services. 4G mobile network facilities are also available in the subproject area although network or quality is poor. Similarly, internet facilities and facilities of dish home (Satellite television) are also available in major settlements. There are two post offices in the RM. Himal FM and Solu FM based on Salleri, headquarter of Solukhumbu, are aired and covers some part of subproject area although locals hardly listen radio. The major source of information in the subproject area is internet (usages of social network sites like Viber, Whats Apps, & Facebook etc.) and visual media (News from television).

4.3.14 Local Amenities

The foot trail for trekking is available as road facility in the subproject area. People transport goods on mules, horse, jyokpo and by air (helicopter). The headwork and powerhouse areas can be accessed through foot trail from Pangboche (about 3.25 Km headwork and 1.6 Km power house from away Pangboche).

There are three micro hydro in the subproject area (**Table 32**). The existing micro hydro in the subproject area are not operational in their full capacity as these hydro was 10-12 years older and need repair & maintenance. Thus, these hydro are not able to meet energy demand of community people in subproject area. In addition, schools, health post, community hall, drinking water facilities, internet facilities, post offices, bridges, and helipads are some of the public amenities observed in subproject area.

Table 32: Existing Micro Hydro Projects

SN	Hydropower	Ward	Installed Power (kw)	Present Generation, kW
1	Tengboche Micro Hydropower	4	35	15
2	Pangboche Micro Hydropower	4	25	20
3	Phorche Micro Hydropower	4	50	45

Table 33: Bridges in SPIA

SN	Name of Bridge	Type of Bridges	Address	Remarks
1	Phungi Tenga Bridge	Suspension	Phungi Tenga	Dudhkoshi Crossing
2	Milingo Bridge	Suspension	Milingo	Crossing
3	Dingboche	Iron Bridge	Dingboche	Pheriche Crosing
4	Feriche Bridge	Iron Bridge	Feriche	
5	Thugla Bridge	Iron Bridge	Thugla	Pheriche Crosing
6	Fortse Tenga	Iron Bridge	Fortse Tenga	Dudhkoshi Crossing
7	Dole Kathe Sangu	Wooden Bridge	Dole Kathe	Crossing
8	Nala Iron Bridge	Iron Bridge	Nala Phalame	
9	Gokyo Iron Bridge	Iron Bridge	Gokyo	Crossing
10	Imja	Iron Bridge	Pangboche	Crossing

4.3.15 Customary Practices on Dispute Management

People in the subproject area gather at public place especially at Gumba or community hall or at school for discussion at presence of community leaders when there are any disputes arises among community members. Collective decision making is in practice in the subproject area where each community member can express their views without any kind of coercion. Generally, Senior Lama from the Gumba acts as the community leader. Sometimes a senior public figure in the Sherpa community also play the role of the leader. Concerned community members are invited for dispute settlement via phone or personal visit by the leader. Mostly household related disputes (land ownership, family quarrel, misbehavior etc.) are resolved through this process. If the disputes are not settled through this process it is taken to Ward or Rural Municipality Office and in some cases to the police.

4.3.16 Status and Issues of Women and Children and other Vulnerable Groups in Subproject Area

In the subproject area, women are primarily responsible for taking care of children and household chores. A part from this, they are also engaged in running the hotels run by their family. During the consultation, women reported that they also go to work in construction site as labour in community. They also reported that the wages paid to women in such works is less than the amount paid to their male counterpart. Women in Sherpa community are also involve in decision making process. Gender discrimination is observed less in the community. Due to insufficiency of energy in subproject area, women are responsible to collect cow dungs and fodder needed for their houses. Most of the children in subproject area found that they in Kathmandu for education and as parents are aware about the importance of education, children who reside with their parents in subproject area also goes to school. The presence of child labour around the hotels in subproject area also not observed.

4.3.17 Local Institutions and Activities: Government and Non-government Agencies, Cooperatives, CBOs

KPLRM is the local governing government institution. Beside the KPLRM, ward authority, Buffer Zone Management Committee, Buffer Zone User Groups, Buffer Zone Community Forests, Women Groups, Youth Clubs and other many institutions also exist in the subproject area. The Buffer Zone Management Committee (BZMC) is an apex body under which 3 Buffer Zone User Committees (BZUCs), and 28 Buffer Zone User Groups (BZUGs) have been formed and institutionalized in SNP and its BZ. In addition, Khumbi Yulha BZUC exists in subproject area with 9 BZUGs.

4.4 Outstanding Universal Values (OUV) of Sagarmatha National Park Heritage Site

According to Operation Guideline for Implementing the World Heritage Convention (UNESCO 2017), the Outstanding Universal Value (OUV) is cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity whose permanent protection of the heritage is of the highest importance to the international community as a whole. The OUV consists of Criteria/Value, Integrity and Protection and Management at the time of nomination as a World Heritage Site. SNP has been inscribed as a UNESCO's natural World Heritage in 1979 AD. The OUV of SNP as inscribed (OUV statement), are as followings.

4.4.1 Value/Criteria

The SNP is under the criteria VII of the World Heritage Criteria for superlative natural phenomenon or areas of exceptional beauty and aesthetic importance. SNP contains the highest point of earth's surface- Mount Everest and has religious and cultural settings such as Tengboche monastery and Sherpa culture. Along with its 'unquestionable' superlative natural phenomena (Mt. Everest and its surrounding natural features) and unique Sherpa culture and Lifestyle (as in IUCN, 1979), SNP perfectly meets and falls under the UNESCO World Heritage criteria VII as evaluated by IUCN, 1979.

The site contains 7 other peaks with altitude more than 7000 m that are geologically young with deeply incised valleys by glacier giving rise to magnificent landscape that are aesthetically striking features. The zone provides the barrier between the Palearctic realm and Indo-Malayan realm. There are six altitudinal vegetation classes from oak forest at lower elevation to lichen and mosses at higher elevations that harbors some rare and endangered

animals such as Snow Leopard and Red Panda. The Gokyo and associated lake group has been enlisted as Ramsar sites since 2007 that has added value to the site. The property (site) also hosts about 6000 Sherpa people and over 20 Sherpa villages whose culture and lifestyles has allowed sustaining protection of the park.

4.4.2 Integrity

The SNP has an area of 124,400 ha., which was established as a national park in 1976 under the National Park and Wildlife Conservation Act, 1973 (NPWC Act) and managed by the Department of National Parks and Wildlife Conservation. The entire site is bounded by Great Himalayan range that borders the Qomolongma Nature Reserve of China, physically at Monjo in south, Makalu-Barun National Park in east and Gaurishankar Conservation Area in west. A buffer zone was established in 2002 in the south, as the name suggest itself, with objective to protect its integrity. The buffer zone is not among SNP's OUV.

The site integrity can be sought as combination of natural features with the Sherpa culture and lifestyle. The conservation-oriented Sherpa cultural elements such as 'Nawa' (pastureland regulator), 'Beyul' (sacred hidden valleys), 'Yul-lha' (Mountain protector), 'Chaam/Nyingje' (Principle of kindness among all living beings), 'Gompa' Forest (Forest sanctioned by Monasteries' etc. have contributed the integrity of the existing landscape. The properties related with trade and agriculture held by the Sherpa people does not come under park administration i.e. those are excluded from the park by legal definition.

4.4.3 Protection and Management

The NPWC Act 1973 is the principal legislation under which the site is protected supplemented by the Himalayan National Park Regulations (1978). The Sagarmatha National Park office has the administrative role of ensuring park services with conservation under the Department of National Parks and Wildlife Conservation, Ministry of Forest and Environment and Nepalese Army has been deployed for its protection. A Buffer Zone Management Committee (BZMC) manages 3 Buffer Zone Users Committee (BZUC) that have 28 Buffer Zone User Groups (BZUG) within the national park (as Village Enclaves) and outside to the south. The park provides 50% of its revenue to the local communities through the Integrated Conservation and Development Program (ICDP). The Park and Buffer Zone Management Plan (2016-2020) focuses on habitat and biodiversity conservation, Tourism and Interpretation, Buffer Zone Management and Research, Monitoring and Capacity building with special programs on species conservation for Snow Leopard, Musk Deer and Red Panda. As from the experience from the implementation of the earlier plan (2007-2012, budget constraints hindered the effectiveness (SNP/GoN, 2016).

Tourism is the main income source for the local people and the park. Due to huge number of tourist movement (45,112 tourist visited in FY 2016/017 AD) in the subproject area has created human pressure in park's ecology and other resources. The effects generate in form of demand for more food, water, energy, lodging, solid waste generation and new trail development. Other sources of impact in the site are from development works such new trail construction, building resorts and lodges. The local demand for firewood is also a major cause for deterioration of the park OUV where only 3% of the park is forested. The park is affected by air pollution, illegal activities, impacts from tourism, use of excess energy, livestock farming, visitor's accommodation, mining and querying, climate change, solid wastes and wild plant collection as in year 2018 (UNESCO, 2019).

CHAPTER 5: ALTERNATIVE ANALYSIS

Alternative analysis is an integral part of subproject feasibility study. Alternative analysis is primarily governed by the factors like technical feasibility, economic viability, and environmentally and socially acceptable. This section focuses on the assessment and evaluation of the following aspects of the available alternatives: (i) Choice of design; (ii) Analysis of potential alternative subproject sites; (iii) Topography; (iv)Technology; (v) Procedures of Operation, Work Plan; (vi) Raw Materials and (vii) Use of government land.

The aim of the proposed subproject AMHP is to construct the mini hydro of 911 kW capacity and to distribute at local level through 11 kVA transmission lines. The various alternatives to achieve the subproject objectives of AMHSP with no or minimum environmental damages are discussed in the following sections.

5.1 Design Alternative

Proposed AMHP is a run of river and initially it was proposed as an installed capacity of 600 kW. During Detailed Feasibility Study it was found that electricity demand in the subproject area is very high. Therefore, alternative options in the right side and left side of Cholunche Khola were carried out. Technically both sides found feasible for Mini Hydro, but left side option found better than right side with significant head gain to increase subproject capacity up to 911 kW. Additionally, both sides of the Khola is landslide area[7] and left side route found more safe than right side to construction of civil structure, thus left side proposed for development of AMHP.

5.2 Subproject Sites

Upstream locations from the chosen intake are unsuitable because there is not much significant head gain while going upstream as the river gradient is very low. It will only increase the headrace cost with not much contribution to increase in power generation. Going downstream from present location of intake, new intake structures will have to be placed on a landslide which is also not recommended. Choosing right bank of the river, would lead to a power house location in Rala Kharkha (Blue Line). But the gross head was relatively low compared to the proposed power house location (Red Line). As the demand for electricity is very high in this area, this PH location at Rala Kharkha was neglected.

Table 34: Alternative Sites for Powerhouse

	Proposed Power House	Power House option 2
Power House Elevation	3,951.18 asml	4,212.00 asml
Gross Head	471.87 m	211.37 m

[7] It is revealed during discussion with the SNP warden that landslide occurred about 50 years back and after that it no landslide occurred, seems to be stable. Nonetheless necessary precaution will be taken during execution of the subproject to ensure sustainability of subproject.

Figure 13: Different Alternatives of the Subproject

5.3 Topography

Penstock pipe route through right bank was impossible due to rough topography with the deposition of masses of big boulders. Left bank is comparatively smooth with small boulders. Therefore, left bank was chosen for laying of penstock pipe.

5.4 Technology

Solar and wind power are other possible alternatives of electricity in the subproject vicinity. The potentiality of both solar and wind power depends on sunshine hour and wind velocity. The number of sunshine hour available in the subproject area is low which leads to less energy yield.

Moreover, the installation of wind or solar power generation will have a big visual impact on the landscape which will not be compatible with the OUV. Therefore, mini hydro will be the best and reliable source of energy in compare to solar PV.

5.5 Raw Materials

Various physical resources are consumed for the construction of proposed subproject. The materials to be used are boulders (stones) for gabion and walls, gabion wires, masonry wall, brick or concrete block, aggregates for concreting. Other local resources will be quarry and burrow used from the area. Reinforcement bars and cement will also need to be transported from other parts of the country. Electro-mechanical equipment needs to be imported from overseas manufacturers. There are no other cost-effective alternatives for the above materials in construction works of the subproject. The construction is intended to be carried out by manually.

5.6 Use of Forest

The no forest option helps to conserve and protect forest areas for optimal option selected for the subproject. It will obviously provide ecosystem services, soil and nutrient conservation, habitat for wildlife, source of fuel wood, forage and fodder to local people and other forest

based raw materials. Both the climate and terrain is harsh and growth of vegetation is limited. There are scattered trees after 2 Km chainage of penstock. To conserve these trees, penstock alignment has been designed in such a way to avoid tree cutting. Similarly, route for transmission lines and distribution lines will be followed the existing trails to avoid vegetated area and will be buried underground after laid down except river crossing. Thus the proposed subproject does not require tree felling and destruction of forest.

5.7 Construction Schedule

The estimated subproject construction period is 1.5 years from the date of commencement of the work. The construction works are mainly of surface construction works. Thus all works should be done in dry season. Similarly, the climatic condition of the area is very cold during winter. So, severe cold winter will be avoided. All the surface work will be scheduled in day light

5.8 Associated Risks

The subproject design has given due consideration to avoid risks both in terms of environment/social and subproject structures. While doing so, efforts were also made to minimize the subproject's cost. All the structures have been designed based on the surface geological investigations and has risk associated with cost overrun during construction. The powerhouse area is located on the terrace made by the Imja Khola and has been designed considering GLOFs from Imja. The risk of GLOF has also been accounted by referring to the potential GLOF discharge estimates. However, the T&D lines will be underground along the foot trails, except in river crossing areas. Hence, there is no risk associated with the T&D lines.

Another major item to consider is the risk of the peaking reservoir. A reservoir with the designed storage capacity is not envisaged to pose risks to the downstream population and other natural and environmental resources in the event of normal operation. As the dam is small and risk of inundating the downstream even during a dam break event is less.

Next minor risk is due to landslide along penstock alignment (Ch.0+160 to Ch. 0+250). The alignment passes though just below the crown of the slide as loose terrace deposit. The slide falls in loose river terrace deposit; it is not from the hill slope. Therefore, it has been believed that it will not create a great problem and has also been considered in design of the subproject.

On the same way, as there will be insulated cable used for T&D, which will not be risk the electrocution to the birds and other animals where the transmission lines expose while crossing the stream or rivers

CHAPTER 6: ANTICIPATED ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

This section provides a description of beneficial and adverse impact on physical, biological, socio-economic, and cultural environment due to the implementation of the proposed subproject which is based on field observation. The impact assessment has been focused within the subproject influence area considering general profile at RM level. The impacts have been 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.

6.1 Impacts

6.1.1 Beneficial Impacts

6.1.1.1 Construction Phase

i) Employment generation and skill enhancement

Approximately 200 unskilled and 80 skilled human resources will be employed during peak construction period with priority given to workers from the subproject affected area based on their skills and qualifications. The employment generated during construction phase will provide opportunity to increase income of local people which ultimately supports to strengthen the local economy. People involved during the construction of subproject can enhance their skills. After completion of the subproject construction, people can utilize their skills to get other opportunity of similar nature. *The impact will be direct in nature, high in magnitude, local in extent and short term in duration.*

ii) Benefits from implementation of environmental mitigation programs and benefit augmentation measures

The subproject will implement environmental mitigation programs and benefit augmentation measures as proposed in the ESIA report. It will benefit the people of subproject affected area at large. Beside the mentioned activities in ESIA, 1% of total subproject cost has been allocated for implementation of environmental and social mitigation measures during construction and operation. *The impact will be direct in nature, moderate in magnitude, local in extent and long term in duration.*

iii) Benefits from community and social support programs

Although the subproject has not allocated the budget for community and social support programs separately, the subproject will support on various community and social programs such as improvement of local services like health posts, schools, drinking water and social services from the budget allocated for ESMP as 1% of total subproject cost has been allocated for implementation of environmental and social mitigation measures during construction and operation. These programs are envisaged to help develop local infrastructures and social services in the project impacted area helping local people to improve their quality of life.

The impact will be direct in nature, moderate in magnitude, local in extent and long term in duration.

iv) Increase in economic activities in the subproject area and associated beneficial impacts in local economy

During the construction period, migrant work force will reside in the subproject area. Since they will have to purchase goods, there will be plenty of demand for different type of food, beverage, and other daily necessary items from the local market. To meet these demands, many local and outside people may operate a number of small shops and restaurants around the vicinity of the construction sites. This will increase local trade and business in the area. As a result of increased trade and business, significant amount of cash will be channeled into the local economy. *The impact will be indirect in nature, moderate in magnitude, local in extent and short term in duration.*

v) Benefits for exposure of local population to new technologies and technology transfer

The subproject requires professional technical persons for implementation of the construction works. Local people who will get opportunities to work with these professionals will get opportunities to learn knowledge and skills from the professionals. Thus, local people will be able to get employment in similar subprojects. Such knowledge and skills will be obtained, particularly in the areas of masonry, construction of dry walls, gabion walls and bio-engineering etc. *The impact will be direct in nature, low in magnitude, local in extent and long term in duration.*

vi) Utilization of local resources

Construction crew utilizes the local resources such as local agriculture produces, water resources and construction materials. This ultimately supports for local economy. *The impact will be indirect in nature, low in magnitude, local in extent and short term in duration.*

6.1.1.2 Operation Phase

i) Employment generation and skill enhancement

During operation, two operators, one in-charge, one helper, and one technician will be required for operation of the plant. This creates opportunity for employment and enhancement of skill to locals. *The impact will be direct in nature, moderate in magnitude, local in extent and long term in duration.*

ii) Benefits to be incurred from addition of 911 kW of power to local people

The implementation of the proposed AMHP will generate 7,225,781.76 kWh of hydroelectricity per year and distributed to local community, thus will help to improve the energy situation. This will be big input in the local level power planning as there is no reliable source of electricity. Hydroelectric being clean renewable energy will also support to protect the environment through replacing traditional use of biomass fuel and LPG. Furthermore, electricity facility will help locals for lighting, establishment of small industries related to tourism, reduction of time in searching fuelwood in forest, improvement in health, replaced the traditional use of biomass as fuel, LPG, operation of electronic appliances such as fridge, washing machine, television and room heater etc. *The impact will be direct in nature, high in magnitude, local in extent and long term in duration.*

iii) Sharing of electricity royalty to concerned authorities

As per the provisions in the Inter-governmental Fiscal Arrangement Act, 2074, 50 % of the total royalty obtained will be allocated to the Government of Nepal, 25% to the concerned state and 25% to the concerned local level. Although this will not be applicable in mini hydro subprojects, local government can fix the royalty from the mini hydo subproject. *The impact will be direct in nature, moderate in magnitude, local in extent and long term in duration.*

6.1.2 Cumulative Impacts

There is no existing/planned hydropower and irrigation project in Cholunche Khola. It is decided during the screening that cumulative impact analysis is not necessary.

6.1.3 Adverse Impacts

6.1.3.1 Physical Environment

6.1.3.1.1 Construction Phase

i) Change in Land Use

Areas under different land use patterns will be required for the subproject construction. In the case of AMHP, river deposit areas, grassland and foot trails will be utilized for the subproject construction. About 5.711 ha of land is planned to be acquired temporarily and permanently for subproject infrastructure construction. Out of the total land to be acquired, subproject requires 0.626 ha permanently for the construction of different subproject components such as headworks, office, powerhouse, switch yard, tailrace, reservoir, and electric poles at river crossing, thus changing the land use category. Spoil disposal sites, quarry and borrow sites, workshop and material storage and subproject camps require 1.55 ha land temporarily. Laying of penstock pipe, transmission and distribution lines need 4.95 ha of land temporarily, but these will be made underground to reduce the impact on OUV of SNP. Thus impact of subproject on land use change seems minimal. *The impact will be direct in nature, moderate in magnitude, site specific in extent and long term in duration.*

ii) Change in Topography

The topography of the subproject area will be changed due to excavation, slope cutting, grinding etc. during construction. The placement of the subproject structure like intake, power house and staff quarters will change the landscape of the sites. Impact on the topography will also occur by the disturbance of fragile slopes, clearance of land and disposal of muck. As these areas will be rehabilitated and stabilized, the subproject will have minimal impact on topography. *The impact will be direct in nature, low in magnitude, site specific in extent and long term in duration.*

iii) Possible Glacier Lake Outburst Flood (GLOF) and associated impacts

The impacts of potential outbursts of glacial lakes upstream of the Chulunche Khola (Nare Khola) and mja are expected to be significant. However, GLOFs occur in many different forms and can vary in character from catastrophic to insignificant and unrecorded. The downstream impact of any lake outburst depends on the size, depth, and type of dam of the lake, distance from the subproject, nature of dam break, slope of the river channel downstream, possible obstruction to high floods by narrow cross sections downstream and other factors. A major lake outburst may release enormous amounts of stored water that, together with the debris flow, can causes serious flood damages downstream along the river

channel. Vulnerability of people and property is higher during construction due to the number of people being exposed to the dangers of GLOF events. Impacts of GLOFs, unrelated to the Subproject, are expected to be low as probability of GLOFs from Nare glacier has been hardly expected. If it occurs, it may affect headwork only. *The impact will be indirect in nature, high in magnitude, local in extent and short term in duration.*

iv) Landslide and Soil Erosion

Construction activities like land excavation, slope cutting, grading etc. which will change the existing slope of land. So, these activities on slopes may induce slope failure and mass wasting. Minor Landslide along penstock alignment (Ch.0+160 to Ch. 0+250) may increase in size due to excavation work. The clearing activities of grassland for the construction of subproject structures will make the soil surface loose. So, soil erosion may occur during the rainy season especially in the steep slopes. The eroded particles may be transported to the river by monsoon runoff and exacerbate sedimentation in river. The unstable slopes and landslide areas has been identified during DFS and to minimize the risk, a suitable Gabion protection of length 100 m and cross-sectional area of $6m^2$ is construction on landslide area in penstock alignment. Thus these problems will not aggravate the environmental issues. *The impact is indirect, moderate in magnitude, site specific in extent and long term in duration.*

v) Generation of spoils and spoil disposal related issues

The spoil generated during the execution of the subproject components will be utilized to label the surrounding area of intake and powerhouse area. However, remaining spoil will be disposed to the already identified areas nearby desilting area and powerhouse area, which will be reinstated after the completion of all construction related activities. Prior approval for the sites will be taken from the RM before starting the construction work.

Management of the wastes would be challenging. Improper disposal of the spoil may result in destruction of grassland, increased turbidity of river water, increased dust in subproject environment, adverse impact on aquatic life, and ugly scars in the landscape. This occurs during construction period only. These sites will be rehabilitated and reinstated immediately after construction. The ESCO shall prepare rehabilitation plan and implement it effectively after taking approval from the RM. *This impact is predicted to be direct in nature, moderate in magnitude, short term in terms of temporal coverage and site-specific in terms of spatial coverage.*

vi) Impact due to quarrying activity

Local construction material requirement will be minimal and the sites have been identified based on geological investigation. Hence, the construction material will be collected from the riverbank without disturbing the riverine ecology. Quarrying of construction material produces some unwanted material also, thus affecting air quality due to dust and water quality through sedimentation. Similarly, it effects on local topography. The impacts last for construction period only. These sites will be reclaimed immediately after completion of construction activities. *This impact is predicted to be direct in nature, moderate in magnitude, short term in terms of temporal coverage and local in terms of spatial coverage.*

vii) Impact on material quarrying sites

Due to quarrying activities, the topography of quarry sites will be changed. The site may become unstable and materials for future may be shortage. The sites will be reinstated and rehabilitated immediately to reduce the impacts. The ESCO shall prepare rehabilitation plan

and implement it effectively after taking approval from the RM. *This impact is predicted to be direct in nature, moderate in magnitude, long term in terms of temporal coverage and site specific in terms of spatial coverage.*

viii) Water Pollution and Increase in sediment loads

Changes in water quality of surface water bodies are likely to occur due to construction activities. There will be a temporary increase in the turbidity and sediment content of the river due to unavoidable disturbance of river beds and banks and likely accidental spills of sediment producing material in the river. In addition, potential uncontrolled spillage of petrochemicals, oils, paints, cement slurry, and hazardous substances may also have an adverse impact on the river water quality during construction on headwork site. Besides this, some wastewater from labour camps are likely to pollute the water microbiologically and add inorganic elements like carbon, nitrogen and phosphorus. Such pollution will take place in spite of subproject efforts to contain discharges and limit the extent as far as possible. The discharge of the camps' effluent into the water bodies could be significant with far reaching implications to the water users downstream, but mitigation measures to prevent this are included in the subproject. Improper management of waste, both solid and liquid, generated by the people directly or indirectly involved in the subproject will probably take place, and increased BOD and Fecal coliform in Cholunche and Imja Khola can be expected to a certain level. The potential for adverse impacts is nevertheless short-term in nature. *The impact will be direct in nature, moderate in magnitude, short term in duration and local in terms of spatial coverage.*

ix) Noise Pollution

Construction activities and aggregate crushing plants at subproject sites will generate noise and vibrations. The increase in ambient noise levels will have impacts to workers and on settlement (lower Pangboche) just opposite of powerhouse site. The impact is expected to be low in magnitude and for short duration. *The impact is direct in nature, low in magnitude, site specific in extent and short term in duration.*

x) Soil Pollution

Various chemicals, paints, petrochemicals etc. will be used in the different activities of subproject. Mishandling and spillage of different chemicals, paints, petrochemicals etc. may affect the soil of the subproject construction area. To prevent soil pollution, these materials should be handled carefully and stored in safe place. *The impact will be of direct in nature, low in magnitude, site specific in extent and short term in duration.*

xi) Issues of Haphazard Stockpiling of Construction Material

The subproject has designated separate areas for the stockpiling of construction materials such as sand, aggregates, iron rods, steel frames, cement, etc for the subproject construction period. However open and haphazard stockpiling is a potential to degrade the aesthetic beauty of the stockpiling areas. Seepage and leakages from the stockpiled construction materials can directly impact soil and water quality of the river. *The impact will be direct in nature, moderate in magnitude, site specific in extent and short term in duration.*

xii) Solid Waste Generation

During construction, two types of wastes will be generated by the subproject i.e. domestic and construction wastes. Improper handling and management of these wastes can result in unpleasant odor, deterioration of water qualities, visual impacts and public health hazards.

Construction wastes generated include synthetic materials and some forms of inorganic wastes like metal scraps, unused concrete mixtures, cement bags, containers, rubbers, iron bars etc. The improper disposal of these materials will cause land pollution and visual impact. *Considering the size of the subproject and quantity of waste generated, the magnitude of impact is considered to be medium, extent is local and the duration is short term.*

Domestic wastes generated include kitchen wastes, grocery packaging, and waste from worker's camp. Improper dumping of these wastes will result in unpleasant odor, water pollution and land pollution. The amount of domestic waste depends on the numbers of people involved in the subproject construction. It is expected that domestic wastes generated will be mostly organic in nature and if not managed properly will produce foul smell, visual impact and land pollution. The nearest settlement from the subproject site is Lower Pangboche which is approx. 1.6 km away from the powerhouse construction site and proposed labour camps. As the subproject construction site is in isolated area and far from human settlement, adverse impacts to community due to solid waste are not envisioned. *Considering the size of the subproject and types of waste generated, the magnitude of impact is considered to be low; extent is site specific and short term in duration.*

xiii) Air quality degradation

During construction period, activities such as transportation of material, excavation and operation of crushing plant will generate dust. This impact on air quality will however be short in duration and limited to the subproject site. The impact will be most severe at weir site, powerhouse site, crushing plant, concrete mixing sites, and the spoil disposal area. Other potential impacts on air quality are unpleasant odor due to improper management of sewage and solid waste and indoor air pollution due to cooking activities. Increased dust in the air will impair the health of people through increased incidence of Acute Respiratory Infections (ARI), wheezing, shortness of breath and dust allergies. *The impact will be indirect in nature, low in magnitude, local in extent and short term in duration.*

xiv) Hydrology and River Morphology

The diversion of water through the pipe will have an impact on the river flow and morphology. The river will divert up to 0.25 m^3/s of flow through the pipe to the powerhouse located downstream. Therefore, the river stretch of about 3.35 km between the proposed intake and confluence between Imja Khola and Cholunche Khola site can be classified as a reduced flow length or zone. The basin hydrology and flow regime of Cholunche Khola will not be impacted by the subproject during the construction phase. Shortly downstream of the weir construction site, the river will be running in its natural state until dam closure and diversion to the power station commences. Possible extraction of large boulders from the riverbank for construction purposes may have some impact on the river morphology in the long run. *The impact will be direct in nature, moderate in magnitude, site specific in extent and long term in duration.*

xv) Loss of Top Soil

Subproject requires grass land. The top soil, estimated to be about 300 m^3 will be destroyed if not removed before construction. *The impact will be direct in nature, low in magnitude, site specific in extent and long term in duration.*

xvi) Impacts on Dewatered Zone

The river stretch of about 3.5 km between the proposed intake and confluence between Imja Khola and Cholunche Khola site can be classified as a dewatered zone. The water in this

segment of river is not used for irrigation, drinking and not any livelihood purposes by local communities as there is not any human settlement exist in dewater zone.

Similarly, as per the consultation with RM representatives, SNP officials (Chief Warden and Assistant Warden) and locals, due to high slope gradient, altitude and extreme cold water the presence of fishes in Cholunche Khola is not reported. SNP and its Buffer Zone Management Plan was also referred for information on fisheries. Thus, impacts on fishes and community livelihood due to the reduction of river flow (50% release of water as per GoN policy) in dewatered zone is not observed.

6.1.3.1.2 Operation Phase

i) GLOF and associated impacts

The probability of GLOF in Chulunche khola from Nare Glacier is expected to very low and if occurred, it will impact on headwork area while GLOFs from Imja may affect on transmission and distribution system. The powerhouse of AMHP is located at left bank of Imja Khola with an altitude 3951.50 masl. Elevation difference (3951.50-3911 masl) between the riverside and powerhouse location is 40 m. As the potential GLOF depth at Pangboche is 7.6 m (Bajracharya et al., 2007), the Powerhouse location is safe from potential Imja GLOF. Impacts of GLOFs, unrelated to the subproject, are expected to be from moderate to high in magnitude, as it has been expected to affect headworks and distribution system. *The impact will be indirect in nature, high in magnitude, local in extent and short term in duration.*

ii) Change in topography and land use

Change in topography is not expected during operation phase as no additional structural components will be constructed. However, land used for the intake area and powerhouse area will be in use by subproject. The subproject structural features will be in existence till the subproject exists and the impact remains as a residual impact till then. *The impact is considered to be low in magnitude, site specific in extent and long term in duration.*

iii) Impacts on river morphology and possible microclimatic changes

The diversion of Cholunche Khola in intake site will eventually result in some impacts on the downstream dewatered zone. Low volume of water is likely to increase the temperature in the dewatered zone. The change in flow during wet season is not considered significant, but the flow will be reduced during the dry period from February to March which might cause adverse impact on river morphology. This will be a residual impact until the subproject will be in operation. **Table 35** presents the predicted range of monthly water discharge in the River and reduction from original water flow. **Figure 14** presents the current and future seasonal water flow. Monthly design discharge was determined using Medium Irrigation Project (MIP) method.

Table 35: River Discharge after Flow Diversion

Months	Monthly River Discharge, (m3/sec)	Design Discharge for power generation, (m3/sec)	Discharge at the river after flow diversion to intake, (m3/sec)	Percentage
January	0.70	0.25	0.45	64.29
February	0.53	0.25	0.28	52.83

March	0.38	0.18	0.20	52.63
April	0.29	0.14	0.15	51.72
May	0.76	0.25	0.51	67.11
June	1.76	0.25	1.51	85.80
July	4.25	0.25	4.00	94.12
August	7.32	0.25	7.07	96.58
September	4.83	0.25	4.58	94.82
October	2.34	0.25	2.09	89.32
November	1.20	0.25	0.95	79.17
December	0.91	0.25	0.66	72.53

There will be some change in the water quality in the dry season in the reduced flow length of the river between weir and confluence of Cholunche khola and Imja Khola. Because of the reduction of the flow discharge and contribution of nutrients, there may be growth of blue filamentous algae in the reduced flow length stretch of the river. The dissolved oxygen level might drop with increased in water temperature. *The impact will be direct in nature, moderate in magnitude, local in extent and long term in duration.*

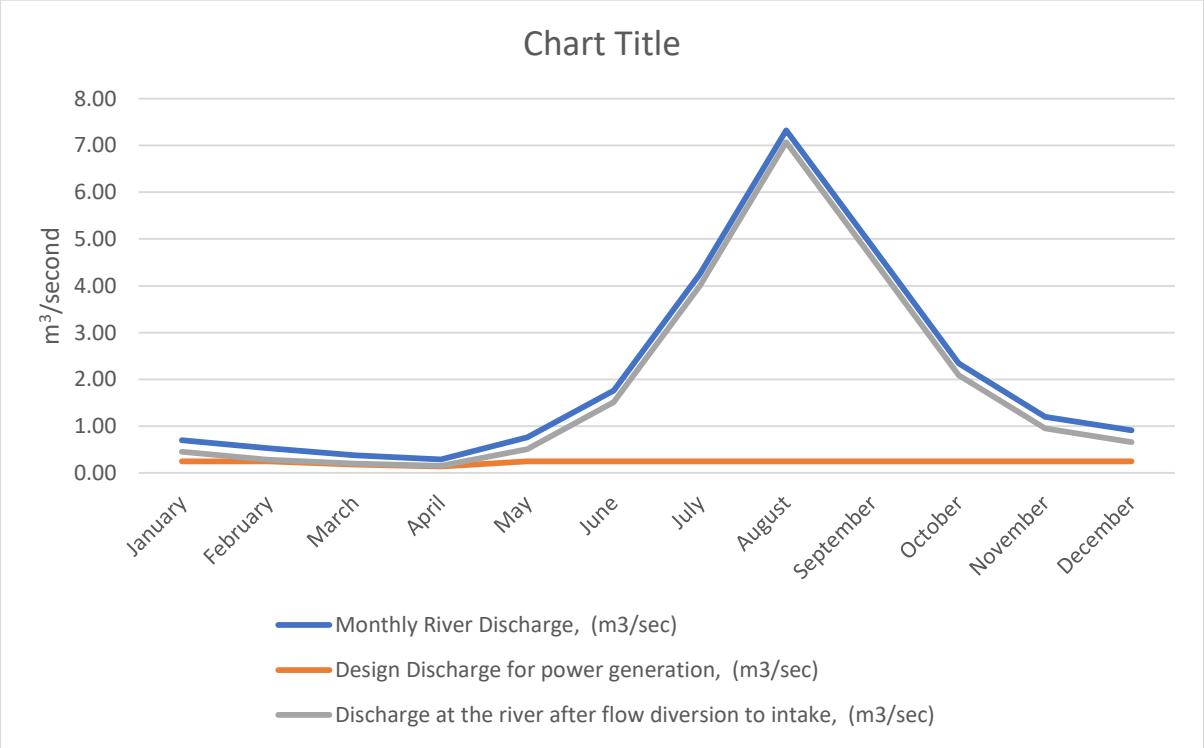

Figure 14: Discharge at the River after Flow Diversion

iv) Land submergence due to diversion weir and associated impacts

The diversion structure and creation of reservoir in front of the diversion structure in the operation phase divide the existing river morphology into distinct three sections as follows:

(i) Undisturbed section upstream the upper limit of the reservoir
(ii) Reservoir section of about 30 m length
(iii) Reduced flow length section of about 3.35 km length

As the existing aquatic life are co-existing with the undisturbed river morphology but are unlikely due to difficulties to sustain their life cycle in the changed morphological and water conditions of the changed river stretches. Some changes in aquatic life may occur in the reservoir section and in the dewatered section through November to May every year. But due to freezing temperature, high altitude and steep topography, there are no fishes in the Cholunche Khola. The aquatic fauna is restricted to a limited diversity of invertebrates which have season life cycles. Most of these species are restricted to the aquatic environment during their larval stage but are able to fly and thereby disperse during their adult life stage. The aquatic habitat will therefore not be fragmented for most invertebrate species, and the impact of the subproject is expected to be nominal. No vegetation will be impacted due to submergence as there is no vegetation in the area.
The impact will be direct in nature, low in magnitude, local in extent and long term in duration.

v) Management/final disposal of solid waste and waste water (both black water and grey water)

Pollution due to solid waste in and around subproject area during operation phase will be very low as compared to that during construction period. The solid waste generation sources will be limited after subproject construction. Waste water will be generated only from the Quarter and Office of the subproject site which will be managed by constructing septic tank. *This impact is indirect in nature, low in magnitude, site specific and long term in duration.*

vi) Change in river water quality

The requirement to maintain more than 50% of the total monthly flow and not any source of contaminants around the river environment, change in water quality is not envisioned.
This impact is low in magnitude, site specific and long term in duration.

vii) Noise and vibration at powerhouse

The noise and vibration is expected to be low at powerhouse site due to running of turbines and generator. As the powerhouse site is isolated from the human settlements, there will not be any impact to the community. Noise and vibration will be confined to the powerhouse site only. *The noise impact is direct in nature, low in magnitude, site specific and long term in duration.*

viii) Soil erosion due to tailrace discharge

The water from two units of powerhouse is conveyed to a nearby Kholsi through combination of tailrace canal and pipe. The confined discharge of water from tailrace might erode the soil around the tailrace during operation of the power generation plant. *The impact is direct in nature, low in magnitude, site specific and long term in duration.*

ix) Impact on downstream due to sediment flushing

Sudden release of sediment from reservoir may erode the river bank. *The impact is indirect in nature, low in magnitude, site specific in extent and long term in duration.*

6.1.3.2 Biological Environment

6.1.3.2.1 Construction Phase

i) Loss of grassland area

Total grassland required by the subproject is 1.161 ha. The subproject will acquire 0.626 ha of grass land on long term lease and 0.535 ha of land on short term lease. As thee is abundant of open space is available for grazing, the loss of small parcel of grass land will not have significant impacts. *Impact is of direct in nature, moderate in magnitude, site specific in extent and long term duration.*

Table 36: Grassland Required for Subproject Components

SN	Component	Land Area (ha)	Ownership	Acquisition
1	Headworks	0.097	GoN/SNP	Long Term Lease
2	Office, Powerhouse, Switchyard and Tailrace	0.085	GoN/SNP	Long Term Lease
3	Penstock	0.4	GoN/SNP	Long Term Lease
4	Electric pole at river crossings	0.008	GoN/SNP	Long Term Lease
5	Reservoir	0.036	GoN/SNP	Long Term Lease
	Sub-total	*0.626*		
6	Spoil Disposal Sites	0.025	GoN/SNP	Short Term Lease
7	Quarry and Borrow Sites	0.38	GoN/SNP	Short Term Lease
9	Workshop and Material Storage	0.08	GoN/SNP	Short Term Lease
10	Subproject camps	0.05	GoN/SNP	Short Term Lease
	Sub-total	*0.535*		
	Total	**1.161**		

ii) Loss of vegetation and overall vegetation diversity

There is no presence of tree in penstock route and any civil structure. With respect to T & D, it will be taken underground through foot trails without disturbing any vegetation. *The impact is low in magnitude, site specific in extent and short term in duration.*

iii) Pressure on Forest for Fuelwood

As the area is cold, unsupervised construction crews might use or demand fuelwood for heating as well for cooking. This might increase the pressure on forest products for fuelwood. *The impact will be indirect in nature, moderate in magnitude, site specific in extent and short term in duration.*

iv) Impact on Sagarmatha National Park

There will be construction workers brought into the national park as well as a lot of equipment. This might have risk of introducing invasive alien plants, increased risk of poaching wildlife and a disruption to tourism during the construction period, especially along T&D route, which will place an increased burden on management and could also have a financial impact through reduce tourist park entry fees. *The impact will be direct in nature, moderate in magnitude, site specific in extent and short term in duration.*

v) Impact on natural and critical natural habitat features

Although the proposed subproject area is open and is not suitable for large wild animals to live there, movement of various wild animals is expected for forage and water. Movement of workers and construction activities might affect in the movement of these wild animals and their forage habitats. These impacts are almost unavoidable during the construction period. *This impact is of direct in nature, low in magnitude, site specific in extent and short term in duration.*

vi) Impact on Red Panda and Himalayan Musk Deer:

The preferable altitude for the habitat of Red Panda (3000-3200 m)[8] and Himalayan Musk Deer is (3800-4000 m)[9]. The range of project area is 3860 m (Mongla village) to 4422 m (intake area), which is not habitat for Red Panda. However, Himalayan Musk Deers are rarely spotted around the project vicinity. Furthermore, during consultation with local people and other relevant stakeholders (SNP, Buffer Zone Committee, and RM) revealed that this animals rarely travel around the subproject area; they are not territorial of the major project component like intake and powerhouse area. Some of the indirect impact might be an influx of workers which could disturb Musk Deer through illegal hunting or through the introduction of domestic dogs. *This impact is of direct in nature, moderate in magnitude, site specific in extent and long term in duration.*

vii) Impact on Himalayan Black Bear:

The preferable altitude for the habitat of Himalayan Black Beer is (1000-3000 m)[10]. They are dangerous animals that forage opportunistically as both hunters and scavengers. Food waste that is disposed inappropriately will attract bears into close proximity with people and increase the risk of harm to both people and bears. Most of the subproject components are above the Pangboche village and along the trekking trails so there is very less chance of animal's movement except intake area. *This impact is of indirect in nature, moderate in magnitude, site specific in extent and long term in duration.*

viii) Impact on aquatic flora and fauna

Construction activities and waste from labour camps may degrade the water quality affecting the aquatic flora and fauna. Dumping of spoils and other construction waste in river might increase sediment load and discharge of chemicals and organic waste might increase the BoD of the river water, which may deplete DO in the water. *The impact is direct, low in magnitude, site specific in extent and short term in duration.*

ix) Impact on non-timber forest products/MAPs

Aconitum sp. (Bikh), *Anaphilis sp.* (Bukiful), *Arisaema flavum* (Banko), *Barberis sp.* (Chutro), *Clematis sp.* (Junge Lahara), *Cotoneaster microphyllus* (Khareto), *Drepanostachyum sp.* (Nigalo), *E. gerardiana* (Somlata), *Juniperus sp.* (Dhupi), *Nardostachys grandiflora* (Jatamashi), *Plantago erosa* (Isafgol), *Rheum austtrale* (Padamchal), *R. anthopogon* (Sunpati), *R. campylocarpum* (Chimal), *Rumex nepalensis* (Halhale) and wild edible mushroom are the major NTFPs/MAPs that might be affected due to excavation during subproject construction. The affected NTFPs/MAPs are abundant in

[8] Environment Service and Engineering Consultancy Pvt. Ltd. 2020, *Assessment of Status of Red Panda ad its Habitat in Sagarmatha National Park and Buffer Zone Area*

[9] Asian Centre for Development Pvt. Ltd. 2018, *Musk Deer Count in Sagarmatha National Park and its Buffer Zone*

[10] Sagarmatha National Park 2016, *Sagarmatha National Park and its Buffer Zone Management Plan 2016 - 2020*

other parts of the subproject area as well as outside the subproject area. *The impact will be direct in nature, low in magnitude, site specific in extent and short term in duration.*

x) Possible Risk of forest fire

Many types of fuel might be in use in and around the construction area that pose fire hazards, such as slash accumulation of ground clearance, dried grass and debris accumulation, accumulation of flammable leaves, dry bushes etc. Fire might be set accidentally due to inadvertently thrown cigarette stub and left campfire or deliberately by some ruffians. Small fire can turn huge forest fire. Improper garbage disposal and improper storage of inflammable gases and liquids at the construction site can aggravate the situation.
The impact will be indirect in nature, low to moderate in magnitude, local in extent and short term in duration.

xi) Wildlife hunting and poaching

Workers from outside the subproject area may involve in wildlife hunting and poaching. However, this risk is unlikely as the community follow Buddhisim and slaughtering is strictly prohibited in the Khumbu region. *The impact will be indirect in nature, low in magnitude, local in extent and short term in duration.*

xii) Increased Incidence of Human Wildlife Conflict

Though the prime habitat of wildlife is not reported in the subproject area, some construction activities may affect the wildlife movement. In addition, they might enter to nearby agriculture land and settlements, resulting in increased crop raiding and livestock loss. Moreover, construction actives may result in food waste near construction camp and construction site which could attract wild animal and increase the risk of human wildlife conflict. The encounter of villagers and workers with wildlife may create conflict between them leading to wildlife killing. However, human wildlife conflict is expected to decrease after the construction work is over. *The impact will be indirect in nature, low in magnitude, site specific in extent and short term in duration.*

6.1.3.2.2 Operation Phase

i) Reduced river flow

The diversion of Cholunche Khola in intake site will eventually result in some impacts on the downstream dewatered zone. Low volume of water is likely to increase the temperature in the dewatered zone. The change in flow during wet season is not considered significant but in dry period (2 months) the flow will be reduced which may causes adverse impact on river morphology. This will be a residual impact until the subproject will be in operation. There will be some change in the water quality in the dry season in the dewatered stretch of the river. Because of the reduction of the flow discharge and contribution of nutrients, there will be growth of blue filamentous algae in the dewatered stretch of the river. The dissolved oxygen level might drop with increased water temperature. *The impact will be direct in nature, low in magnitude, local in extent and long term in duration.*

ii) Disturbance to the wildlife due to resident workforce

The Resident workers associated with operation and maintenance of mini hydro plant have to inspect the headwork areas and other structures on regular basis which might affect the movement and forage of wild animals. *The impact will be indirect in nature, low in magnitude, site specific in extent and long term in duration*.

iii) Impact on rare, endangered, protected and threatened species of flora and fauna

All the excavated areas for penstock pipes and transmission lines will be rehabilitated immediately. Movement of work force will be almost negligible after construction. Thus it has been expected that there will not be impact on rare, endangered, protected and threatened species of flora and fauna during operation period. *The impact will be indirect in nature, low in magnitude, site specific in extent and long term in duration.*

iv) Bird casualties due to electrocution and collision with transmission line

The T & D line will be underground in all areas except in river crossing. And the transmission lines will have armored cable. Therefore, the probability of bird causality due to electrocution and collision with transmission line is almost nil and the impact is negligible. Therefore, the impact has not been envisioned.

v) Forest fire

As there will be some resident workers for operation and maintenance of power plant, there is likelihood of incidence of the forest fire caused by workforce indiscipline. The grass species and pine trees present in subproject sites are vulnerable to fire, especially during the dry season. Even a small fire in the form of cigarette bud and match stick used by the resident crew could be a crucial factor for fire hazard. Likewise, short circuit of electricity could also be the cause of fire. The forest fire could create a big fire hazard affecting the whole region. *The impact will be indirect in nature, low in magnitude, local in extent and long term in duration.*

6.1.3.3 Socio-economic and Cultural Environment

6.1.3.3.1 Construction Phase

i) Land acquisition and compensation related issues

Approximately 5.711 ha land is required for construction of the subproject components, of which 0.626 ha land will be acquired for long term for subproject component construction and the remaining 5.085 ha land will be acquired for short term temporarily (for quarry, borrow and spoil disposal sites, T & D lines). The land required for long term lease is grassland, not forest land. The permanent structure of the subproject will be constructed in the permanently leased land and temporary subproject ancillaries will be constructed in leased land. Land acquisition process starts only after approval of EA report from GoN. *The impact is direct, moderate in magnitude, local in extent and long-term in duration.*

ii) Loss of Agriculture Land and Crop

The subproject components will be constructed in the GoN land within the SNP and not any agricultural land going to be used. So, the subproject development activities will not pose any risk of losing agriculture land and crops.

iii) Pressure on existing facilities, services and natural resources of the subproject area

There will be increased pressure on social services and facilities due to the migrant workforce and influx of outsiders. The population of a relatively smaller subproject area can become crowded with the addition of outsiders, creating pressure on social service-providing institutions in the area. Experiences of hydropower subproject construction in Nepal reveal pressure on social service institutions, particularly health services, water supply systems,

administrative services, local law and order-maintaining institutions, and, above all, sanitation management of the area. This implies shortages of medicine and medical personnel in nearby health posts, shortages in water supply, an increase in thefts and quarrels over resources, a burden on local administrative office and, above all, can increase in solid waste, human waste, and degradation of the overall sanitation status of the area. In addition to this, subproject development activities (such as laying penstock pipe) may temporarily obstruct the access trail of natural and ecosystem resources for people during the construction period, though people of Lower Pangboche visit the forest occasionally to collect dry leaves and fodder for their livestocks by passing through the subproject development site. *The impact will be indirect in nature, moderate in magnitude, site specific in extent and short term in duration.*

iv) Health, sanitation and public safety

Public safety during construction phase is also an issue of concern. People unknowingly can get into accidents during construction activities. Also, the spilled chemical, hazardous materials, sharp construction materials pose threat to public safety unless adequate awareness is provided and strict regulations are formulated. Similarly, trench made for laying of transmission distribution lines may be ambush for locals and trekkers. Notice board and temporary fencing will be placed at the construction sites and such sites will be reinstated daily making section wise works. *The impact will be indirect in nature, moderate in magnitude, site specific in extent and short term in duration.*

v) Occupational health and safety related issues

The construction activities such as working in the river, steep slopes, may cause accidents and injuries. The most common injuries that might occur are due to accidental falls from scaffoldings or other structures, injuries due to falling objects such as rocks or other construction equipment. The victims will most probably be construction worker although injuries to local people area also possible. Similarly, construction practice without use of Personal Protective Equipment (PPE) like glove, boot and helmet results into the minor accidents. Health hazard may also occur due to unhygienic sanitation condition of camps. Work related injuries are the likely impacts predicted due to implementation of the proposed subproject. *The impact will be direct in nature, high in magnitude, site specific in extent and short term in duration.*

vi) Social-cultural conflict between local community and the outside work force

Another socio-cultural impact in the subproject area during construction will be an overall disruption of the traditional cultural ways of people living in and near the subproject area. Disruption of social life will also be caused by the presence of the construction workforce and an anticipated influx of job seekers during construction period of the subproject. For example, it is likely that the influx of construction workers will result in increased cases of inter-caste marriages locally. Eventually, some changes in ethnic and community solidarity and occupational patterns can be expected in the area. It is also likely that the construction workers, contractors and engineers and their families, would interact with the local people that could expose them to wide range of information opinions and ideas outside of their areas. Thus, the subproject will have some impacts on social, cultural and religious features of the subproject areas. *These impacts are expected to be direct, low in magnitude, local in extent and of short term.*

vii) Issues relating to unsocial activities like gambling, alcoholism, girl trafficking and prostitution

With the beginning of construction of subprojects involving numbers of migrant workforce introduced to new areas, there is always risk of introduction of new communicable diseases carried by the migrant workforce from elsewhere. While there are risks of communicable diseases being brought into the subproject area, the situation gets worst as these diseases spread to the local population and turn to an epidemic. As evident from other subprojects in Nepal, the risks of sexually transmitted diseases (STD) including HIV and AIDS increases in the subproject area. With a number of outsider population introduced to the area, there is always likelihood of conflicts between the locals and the outsiders. The locals have their own way of living as guided by the traditional cultures and practices. The outsider populations have a different way of living life as they are from a different area with different societal settings and customary traditions. This difference between the locals and outsiders creates a cultural gap and with any kind of intrusion to the existing traditions in the local area by the outsiders there could be conflicts generated. Moreover, with increased migrant workforce in the area, there could be increased alcoholism, gambling, prostitution in the subproject area and thereby the law and order situation may get vandalized. *The impact will be indirect in nature, moderate in magnitude, local in extent and short term in duration.*

viii) Gender discrimination (issues of equal pay between women & men for work of equal value)

Male and female workers may be paid unequally for the same or similar works. Similarly, contractor may select male and female workers for selective works rather than the capacity of individual workers. Such gender discrimination on works and pay scale may create dispute at workplace and hindrance on progess of works. *The impact will be indirect in nature, moderate in magnitude, site specific in extent and short term in duration.*

ix) Stakeholder Engagement and information disclosure

Stakeholder engagement and information disclosure is very important for the successful implementation of the proposed subproject. Avoiding or evading the stakeholders on proposed subproject activities may hamper the progress and sustainability of the subproject. Likewise, if information regarding the subproject is not shared with concerned stakeholders and locals of SPIA, it can also creates problem in subproject implementation and sustainability. *The impact will be indirect in nature, moderate in magnitude, local in extent and long term in duration.*

x) Issues of Grievances Management and Gender Based Violence (GBV)

Locals of SPIA, construction crews and other concerned stakeholders may have complaints regarding subproject activities and also about the behaviors of subproject staffs and workers. On the same way, there may be gender based violence and sexual exploitation & harassment in/among workers, subproject staffs and also with local people. Due to the large number of labour influx in the subproject area during the construction phase can pose risk related to SEA/SH. The risks of GBV triggered by labor influx when workers interact with community girl and women in the local communities cannot be ruled out for the subproject. For example, the subproject construction (specially T&D) will potentially take place near school or trekking route or access route to natural resources (fodder & dry grass collections) that women and girls use for their daily activities and which may increase the risk of GBV and thus, abusive behavior can also occur between subproject related staffs and those living in and around the subproject construction area. So, an effective and timely mitigation measures

need to be placed to deal with the risk of SEA/SH. *The impact will be indirect in nature, high in magnitude, local in extent and short term in duration.*

xi) Issues related to disturbance to community during construction

Construction activities, movement of construction crew and associated activities may disturb to local communities. Socio-cultural invasion, unsocial behavior, increment of wastes, unnecessary noise and shouting might disturb the nearby community during the time of T&D construction that take places near to the human settlement. *The impact will be indirect in nature, moderate in magnitude, local in extent and short term in duration.*

xii) Child labor

There is probability of using children as cheap construction labour. However, the subproject area lies on a world renowned trekking trail, the local people and the local government are very careful on preventing child labor because it can cause a bad reputation on their tourism business. *The impact will be direct in nature, low in magnitude, local in extent and short term in duration.*

xiii) People's Behaviors due to change in economy

The area is along famous tourist trekking route and people are earning handsome money in every tourist season. Thus it has been supposed that there will not be significant economic change of local community. Therefore, it does not play important role to change behaviors of local people.

xiv) Stress on local resources & infrastructure

Laying of transmission and distribution lines needs to be dig along the trails. Similarly, drinking water distribution pipes may be affected. This also impacts on travel and associated risks of accidents. *The impact will be direct in nature, moderate in magnitude, site specific in extent and short term in duration.*

xv) The pattern of uses of natural resources in festivals and religious rituals (if any)

The proposed subproject does not have any negative impacts on pattern of uses of natural resources in festivals and religious rituals.

xvi) Impact on historical, religious, cultural& touristic important sites

The subproject is located at around 1.5 km away from the human settlement and major construction works of intake & powerhouse and penstock pipe installation will be taken place at isolated area from the community where there is not presence of any historical, religious, and culturally important sites. So, the proposed subproject does not have any negative impacts on historical, religious, cultural, and touristic sites. However as the T&D works will be carried out near the community, the increased labour influx from outside the subproject area could have some influence on tradition, belief, and practices of local community.
The impact will be direct in nature, low in magnitude, site specific in extent and short term in duration.

xvii) Issues related with COVID-19 Pandemic

No place has remained untouched by COVID-19 pandemic since last two years. Construction crew and subproject staffs may transfer virus to community level or vice-verse. In this situation, both community people and workers may get infected and situation may become

chaos. The *impact will be indirect in nature, moderate in magnitude, local in extent and short term in duration.*

6.1.3.3.2 Operation Phase

i) Occupational health and safety related issues of the power station workers

Occupational Health and Safety issues during operation phase are particularly associated with long term exposures to noise from turbine operation and accidents due to electrocution causing injuries and deaths.

Occupational health impacts are direct in nature, moderate in magnitude, site specific in extent and long-term duration.

ii) Public Safety Related Issues/Movement of people in dangerous places

Local people with ignorance may not know about new structures and dangerous places such as the switch yard. They may visit these areas and risk their well-being. Children are especially susceptible to such hazards, which can result in accidents. *The impact will be direct in nature, moderate in magnitude, site specific in extent and long term in duration.*

iii) Issues related to benefit sharing of subproject

The local people of subproject are also found keen (during the consultation) to invest in subproject in the form of share equity and they are also demanding benefits from the subproject as the private company is going to used their natural resources. If the issue regarding to benefit sharing is not managed effectively, it may affect on sustainability of the subproject. *Thus this impact is indirect in nature, moderate in magnitude, local in extent and long term in duration.*

iv) Issues related to tariff of electricity

Most of the locals in the subproject area are using energy from existing micro hydro and solar for lighting purposes only. Most of the micro hydro plants were constructed from community initiatives and ownership, providing electricity service to the people of the subproject area. The existing micro hydro in the subproject area are not operating at full capacity, as these plants are more than 10-12 years old and need regular repair and maintenance. The micro hydro management committee of the existing micro hydro have fixed the tariff rate in consultation and mutual understanding with the community people. Though the community people have shown their readiness to pay the tariff according to their electricity consumption, the existing MHPs are not able to meet the current energy demand of the community people. During the consultation with the people of the proposed subproject area, they requested the ESCO to fix the tariff rate in line with the tariff rate of the existing micro hydro.*This impact is indirect in nature, moderate in magnitude, local in extent and long term in duration.*

v) Issues relating to sudden release of water to downstream

Water is released suddenly to downstream area to flush out the sediment load from settling basin especially during the wet season. People may be washing in the river if they are unaware of the situation. Thus, there is a high risk of accidents and even loss of life if people are unknown and are not informed about the sudden release of water.

The impact will be direct in nature, moderate in magnitude, local in extent and long term in duration.

vi) Withdrawal of economic opportunity

The first and foremost impact during the operation phase is the withdrawal of economic activities which flourished during the construction phase since majority of the construction workforce will leave the subproject areas. During operation phase when the energy is distributed to locals, the economic activities will be much less, only about 2~3 percent of total investment is necessary for annual expenditure. The labour requirement will decrease drastically, and so will be the income opportunities from construction related activities. But the impact may be compensated from the electricity generation which brings more opportunity in subproject area through uses of electricity in various purposes such as bakery, small cottage industry and other tourism related business. The impact will be indirect in nature, low in magnitude, local in extent and short term in duration.

vii) Water right issues

Currently water has not been used for any other purposes. Thus there is no issues in water use right.

viii) Stress on local resources & infrastructure

The proposed subproject does not make any stress on local resources and infrastructures during operation phase.

ix) Issues related to management of micro hydro subproject that exist in subproject affected area

There are three existing micro-hydro systems in the subproject area (Table 29 in Section 4.3.14) which are older than 10-12 years and currently providing electricity service mainly for lighting purposes. As the existing micro-hydro systems are not able to meet the current energy demand of the community people, they are looking for alternatives that can provide them reliable and sufficient energy. In this regard, when the AMHP is constructed and starts to provide reliable electricity, the community people will automatically switch to get electricity from the mini-hydro instead of the existing micro-hydro. Thus, the existing micro-hydro will be impacted to some extent and their revenue collection can be impacted.*This impact is direct in nature, high in magnitude, local in extent and long term in duration.*

6.1.3.4 Impacts to integrity of protected areas and Outstanding Universal Values

6.1.3.4.1 Beneficial Impacts

A. <u>Construction Period</u>

i) Slope Stability

During construction period, slope instability might occur along penstock alignment from chainage Ch.0+160 to Ch. 0+260m. The alignment passes beneath the crown of the slide on loose alluvial terrace deposit. Some hanging loose blocks were observed near the crown part of slide area. *The impact is indirect in nature, moderate in magnitude, local in extent and long term in duration.*

B. Operation Period

i) Ecological Integrity and Conservation in SNP

In operation period, it has been expected that dependency on biomass fuel for heating and cooking will be drastically decreased and forest and vegetation of SNP will be ultimately protected thus supports for habitat protection of diverse groups of wild animals in SNP. This will support for conservation of ecological integrity and conservation in SNP. *The impact is indirect in nature, high in magnitude, local in extent and long term in duration.*

6.1.3.4.2 Adverse Impacts

A. Construction Period

i) Impacts on Landscape

Construction activities for power generation and distribution may have minor impacts to local physical landscape. Trench making by excavation for laying of penstock pipe, transmission and distribution lines certainly changes the local landscape. But all the excavated sites will be rehabilitated immediately. *The impact is indirect in nature, low in magnitude, local in extent and short term in duration.*

ii) Impacts on Ecological Integrity

During construction, ground vegetation needs to be cleared for power generation and construction of physical structures. Construction activities may impact on movement of wildlife. Workers may involve in hunting poaching of wildlife. In addition, this may lead to loss of vegetation, grassland area and have impact on natural and critical natural habitat, impact on aquatic flora and fauna, rare, endangered, protected and threatened species of flora and fauna. All these will certainly impact on ecological integrity for short time of construction in specific locality. *The impact is indirect in nature, moderate in magnitude, site specific in extent and short term in duration.*

iii) Impacts on Scenic Beauty

Construction activities for power generation and distribution may impact local physical landscape. Fresh excavation works impart some visual disturbances and attracts the attention of visitors even for short time of construction. All the excavated sites will be rehabilitated immediately after completion of construction works. *The impact is indirect in nature, moderate in magnitude, local in extent and short term in duration.*

iv) Impacts on Social and Cultural Integrity

Influx of outsider construction workers may impact on local social and cultural practices. But the locals have been exposed to external social, cultural and traditions from last 75 years. Thus it has been expected that the impacts from the external workforce on social and cultural practices will be of minimum and of short period during the construction. However, this might have pressure on forest for fuel. *The impact is indirect in nature, low in magnitude, local in extent and short term in duration.*

6.1.3.4.3 Operation Period

During operation period, the impacts on OUV of SNP are very minimal. All the excavated area will be restored and rehabilitated. During operation, there are no impacts on landscape and ecological integrity. Impacts on scenic beauty are very minimal (only in river crossing area due to transmission and distribution lines that already exist). Water from tailrace will be

released in Cholunche Khola itself. The water current of such discharge will be minimal so it is envisaged not to have adverse impacts on the ecology of Cholunche Khola Thus it has been observed that there is no significant impact on OUV of SNP during operation.

6.2 Evaluation of Impacts

The significance of the impacts has been evaluated using the words significant, moderately significant and insignificant. Assumption has also been made to evaluate the significant impacts. Impacts having total score of over 75 are considered significant; impacts having 45 to 75 score are considered moderately significant; and impacts having total score of less than equal to 45 are considered insignificant for this subproject. However, some of the impacts whose total score exceeds 45 may not be significant in view of the nature of the predicted impacts. Some impacts having less than 45 score could also be considered significant. It has been done so as the impacts are related to the subjective judgment on magnitude, extent and duration of the impacts (Table 37, 38 and 39). For example, impacts likely to occur outside the subprojects direct impact zone and of indirect nature may not be significant although the total score exceeds 45. This ranking has provided a basis to select and propose environmental protection measures, i.e., beneficial impacts augmentation measures, and adverse impacts mitigation measures.

Table 37: Evaluation of Beneficial Impacts

SN	Likely Impacts	Nature	Magnitude	Extent	Duration	Total Score	Significance (pre-mitigation)
1. Construction Stage							
1.1	Employment generation and skill enhancement	D	H(60)	L(20)	ST(05)	85	Positively Significant
1.2	Benefits from implementation of environmental mitigation programs and benefit augmentation measures	ID	M(20)	L(20)	LT(20)	60	Moderately Positively Significant
1.3	Benefits from community and social support programs	D	M (20)	L (20)	LT (20)	60	Moderately Positively Significant
1.4	Increase in economic activities in the subproject area and associated beneficial impacts in local economy through micro-enterprise development	ID	M(20)	L(20)	ST(05)	45	Moderately Positively Significant
1.5	Benefits for Exposure of local population to new technologies and technology transfer	D	L(10)	L(20)	LT(20)	50	Moderately Positively Significant
1.6	Utilization of local resources	ID	L (10)	L (20)	ST (05)	35	Insignificant
2. Operational Stage							
2.1	Employment generation and skill enhancement	D	M (20)	L(20)	LT(20)	60	Moderately Positively Significant
2.2	Benefits to be incurred from addition of 911 kW of power	D	H(60)	L(20)	LT(20)	100	Highly Positively Significant
2.3	Sharing of electricity royalty to concerned authorities	D	M (20)	L(20)	LT(20)	60	Moderately Positively Significant

Note: D = Direct, ID = Indirect, S= Site specific, L= Local, R= Regional, ST=Short Term, LT= Long Term, H = High, M=Moderate, LO= Low
Value in the parenthesis are based on numeric value provided in National Environmental Impact Assessment
*Guideline, 1993. Priority rank; 1 (sum of numerical value 70 or above) = highly significant; 2 (sum of numerical value4*5- 70*) = moderately significant; 3 (sum of numeric value* below *45) = low significant.*

Table 38: Evaluation of Adverse Impacts

SN	Likely Impacts	Nature	Magnitude	Extent	Duration	Total Score	Significance
1. Physical Environment							
1.1 Construction Phase							
1.1.1	Change in land use	D	M (20)	SS (10)	LT (20)	50	Moderately Significant
1.1.2	Change in Topography	D	L (10)	SS (10)	LT (20)	40	Insignificant
1.1.3	Possible Glacier Lake Outburst Flood (GLOF) and associated impacts	IN	H (60)	L (20)	ST (05)	85	Significant
1.1.4	Landslide and soil erosion	IN	M (20)	SS (10)	LT (20)	50	Moderately Significant
1.1.5	Generation of spoils and spoil disposal related issues	D	M (20)	SS (10)	ST (05)	35	Insignificant
1.1.6	Impact due to quarrying activity	D	M (20)	L (20)	ST (05)	45	Moderately Significant
1.1.7	Impact on material quarrying sites	D	M (20)	SS (10)	LT (20)	50	Moderately Significant
1.1.8	Water pollution and increase in sediment loads	D	M (20)	L (20)	ST (05)	45	Moderately Significant
1.1.9	Noise Pollution	D	L (10)	SS (10)	ST (05)	25	Insignificant
1.1.10	Soil Pollution	D	L (10)	SS (10)	ST (05)	25	Insignificant
1.1.11	Issues of haphazard stockpiling of construction material	D	M (20)	SS (10)	ST (05)	35	Insignificant
1.1.12	Solid Waste Generation	D	M (20)	SS (10)	ST (05)	35	Insignificant
1.1.13	Air quality degradation	ID	L (10)	L (20)	ST (05)	35	Insignificant
1.1.14	Hydrology and river morphology	D	M (20)	SS (10)	LT (20)	50	Moderately Significant
1.1.15	Loss of Top Soil	D	L (10)	SS (10)	LT (20)	40	Insignificant
1.2. Operational Phase							
1.2.1	GLOF and associated impacts	ID	H (60)	L (20)	ST (05)	85	Very Significant
1.2.2	Change in topography and land use	D	L (10)	SS (10)	LT (20)	40	Insignificant
1.2.3	Impacts on river morphology and possible microclimatic changes	D	M (20)	L (20)	LT (20)	60	Moderately Significant
1.2.4	Land submergence due to diversion weir and associated impacts	D	L (10)	L (20)	LT (20)	50	Moderately Significant
1.2.5	Management/final disposal of solid waste and wastewater (both black water and grey water)	ID	L (10)	SS (10)	LT (20)	40	Insignificant
1.2.6	Change in river water quality	D	L (10)	SS (10)	LT (20)	40	insignificant
1.2.7	Noise and vibration	D	L (10)	SS (10)	LT (20)	40	Insignificant
1.2.8	Soil Erosion due to Tailrace Discharge	D	L (10)	SS (10)	LT (20)	40	Insignificant

SN	Likely Impacts	Nature	Magnitude	Extent	Duration	Total Score	Significance
1.2.9	Impact on Downstream due to Sediment Flushing	ID	M (20)	L (20)	LT (20)	60	Moderately significant
2. Biological Environment							
Adverse Impacts ***2.1. Construction Stage***							
2.1.1	Loss of grassland area	D	M (20)	SS (10)	LT (20)	50	Moderately significant
2.1.2	Loss of forest vegetation and overall vegetation diversity	D	L (10)	SS (10)	ST (05)	35	Insignificant
2.1.3	Pressure on Forest for Fuelwood	ID	M (20)	SS (10)	ST (05)	35	Insignificant
2.1.4	Impact on Sagarmatha National Park	D	M (20)	SS (10)	LT (20)	50	Moderately significant
2.1.5	Impact on natural and critical natural habitat features	D	L (10)	SS (10)	ST (05)	35	Moderately significant
2.1.6	Impact on Himalayan Musk Deer	D	M (20)	SS (10)	LT (20)	50	Moderately significant
2.1.7	Impact on Himalayan Black Bear	D	M (20)	SS (10)	LT (20)	50	Moderately significant
2.1.8	Impact on aquatic flora and fauna	D	L (10)	SS (10)	ST (05)	35	Insignificant
2.1.9	Impact on non-timber forest products/MAPs	D	L (10)	SS (10)	ST (05)	35	Insignificant
2.1.10	Possible Risk of forest fire	ID	L (10)	L (20)	ST (05)	35	Insignificant
2.1.11	Wildlife hunting and poaching	ID	L (10)	L (20)	ST (05)	45	Moderately significant
2.1.12	Increased incidence of Human Wildlife Conflict	D	L (10)	L (20)	LT (20)	50	Moderately significant
2.2. Operational Stage							
2.2.1	Reduced river flow	D	L (10)	L (20)	LT (20)	60	Moderately significant
2.2.2	Disturbance to the wildlife due to resident workforce	ID	L (10)	SS (10)	LT (20)	40	Insignificant
2.2.3	Impact on rare , endangered, protected and threatened species of flora and fauna	ID	L (10)	SS (10)	LT (20)	40	Insignificant
2.2.4	Bird casualties due to electrocution	-	-	-	-	-	No impact
2.2.5	Forest Fire	ID	L (10)	L (20)	LT (20)	60	Moderately significant
3. Socio economic and Cultural Environment							

SN	Likely Impacts	Nature	Magnitude	Extent	Duration	Total Score	Significance
Adverse Impacts							
3.1. **Construction Stage**							
3.1.1	Land acquisition and Land compensation related issues	D	M (20)	L (20)	LT (20)	60	Moderately significant
3.1.2	Pressure on existing facilities, services and resources of the subproject area	ID	M (20)	SS (10)	ST (05)	35	Insignificant
3.1.3	Health and sanitation and public safety	ID	M (20)	SS (10)	ST (05)	35	Insignificant
3.1.4	Occupational health and safety related issues	D	H (60)	SS (10)	ST (05)	75	Significant
3.1.5	Socio-cultural conflict between local community and outside work force	D	L (10)	L (20)	ST (05)	35	Insignificant
3.1.6	Issues relating to unsocial activities like gambling, alcoholism , girl trafficking and prostitution	ID	M (20)	L (20)	ST (05)	45	Moderately significant
3.1.7	Gender Discrimination	ID	M (20)	SS (10)	ST (05)	35	Insignificant
3.1.8	Stakeholder Engagement and information disclosure	ID	M (20)	L (20)	LT (20)	60	Significant
3.1.9	Issues of Grievances Management and Gender Based Violence (GBV)	ID	H (60)	L (20)	ST (05)	85	Significant
3.1.10	Issues related to disturbance to community during construction	ID	M (20)	L (20)	ST (05)	45	Moderately significant
3.1.11	Child labour	D	M (20)	L (20)	ST (05)	45	Moderately significant
3.1.12	Stress on local resources and infrastructure	D	M (20)	SS (10)	ST (05)	75	Insignificant
3.1.13	Impact on historical, religious, cultural& touristic important sites	D	L (10)	SS (10)	ST (25)		Insignificant
3.1.14	Issues related with COVID-19 Pandemic	ID	M (20)	L (20)	ST (05)	45	Moderately significant
3.2. Operation Phase							
3.2.1	Occupational health and safety related issues of the power station workers	D	M (20)	SS (10)	LT (20)	50	Moderately significant
3.2.2	Public Safety Related Issues/Movement of people in dangerous places	D	M (20)	SS (10)	LT (20)	50	Moderately significant
3.2.3	Issues related to benefit sharing of subproject	ID	M (20)	L (20)	LT (20)	60	Moderately significant
3.2.4	Issues related to tariff of electricity	ID	M (20)	L (20)	LT (20)	60	Moderately significant
3.2.5	Issues relating to sudden release of water to downstream	D	M (20)	L (20)	LT (20)	60	Moderately significant
3.2.6	Withdrawal of economic opportunity	ID	L (10)	L (20)	ST (05)	35	Insignificant
3.2.7	Issues related to management of micro hydro subproject that exist in	ID	H (60)	L (20)	LT (20)	100	Very Significant

SN	Likely Impacts	Nature	Magnitude	Extent	Duration	Total Score	Significance
	subproject affected area						

Table 39: Evaluation of Impacts on Protected Areas and OUV

SN	Likely Impacts	Nature	Magnitude	Extent	Duration	Total Score	Significance
4. Integrity of Protected Areas and OUVs							
4.1 Beneficial Impacts							
4.1.1 **Construction Stage**							
4.1.1.1	Slope Stability	ID	M (20)	L (20)	LT (20)	60	Moderately significant
4.1.2 **Operation Stage**							
4.1.2.1	Ecological Integrity and Conservation in SNP	ID	H (60)	L (20)	LT (20)	100	Significant
4.2 Adverse Impacts							
4.2.1 Construction Stage							
4.2.1.1	Impact on Landscape	ID	L (10)	L (20)	ST (05)	35	Insignificant
4.2.1.2	Impact on Ecological Integrity	ID	M (20)	SS (10)	ST (05)	35	Insignificant
4.2.1.3	Impact on Scenic Beauty	ID	M (20)	L (20)	ST (05)	45	Moderately significant
4.2.1.4	Impact on Social and Cultural Integrity	ID	L (10)	L (20)	ST (05)	35	Insignificant
4.2.2 Operation Stage		-	-	-	-	-	No Impact

6.3 Mitigation Measures

To overcome any adverse impacts by the subproject, the team have suggested 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 as well as WB Safeguard Policies and EHS Guidelines where available. Measures have been proposed based on nature of environmental impacts and components of environment that is affected, appropriateness and cost analysis. Each of the identified adverse impacts has been evaluated in detail and cost effective mitigation measures have been suggested to avoid and/or minimize the adverse impacts. Furthermore, enhancement measures have been proposed to enhance or augment beneficial impacts due to implementation of the subproject. Furthermore, the ESIA report has also included Environmental and Social Mitigation and Management Action Plan with responsible agency/party to carry out mitigation activity, the location of mitigation implementation, methods, time schedule and estimated budget. The ESIA report has defined organizational set up to carry out these activities. The costs for mitigation and enhancement measures have provided separately for both construction and operation stages for physical, biological, socio-economic and cultural environment.

6.3.1 Environmental Enhancement Measures

The benefit from the subproject could be enhanced or made more effective if they are planned properly. The following are the possible augmentation measures to enhance the benefit(s).

6.3.1.1 Enhancement Measures during Construction Phase

i. Employment opportunity and skill enhancement

The subproject will give first priority to local people who want to work in the subproject. The subproject will provide necessary training to local people engaged in construction work, if necessary, depending upon the nature of the work offered. The subproject will include a binding clause in the contractor's agreement to give first priority to local people while hiring both skilled and unskilled labor forces and to give daily wages or monthly wages not less than the RM approved rates. Local people will be recruited for administrative and technical works as per their qualifications and skills.

Table 40: Estimated Cost for the Skill Development Training

SN	Particular	Number of trainees	Per trainee cost	Training Duration/Period as per CTEVT	Total Cost (NRs.)
1	Electrical /Plumbing training	10	55,000.00	390 Hrs	550,000.00
2	Mason	10	20,000.00	15 Days	200,000.00
3	Other training as local interest	10	55,000.00	45 Days	550,000.00
4	Tourism hospitality & Cook	15	50,000.00	45 Days	750,000.00
	Total	**30**			**2,050,000.00**

ii. Benefits from implementation of ESMP

Implementation of ESMP during the construction period will benefit the local community. Support on community facilities such as education, health, drinking water and trekking trails will certainly benefit the local people. In addition, training will be provided to local community to boost local economy. Electrician, house wiring, electrical appliance repairing, tourism related training (housekeeping, chef), bakery, vegetable farming are some of the trainings.

iii. Benefits due to Exposure of local population to new technologies and technology transfer

The subproject will launch training programs in specialized area such as electro–mechanical works of hydroelectric, house wiring and maintenance, spoil handling etc. First priority will be given to the subproject affected families (PAFs) and local people to the extent they are interested to get involved in the construction activities.

6.3.1.2 Enhancement Measures during Operation Phase

i. Benefits to be incurred from addition of 911 kW of power to local people

As the subproject is aimed for selling the energy to local community, there will be additional availability of power/energy to locals. The locals can use the electricity as per their needs such as cooking, heating, lighting and so on. Tariff for electricity will be made in close coordination with community so that all can use the electricity at affordable cost.

ii. Public Shares

The subproject will provide 10% of the public shares to the locals in the subproject area.

iii. Implementation of ESMP

Two percent of total subproject cost has been allocated for ESMP. Remaining amount after expenses during construction will be utilized in operation phase for community support programs focusing on community facilities such as education, health, drinking water and trekking trails will certainly benefit the local people. Benefit sharing plan will be made in consultation with locals during operation period.

6.3.2 Environmental Mitigation Measures

6.3.2.1 Mitigation measures for impacts on Physical Environment

6.3.2.1.1 Construction Phase

i. *Change in land use*

- Due consideration will be given to avoid use of forest land for the establishment of labour camp, quarry sites, construction material stockpiling area including other permanent subproject features such as power house, staff quarter, switch yard ;
- Temporarily acquired land will be leased for construction period and it will be rehabilitated and brought to its original status, after the completion of construction work, to the extent possible.
- Plantation will be done with local species to rehabilitate excavated sites.
- All the muck will be disposed in designated areas only.

ii. *Change in topography*

Change in topography is very minor in the implementation of the subproject. All the temporarily used areas such as quarry sites and disposal sites will be rehabilitated. All the areas dug for laying of penstock pipe, transmission and distribution lines will be rehabilitated immediately by burying and plantation.

iii. *Possible Glacier Lake Outburst Flood (GLOF) and associated impacts*

GLOF impacts on the subproject area will be caused by natural events without relationship to subproject activities or facilities. But due to the establishment of the subproject, mitigation measures against natural GLOFs will be introduced and should in principle be classified as enhancement rather than mitigation measures. From an environmental perspective the most important actions are:

- Make aware to workers about GLOF warning system established in Imja Khola and its significance while working at powerhouse and tailrace site.
- Prepare emergency plans in respect of GLOF warnings and establishment of evacuation paths for escape to higher ground at critical sites.
- Establishment of GLOF warning system at intake site.

iv. *Landslides and soil erosion*

Following mitigation measures for the soil erosion and landslides impacts has been prescribed;

- Land clearance will be minimized as far as possible
- Storage and dumping of excavated spoils in the hill slope will be avoided
- Surface excavations works in headwork, penstock pipe, powerhouse and transmission and distribution lines areas will be controlled as to the geotechnical requirements of land stability and erosion
- After excavation works, the excavated slopes in all areas will be stabilized by the application of bioengineering works as required by the local geotechnical conditions.
- The spoil will be deposited to levels and heights taking into consideration of the geotechnical stability of deposited materials and reused for land filling as in case of pan stock laying.
- All excavated materials will be deposited in the safe spoil disposal sites as designated in the proposal
- Disposal of excavated loose materials along the water pathways will be prohibited
- Appropriate protection measures for major landslides shall be constructed.
- A suitable Gabion protection of length 100 m and cross-sectional area of $6m^2$ is construction on landslide area in penstock alignment

- Retention wall constructed should be that of filling the gabion mess wire. The possibility remained of the deer family and other animals to be stuck on them, which could be life taking.

v. *Generation of spoils and spoil disposal related issues*

Following mitigating measures need to be adopted:

- Top soil (up to 15cm depth from the surface) from the affected area will be scrapped and stored for later reuse in land development at disposal sites and other degraded land in the subproject area.
- The excavation materials will be used for backfilling purposes wherever required

- All excavated materials will be deposited in the safe spoil disposal sites as provided by the subproject design.
- Deposition of the spoils on the hill slopes, drainage structures, natural waterways etc will be strictly prohibited.
- The excavated areas including the slopes will be vegetated with the local species of grass, herbs, shrubs or trees so that the erosion prone area could be protected.
- The ESCO shall prepare rehabilitation plan and implement it effectively after taking approval from the RM.

vi. *Impacts due to quarrying activity*

- Quarry will be done in specified area
- Construction materials will be kept in designated area with appropriate covering materials such as textile, plastic;
- Haphazard quarry activities will be prohibited
- Spoils will be kept separately and used for land reclamation
- Quarry sites will be reclaimed
- The ESCO shall prepare rehabilitation plan and implement it effectively after taking approval from the RM.

vii. *Impact on material quarrying sites*

- Materials will be extracted with careful manner so that slope stability will be maintained
- Haphazard materials extraction will be prohibited
- Spoils will not throw/kept haphazardly
- Natural drainage will not be blocked due to stock piling of construction materials and spoils
- The quarry site will be rehabilitated and vegetated.
- The ESCO shall prepare rehabilitation plan and implement it effectively after taking approval from the RM.

viii. *Water pollution and increment in sediment loads*

- The storage areas for the chemicals, oils and other substances will be located far from the water sources to avoid the contamination by spillage.
- Workshop facilities will be located at least 100 m away from the water sources. Spilled oil and grease trapping systems will be built in the workshop to avoid contaminated runoff into the water courses.
- Both degradable and non-degradable waste will be kept away from water sources to avoid contamination through seepage or direct runoff.
- Toilets shall be provided at all construction sites and camp site with appropriate septic system. Toilets will be located away from water courses.
- Open urination and defecation shall be prohibited.
- Camp effluents shall not be discharged directly into the water sources. An adequate size effluent treatment system will be constructed to treat the camp effluent.
- Any discharge in inland surface water will be practiced as per the tolerance limit set by the MoFE.
- Water quality of the sources in and around the construction sites, camp sites and major settlements shall be monitored quarterly (dry season and wet season monitoring). The drinking water used in the camps and housings shall also be monitored.

ix. *Noise and vibration related impacts*

- Installing noise reducing equipment in the ventilators, compressors and diesel generator set
- The noise generating machineries and equipment such as generators, crushers etc. will be placed far from the residential areas
- Noise intensity level will be monitored regularly in the major construction sites such as headworks, powerhouse, settlements along the roads etc.

x. *Soil Pollution*

The impacts will be minimized or mitigated by the following mitigation measures:

- Chemicals, paints, petrochemicals etc. will be handled carefully;
- These materials will be stored separately in safe store house.

xi. *Issues relating haphazard stockpiling of construction material*

The impacts will be mitigated by the following mitigation measures:

- Proper disposal mechanisms will be established for the management of remaining of construction materials;
- Stockpiling and storage of the construction materials in designated sites only (Map 12).
- The construction materials such as sand and gravel will be methodically stored at proper locations separately; and
- The residual of construction materials will be re-utilized for other construction purposes like construction of resting places wherever possible.

Map12: Spoil Disposal Sites

xii. *Issues relating to generation of solid waste and their management*

- Dumping facilities will be provided at each construction site to avoid proliferation of the litters and construction trash materials.
- The construction wastes will be managed within the work areas. Tins and other metals are kept in a closed scrap yard within the construction premise.
- Solid waste from the camp and work areas will be collected regularly and disposed in coordination with SNP and RM.
- Separate waste collection bins will be provided in the camps to segregate wastes of different nature such as degradable, non-degradable, hazardous etc.

xiii. *Air pollution related issues*

Excavation will be minimized as far as possible.

- The aggregate crushing plants will be located far from the settlements and camp areas.
- The spoils disposed in the spoil tip areas will be compacted in order to stabilize them and avoid dust blowing by the wind; after the completion of the construction plantation will be carried out in the spoil tip areas.
- Excavated areas will be vegetated to minimize the bare surface.
- The air quality monitoring will be done at least three times - before construction, during construction and operation in major construction sites such as headworks, powerhouse, and settlements. Compliance with National Ambient Air Quality Standard of GoN will be checked.

xiv. *Impact on river morphology*

The extraction of river bed materials will be planned properly in such a way that river morphology does not change after the removal of the materials. Further, during the extraction of materials, due consideration will be given to minimize bank erosion. Similarly, the construction of the weir will be planned in a way so that concentrated flow or the diverted flow does not make bank erosion as such. As the mitigation measure is related to planning, no budget will be required for mitigating this impact.

xv. *Loss of fertile top soil*

While preparing the site for construction for laying of penstock pipe, powerhouse and headworks, the top soil will be managed separately and saved in a separate area for later rehabilitation works. The top soil (0-15 cm) from the productive land (penstock pipe and powerhouse) shall be preserved and reused for plantation and restoration purposes. A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).

6.3.2.1.2 Operation Phase

i. *GLOF and associated impacts*

Following are the mitigating measures to reduce the impact:

- Educate the local residents about the early warning system and characteristics of lake outbursts as there is already early warning system in Imja Khola and Cholunche Khola.

ii. *Impacts on river flow regime downstream of diversion weir (dewatered stretch of Cholunche Khola) and possible microclimatic changes*

Changes in microclimate will be expected during dry season in the downstream area. As a mitigation measure, the subproject will maintain a minimum flow of 50% of the mean monthly flow. Moreover, 5 % additional discharge has been considered in design for seepage and evaporation. The extraction of river bed materials will be planned properly in such a way that river morphology does not change after the removal of the materials. Further, during the extraction of materials, due consideration will be given to minimize bank erosion.

iii. *Land submergence created by 1.37 m high diversion weir and associated impacts*

The river bank erosion due to bed level rise will be minimized by the river bank protection measures in the critical areas as per provided in DFS.

iv. *Management/final disposal of solid waste and wastewater (both black water and grey water)*

Following are the mitigating measures to reduce the impact

- Solid waste from permanent camp and subproject will be segregated as per nature of waste such as degradable and non-degradable. Degradable waste will be composted while non-degradable waste will be managed in coordination with SNP and RM.
- Wastewater from subproject permanent camp and subproject office will be managed properly making soak pit and septic tank as per requirement.
- Haphazard disposal of wastes will be strictly prohibited.

v. *River Water Quality*

- The effluent discharges from subproject office and subproject camp to nearby water sources will be prohibited.
- The spillage of chemicals such as oils and paints which can occur during repairing and maintenance of powerhouse equipment and machines will be controlled.
- Haphazard disposal of spent oils and lubricants from the powerhouse and the switchyard will be prohibited. All the spent oils, lubricants, from the powerhouse and switch yards and transformers will be collected and kept in a separate designated area.
- Drinking water quality of the camp and water quality of the water sources around powerhouse will be monitored periodically.

vi. *Noise and vibration*

Since, the operation phase impacts on air quality, water quality, noise pollution and solidwaste generation is too minimal, the mitigation actions required are also few. The powerhouse workers will be provided with the ear muffs to reduce the exposure to continuous noise of turbine operation.

vii. *Air Quality*

Since, the operation phase impacts on air quality is too minimal, there is no need of mitigation measure.

viii. *Soil erosion due to tailrace discharge*

Pipe and open canal has been proposed for tailrace. Open canal will be made in such a way to protect from ground scouring. At outlet portion, gabion and boulder riprap protection are provided to prevent erosion of soil in Kholsi

ix. *Impact on downstream due to sediment flushing*

People will be made aware and notify regarding the sediment flush. Similarly, weak and vulnerable river banks will be stabilized with proper structures such as gabion wall, dry wall, retention wall.

6.3.2.2 Mitigation Measures for Impacts on Biological Environment

6.3.2.2.1 Construction Phase

i. *Impacts on grassland and vegetation*

Following are the mitigating measures to reduce the impact

- Vegetation will be cleared only to the required by pegging the area;
- The excavated area will be rehabilitated and restored with plantation of local plant species.

ii. *Pressure on forest for fuelwood*

- Use of fuelwood for cooking and heating will be prohibited in camps
- LPG or Kerosene will be provided to workers for cooking purposes

iii. *Possible impacts on protected species of flora*

Following are the mitigating measures to reduce the impact

- As far as possible, clearing of rare, endangered, endemic species of flora will be avoided
- In case of the clearing required by the subproject layout. Such species will be saved when they are excavated and safely replanted during rehabilitation and restoration of the excavated areas.
- Make provision for members of the local communities who have a good knowledge of plants in the area, are involved in the project to identify which plants need to be avoided from construction works and which plants can be transplanted.

iv. *Impact on wildlife and avian fauna*

Following are the mitigating measures to reduce the impact

- Vegetation will be cleared only to the required by pegging the area
- The subproject will organize programs to raise awareness on conservation of wildlife habitats and wildlife species for local people, school's children and subproject workers
- Night time construction activities will be avoided.

v. *Impact on Himalayan Musk Deer*

Following are the mitigating measures to reduce the impact

- No poaching and hunting activities will be allowed.
- Minimum disturbance will be maintained.
- There must be no food waste disposal in or around construction sites.
- Construction camps must use bear-proof dustbins.
- Awareness of Construction workers of the risk of inappropriate food waste encouraging bears and causing problems.
- Keeping of domestic dogs in construction camps will be prohibited
- SNP authorities will be hosted to explain park rules for wildlife protection to construction workers. Risks and penalties if park rules are not followed will be

explained. All construction workers will sign letters that they agree to follow all park rules.

- SNP Park rules will be printed and displayed on a notice board accessible to all workers.
- Contractor will develop appropriate nature awareness programs for workers.
- All workers brought to the site from outside of the SNP will be registered with SNP authorities prior to start working.

vi. *Impact on Himalayan Black Bear*

Following are the mitigating measures to reduce the impact

- No poaching and hunting activities will be allowed.
- Minimum disturbance will be maintained.
- There must be no food waste disposal in or around construction sites.
- Construction camps must use bear-proof dustbins.
- Awareness of Construction workers of the risk of inappropriate food waste encouraging bears and causing problems.
- Keeping of domestic dogs in construction camps will be prohibited
- SNP authorities will be hosted to explain park rules for wildlife protection to construction workers. Risks and penalties if park rules are not followed will be explained. All construction workers will sign letters that they agree to follow all park rules.
- SNP Park rules will be printed and displayed on a notice board accessible to all workers.
- Contractor will develop appropriate nature awareness programs for workers.
- All workers brought to the site from outside of the SNP will be registered with SNP authorities prior to start working.

vii. *Impact on aquatic flora and fauna*

- Unless required by the subproject structural placement, the riverbed will not be disturbed
- Spoil disposal in the river floodplain will be prohibited
- Wastewater from camps will not be discharged to water body without proper treatment

viii. *Impact on Non-Timber Forest Products/MAPs*

Following are the mitigating measures to reduce the impact

- The subproject will develop programs to support NTFPs/MAPs promotion.
- While carrying out afforestation, the plantation of NTFPs/MAPs species will also be carried out.

ix. *Possible Risk of forest fire*

Following are the mitigating measures to reduce the impact

- The subproject staff and workforce will be instructed not to visit the forested areas
- Awareness relating to importance of forest and biodiversity and consequences of forest fires will be provided to the local people and the subproject staffs.

x. *Wildlife hunting and poaching*

- No poaching and hunting activities or purchase of wildlife meat or other products such as skins, horns etc will be allowed by construction workers.
- Minimum disturbance of wildlife and lesser fauna will be maintained
- Workers will be made aware about wildlife conservation and the penalties of non-compliance.

xi. *Human wildlife conflict*

- Wild animals will not be disturbed if seen during construction
- No poaching and hunting activities will be allowed.
- Construction works will not be done at dusk and down, and night.
- Workers will be made aware about wildlife conservation through awareness and sensitization programs.

6.3.2.2.2 Operation Phase

i. *Reduced flow*

Following are the mitigating measures to reduce the impact

- Residual environmental flow (50% of monthly flow) will be released round the year from the weir as per Hydropower Policy to sustain the aquatic life of the dewatered section between weir and tailrace. (Table 35 for monthly discharge). In addition, 5% of design discharge has been considered as seepage and evaporation loss.
- The ESCO will prepare and implement an Environmental Flow Implementation Plan (EFIP), which will be monitored by the RM and SNP. The EFIP will include (but not limited to): (1) Minimum volumes of water flow that will be released from the reservoir at different stages of the year, (2) Responsibilities for implementation; (3) Measures for monitoring downstream flow levels; (4) Reporting requirements such as frequency and report content to other authorities as required; and (5) Review cycle for revision of the EFIP.

ii. *Possible disturbance to the wildlife due to resident workforce*

Following are the mitigating measures to reduce the impact

- No poaching and hunting activities will be allowed.
- Labor camp will be constructed nearby residential area
- Minimum disturbance will be maintained
- The subproject staff and workforce will be instructed not to visit the forested areas
- Awareness relating to importance of forest and biodiversity to the local people and the subproject staff.

iii. *Rare, Endangered, Protected and Threatened Species of flora and fauna*

- Awareness among workforce
- Work in close coordination with the RM and SNP
- No work will be done during dusk and night when there will be movement of wildlife

iv. *Bird casualties*

- Bird deflectors will be used in Transmission line over the river crossing

v. *Forest Fire*

Following are the mitigating measures to reduce the impact

- The subproject staffs will be instructed not to visit the forested areas
- Awareness relating to importance of forest and biodiversity and consequences of forest fires will be provided to the local people and the subproject staffs
- Smoking will be prohibited in forest area

6.3.2.3 Socioeconomic and Cultural Environment

6.3.2.3.1 Construction Phase

i. *Land acquisition and compensation related issues*

Following are the mitigating measures to reduce the impact

- The lands required for the subproject will be acquired as per GoN Rule on short term and long term lease.
- Minimum land will be acquired as per need.
- Land used for temporary uses will be rehabilitated and restored.

ii. *Pressure on existing facilities, services and natural resources of the subproject area*

Following are the mitigating measures to reduce the impact

- The subproject will support the existing educational institution in the subproject area
- The subproject will support existing health institution in the subproject area to upgrade its capacity
- The subproject will support to upgrade the existing trekking trails of subproject affected area
- Trenches especially made for undergrounding the penstock pipe and T& D lines will be reclaimed immediately to avoid accidents.
- People will be well informed about the trails obstruction with proper signage and route diversion will be arranged, if required.

iii. *Issues relating to health, sanitation and public safety*

Following are the mitigating measures to reduce the impact

- Provisions will be made for checking health status of the worker for contagious diseases
- The subproject will launch community awareness program on health and sanitation, communicable disease and ways to prevent such disease.
- Signboards with signs on different construction related activities will be placed in the construction sites.
- All the construction sites will be fenced and unauthorized persons will not be allowed in the construction sites.
- All visitors in the construction site will be instructed to wear protective gears

iv. *Occupational health and safety related issues*

Following are the mitigating measures to reduce the impact

- The subproject will have the facility of first aid for its staff and construction worker. Such service will be provided free of cost service to the people of local area.
- A contract will be done with Helicopter Company for emergency cases of injury and illness.

- Emergency firefighting systems will be provisioned in the camps and the construction areas.
- Personnel protective equipment such as helmets, gloves, boots, mask, ear plugs, safety belts etc. as to the requirement of the construction work nature to each of the construction workers and supervisors will be provided. Workers without required PPEs will not be allowed to enter in to the construction site.
- The subproject will make the Contractor to organize regular safety instruction prior to, during and after the working hours in a routinely manner.

v. *Socio cultural issues such as community conflict with the outside work force*

Following are the mitigating measures to reduce the impact

- Code of conduct for the subproject staff will be prepared and implemented and subproject staff will be provided the orientation on norms, values, and cultural belief of communities.
- The subproject will organize regular ethical behavioral programs to outside workers before work session to respect local people, their culture and traditions
- Labour management plan will be prepared and implemented.
- Gambling and alcohol drinking will be prohibited within the camp and in the communities as well.

vi. *Issues relating to unsocial activities like gambling, alcoholism, girl trafficking and prostitution*

Following are the mitigating measures to reduce the impact

- Code of conduct for the subproject staffs/workers will be prepared and implemented and subproject staffs/workers will be provided the orientation on norms and values of communities
- The subproject will organize regular program on ethical behavioral programs to outside workers before work session to respect local people, their culture and traditions
- Gambling and alcohol drinking will be prohibited within the camp, working areas and in the communities as well.
- If any staffs/workers are involved in any unsocial behaviour, they will be handovered to local administration for legal actions.

vii. *Gender discrimination (issues of equal pay between women &men for work of equal value)*

Following are the mitigating measures to reduce the impact:

- Both women and men will be given equal opportunity for employment and ensured that no one will be discriminated on the basis of sex, caste, religion and ethnicity in subproject development activities
- Participation of women and socially excluded groups will be ensured in any committee formed related to subproject development
- No gender discrimination will be done in terms of wages for the same or similar works.

viii. *Issues related to stakeholder engagement and information disclosure*

All the activities related to subproject will be made transparent and periodic consultation with relevant stakeholders will be carried out. The mechanish to have access to infromation related to subproject will be developed. Information related to suprject will be publicly disclosed via

website, local FM, Newspaper and TV as per need basis. Stakeholder engagement plan will be developed and implemented.

ix. *Issues of Grievances Management and Gender Based Violence (GBV)*

GRC at subproject level will be established to address the issues related to labour, SEA/SH, stakeholders and local people. Orientation to the subproject staff & GRC on sexual exploitation and harassment and gender based violence will be provided. The code of conduct regarding the SEA/SH will be implemented. Furthermore, GRC will be made open to receive and investigate all the concerns and complaints about the subproject activities and will be made functional throughout the subproject lifecycle

x. *Affect on existing social infrastructures*

Trenches especially made for undergrounding the transmission and distribution lines will be reclaimed immediately to avoid accidents. During the work taking place in trekking trails for T & D, people will be well informed about the trails obstruction with proper signage and route diversion will be arranged if required. Precaution will be made while digging trenches to protect water pipes and other cables (if exist in working trails). And if water distribution pipe gets damage, it will be maintained immediately.

xi. *Issues related to disturbance to community*

Followings are the mitigating measures to reduce the impact

- Separate camps for male and female will be made for construction crew.
- Separate toilets and place for breast feeding for women subproject staff
- Construction crew will be made aware about the social activities, customs, and traditional, cultural and religious activities.
- Unnecessary and untimely movement of construction of crew will be checked.

xii. *Issues of Child Labour*

- Uses of child labour will be completely prohibited
- Records of all the workers will be kept along with their identity showing age.

xiii. *Impact on historical, religious, cultural& touristic important sites*

- Workers Code of Conduct (CoC) will be prepared and implemented
- Orientation programs for laborers regarding potential harm and damage that could be done to local religious, cultural, historical, and tourist important sites.

xiv. *Issues related with COVID-19 Pandemic*

Following are the mitigating measures to reduce the impact

- Minimum distance will be maintained.
- Using of PPEs especially mask will be made compulsory
- Sanitizers will be provided at work place and camp
- Workers will not be allowed to visit community
- Isolation wards will be made at camp
- Suspicious workers are immediately kept in isolation and provision will be made to check COVID-19

6.3.2.3.2 Operation Phase

i. *Occupational health and safety related issues of the power station workers*

Following are the mitigating measures to reduce the impact

- Occupational health and safety plan (OHSP) specific to operation and maintenance phase of the subproject will be developed incorporating plans to deal with safety in powerhouse as well as maintenance activities shall be developed and implemented. Compliance of the implementation of the measures recommended in the plan will be monitored periodically.
- Safety signs, warning symbol boards will be placed in powerhouse.
- Powerhouse workers will be equipped with all necessary safety equipment.
- Emergency firefighting system will be provisioned in the camps and the powerhouse
- Powerhouse workers will be made aware of the safety issues inside the powerhouse.

ii. *Public Safety Related Issues/Movement of people in dangerous places*

Following are the mitigating measures to reduce the impact

- All dangerous sites such as switch yard will be fenced as a precautionary measure to restrict people's movement in the area;
- Safety signs and posts will be erected at critical areas; and
- Local people will be made aware of dangerous subproject areas.

iii. *Issues related to benefit sharing of subproject*

ESCO is in consultation with local people of subproject area regarding of providing at least 10% of the shares to people living around the subproject area dring the construction phase. In addition to the shares, locals will benefit from CSR and the implementation of ESMP. The local government will receive the revenue and it can be used for local development activities.

iv. *Issues related to tariff of electricity*

This issue related to tariff will be managed in coordination with bencifiaciaries and Electricity Regulatory Commission (ERC).

v. *Issues relating to sudden release of water to downstream*

During the operation phase, the sudden release of water downstream of the headworks may cause accidents. Thus, as a mitigation measure, a siren system will be established to make the downstream people aware about the timings of the release of water. Similarly, local people will be made aware about the siren system or alternatively local FM will also be used for scheduled flushing or flushing required during emergencies.

vi. *Issues of Withdrawal of economic opportunity*

Upon the completion of the subproject, most of the labour will lose jobs. They will not be able to utilize their skills locally. Therefore, they have to either leave the area or go elsewhere in search of jobs that match their skills or remain in the local area and find jobs which are locally available. To overcome from this issue, following works will be done:

- The subproject will try to appoint maximum number of local people as far as possible during the operation period;
- Training sessions will be conducted at least 3 months prior to the subproject completion, so that the labour force will be able to start their own businesses immediately upon the termination of their jobs in the subproject;

- Training programs will be organized particularly targeting the skilled labour force willing to establish their own entrepreneurship, where they can utilize their skills and make a living.

vii. *Issues related to management of micro hydro subproject that exist in subproject affected area*

Agreement for energy generation, distribution and management with three existing micro hydro has been done separately. The ESCO will purchase the generated energy from existing micro hydro and is responsible for distribution of while micro hydro manage the production system themselves (**Annex XVI**).

6.3.2.4 Impacts to integrity of protected areas and Outstanding Universal Value

A. Construction Period

i) Slope Stability

During construction period, weak and unstable slope will be strengthened. This will be done along the penstock pipe alignment and also foot trails for erection and laying of transmission and distribution lines. The strengthening works certainly support for the landscape conservation at site specific level maintaining slope stability and increasing trails durability. A suitable Gabion protection of length 100 m and cross-sectional area of $6m^2$ is construction on landslide area in penstock alignment.

ii) Impacts on Landscape

Following are the mitigating measures to reduce the impact:

- Excavation of construction materials from designated sites
- Deposition of spoils at specified area
- Rehabilitation and restoration of excavated sites for material collection, laying of penstock, distribution and transmission lines immediately
- Plantation of local grasses/plants at rehabilitated sites of penstock laying and excavation sites for materials.

iii) Impacts on Ecological Integrity

Following are the mitigating measures to reduce the impact:

- No poaching and hunting activities will be allowed.
- Restriction on visit in forest area
- Restriction on collection of forest product from forest
- Prohibition of use of fire in forest area
- Biodiversity conservation awareness raising activities to workers as well as locals

iv) Impacts on Scenic Beauty

Following are the mitigating measures to reduce the impact:

- Rehabilitation and restoration of excavated sites for material collection, laying of penstock, distribution and transmission lines immediately
- Plantation of local grasses/plants at rehabilitated sites of penstock laying and excavation sites for materials.

v) Impacts on Social and Cultural Integrity

Following are the mitigating measures to reduce the impact:

- Preparation and implementation of code of conduct for subproject staffs/workers
- Orientation on norms and values of subproject affected communities
- Organization of regular ethical behavioral programs to outside workers before work session to respect local people, their culture and traditions
- Prohibition of Gambling and alcohol drinking within the camp and working sites.

The mitigation matrix is as given in **Table 41**.

Table 41: Proposed Mitigation Measures

SN	Environment & Social Impact	Mitigation Measures	Mitigation [11]Cost(NPR)	Responsibility	Timeline	Remarks
A. Physical Environment						
Construction						
1	Change in land use	● Avoid of forest area for labor camp, quarry sites, construction material stock piling	No Cost	ESCO/Contractor	Construction Period	
		● Rehabilitation of temporarily acquired land	Included in subproject cost	ESCO/Contractor	Construction Period	
		● Plantation with local plant species to rehabilitate excavated sites	150,000.00	ESCO/Contractor	Construction Period	Though the subproject development activities won't cut any trees, ESCO has allocated budget as a part of environment enhancement
2	Change in Topography	● Rehabilitation of quarry sites and excavated sites for laying of penstock pipe, transmission and distribution lines	Included in subproject cost	ESCO/Contractor	Construction Period	
3	Possible Glacier Lake Outburst Flood (GLOF) and associated impacts	● Awareness to workers about early warning system ● Preparation of Emergency Plan ● Installation of GLOF warning system at intake site	100,000.00	ESCO	Preconstruction/Construction Period	Uses of fund from ESMP

[11] Most of cost required for implementation of mitigation measures has been included in subproject cost; Additionally 1% of base cost of subproject has been allocated for implementation of ESMP

SN	Environment & Social Impact	Mitigation Measures	Mitigation [11]Cost(NPR)	Responsibility	Timeline	Remarks
4	Landslide and Erosion	● Minimal land clearance ● Avoidance of dumping of excavated spoils in hill slope ● Stabilization of excavated slopes with the application of bioengineering ● Gabion protection of length 100 m and cross-sectional area of $6m^2$ will be construction on landslide area along penstock alignment ● Deposition of spoils in designated area ● Reuse of excavated materials ● Prohibition of disposal of spoils in waterways	Included in subproject cost	ESCO/Contractor	Construction Period	
5	Spoil generation and disposal issues	● Top soil will be stored separately and later use in land rehabilitation ● Use in back filling ● Deposit in specified place ● Revegetated the excavated areas ● ESCO shall prepare rehabilitation plan and implement it effectively after taking approval from the RM.	Included in subproject cost	ESCO/Contractor	Construction Period	
6	Impacts due to quarrying activity	● Quarry will be done in specified area ● Construction materials will be kept in designated area with covering ● Haphazard quarry activities will	Included in subproject cost	ESCO/Contractor	Construction/operation Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation [11]Cost(NPR)	Responsibility	Timeline	Remarks
		be prohibited ● Spoils will be kept separately and used for land reclamation ● Quarry sites will be reclaimed ● ESCO shall prepare rehabilitation plan and implement it effectively after taking approval from the RM.				
7	Impacts on material quarrying sites	● Materials will be extracted with careful manner so that slope stability will be maintained ● Haphazard materials extraction will be prohibited ● Spoils will not throw/kept haphazardly ● Natural drainage will not be blocked due to stock piling of construction materials and spoils ● The quarry site will be rehabilitated and vegetated.	Included in subproject cost	ESCO/Contractor	Construction/operation Period	
8	Water quality and waste water disposal issues	● Storage of chemicals away from water sources ● Establishment of workshop facilities at least 100 m away from water sources with oil and grease trapping system ● Provision of toilets at construction and camp sites with appropriate septic system ● Prohibition of open urination and defecation	Included in subproject cost	ESCO/Contractor	Construction Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation [11]Cost(NPR)	Responsibility	Timeline	Remarks
		● No direct discharge of camp effluents in water sources.				
9	Noise and vibration related issues	● Installation of noise reducing equipment in ventilators, compressors and diesel generators ● Placing of generators and crushers away from settlements	Included in subproject cost	ESCO/Contractor	Construction Period	
10	Soil Pollution	● Chemicals, paints, petrochemicals etc. will be handled carefully; ● These materials will be stored separately in safe store house.	Included in subproject cost	ESCO/Contractor	Construction Period	
11	Issues of haphazard stockpiling	● Storage at designated sites ● Proper disposal of remaining construction materials	Included in subproject cost	ESCO/Contractor	Construction Period	
12	Solid waste generation	● Provision of dumping facilities in each construction sites ● Collection and storage of scraps in scrap yard ● Separate collection bins in camps for segregation of waste of different nature	Included in subproject cost	ESCO/Contractor	Construction Period	
13	Air Pollution	● Establishment of crushing plants away from settlements ● Stabilization of spoils at tipping area ● Revegetation of bare area	Included in subproject cost	ESCO/Contractor	Construction Period	
14	Impact on River Morphology	● Extraction of river bed materials without affecting the river morphology	Included in subproject cost	ESCO/Contractor	Construction Period	
15	Loss of fertile top soil	● Preservation of top soil and reused for plantation and restoration purposes	Included in subproject cost	ESCO/Contractor	Construction Period	
Operation						

SN	Environment & Social Impact	Mitigation Measures	Mitigation [11]Cost(NPR)	Responsibility	Timeline	Remarks
1	GLOF and associated impacts	● Educate locals and workers about early warning system ● Preparation of Emergency Preparedness Plan	Included in subproject cost	ESCO	Operation Period	
2	Impacts on flow regime downstream of diversion weir	● Maintain minimum flow of 50% of the mean monthly flow		ESCO	Operation Period	
3	Land submergence created by 1.37 m high diversion weir	● Bank protection measures		ESCO/Contractor	Construction Period	
4	Solid waste and waste water generation	● Solid waste and waste water management at camp ● No disposal of waste and waste water haphazardly		ESCO	Operation Period	
5	Water contamination	● No discharge of effluent and chemicals in water body ● Monitoring of water quality periodically		ESCO	Operation Period	
6	Noise and Vibration	● Ear muffs will be provided for construction workers		ESCO	Operation Period	
7	Soil erosion due to tailrace	● Provision of piped and open canal ● Protection measures for ground and side scouring		ESCO/Contractor	Construction Period	
8	Impacts on downstream due to sediment flushing	● A siren system will be installed ● local people will be made aware about the siren system ● Stabilization of weak river banks		ESCO	Operation Period	
B. Biological Environment						
Construction						

SN	Environment & Social Impact	Mitigation Measures	Mitigation [11]Cost(NPR)	Responsibility	Timeline	Remarks
1	Impacts on grassland and vegetation	● Vegetation will be cleared only to required by pegging and numbering the trees ● Immediate rehabilitation and restoration will be done in excavated areas		ESCO/Contractor	Construction Period	
2	Possible impacts on protected flora	● Clearance of rare, endangered and endemic species of flora will be avoided ● Priority will be given for protected and endemic plants in plantation for restoration and rehabilitation		ESCO/Contractor	Construction Period	
3	Pressure on forest for fuelwood	● Use of fuelwood for cooking and heating will be prohibited in camps ● LPG or Kerosene will be provided to workers for cooking purposes		ESCO/Contractor	Construction Period	
4	Impact on wildlife and birds	● Prohibition on hunting and poaching ● Awareness on wildlife and habitat conservation ● No work on night time		ESCO/Contractor	Construction Period	
5	Impact on Himalayan Musk Deer	● No poaching and hunting activities will be allowed. ● Minimum disturbance will be maintained. ● There must be no food waste disposal in or around construction sites. ● Construction camps must use bear-proof dustbins. ● Awareness of Construction workers of the risk of inappropriate food waste encouraging bears and causing				

SN	Environment & Social Impact	Mitigation Measures	Mitigation [11]Cost(NPR)	Responsibility	Timeline	Remarks
		problems. ● Keeping of domestic dogs in construction camps will be prohibited ● SNP Park rules will be printed and displayed on a notice board accessible to all workers. ● Contractor will develop appropriate nature awareness programs for workers. ●				
6	Impact on Himalayan Black Bear	● No poaching and hunting activities will be allowed. ● Minimum disturbance will be maintained. ● There must be no food waste disposal in or around construction sites. ● Construction camps must use bear-proof dustbins. ● Awareness of Construction workers of the risk of inappropriate food waste encouraging bears and causing problems. ● Keeping of domestic dogs in construction camps will be prohibited ● SNP Park rules will be printed and displayed on a notice board accessible to all workers. ● Contractor will develop appropriate nature awareness programs for				

SN	Environment & Social Impact	Mitigation Measures	Mitigation [11]Cost(NPR)	Responsibility	Timeline	Remarks
		workers. ●				
7	Impact on aquatic flora and fauna	● Unnecessary river bed will not be disturbed ● Prohibition of spoil disposal in river flood plain ● No discharge of waste water in waterbody		ESCO/Contractor	Construction Period	
8	Impacts on NTFPs/MAPs	● Support on NTFPs/MAPs promotion ● Priority for NTFPs/MAPs in afforestation		ESCO/Contractor	Construction/Operation Period	
9	Forest fire	● Restriction of visit on forest area ● Awareness on biodiversity and consequences of forest fires		ESCO/Contractor	Construction Period	
10	Wildlife hunting and poaching	● Prohibition on hunting and poaching ● Minimal disturbance on habitat ● Make aware workers about wildlife conservation		ESCO/Contractor	Construction Period	
11	Human wildlife conflict	● No disturbance to wildlife if seen ● No hunting and poaching ● No work at dusk, down and night ● Awareness on biodiversity conservation		ESCO/Contractor	Construction Period	
Operation						
1	Impacts due to reduced flow	● Maintain residual environmental flow (50% of monthly flow) and additional 5% of design discharge for seepage and evaporation loss		ESCO	Operation Period	
2	Disturbance to wildlife due to resident workforce	● No visit in forest area ● No poaching and hunting ● Labour camp will be constructed nearby residential area		ESCO	Operation Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation [11]Cost(NPR)	Responsibility	Timeline	Remarks
		● Awareness on biodiversity conservation				
3	Rare, Endangered, Protected and Threatened Species of flora and fauna	● Awareness among workforce ● Work in close coordination with the SNP ● No work will be done during dusk and night when there will be movement of wildlife		ESCO	Operation Period	
4	Bird casualties	● Bird deflectors will be used in Transmission line over the river crossing		ESCO	Operation Period	
5	Forest Fire	● Prohibition on visit in forest area ● Prohibition on smoking in forest area ● Awareness on biodiversity conservation		ESCO	Operation Period	
C. Socioeconomic and Cultural Environment						
Construction Phase						
1	Land acquisition	● Acquisition of land as per GoN Rule and regulation on long term and short term lease as per need ● Rehabilitation and restoration of temporarily leased land	Cost required for compensation of land will be borne separately by ESCO	ESCO	Construction Period	
2	Pressure on existing facilities, services and resources of the subproject area	● Support on educational, health and drinking water facilities ● The subproject will support to upgrade the existing trekking trails of subproject affected area	Included in subproject cost	ESCO/Contractor	Construction Period	
3	Issues relating to public health and sanitation and as well as public	● Regular health checkup of Workers ● Awareness program on health and sanitation ● Provision of sign boards	100,000.00 (Health checkup); 25,000.00 (Sign	ESCO/Contractor	Construction Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation [11]Cost(NPR)	Responsibility	Timeline	Remarks
	safety	● Provision of fencing and restriction of unauthorized persons in construction sites	Board); No cost for awareness; Cost for fencing in subproject cost			
4	Issues of Occupational Health and Safety	● Provision of PPEs and First Aid ● Preparation of Emergency Preparedness Plan ● Provision of Fire Fighting Systems ● Regular instruction on safety to workers ● Provision of accidental insurance	100,000.00 (PPEs); 25,000.00 (First Aid); 25,000.00 (Fire Fighting); Cost of Insurance in subproject cost	ESCO/Contractor	Construction Period	
5	Socio-cultural issues	● Awareness program on ethical behavior, local tradition, culture and religious activities ● Prohibition on gambling and alcohol drinking in work place and camp premises	No extra cost	ESCO/Contractor	Construction Period	
6	Issues related to unsocial behaviours	● Implementation of code of conduct ● Organization of programs on ethical behavior programs ● Prohibition on gambling and alcohol drinking in work place and camp premises	No extra cost	ESCO/Contractor	Construction Period	
7	Gender discrimination in terms of payment	● No gender discrimination on payment ● Provision on payment as per work	No extra cost	ESCO/Contractor	Construction Period	
8	Stakeholder engagement and	● Maintenance of transparency of subproject activities	50,000.00 for meeting; No extra	ESCO/Contractor	Pre-construction/ Construction/	

SN	Environment & Social Impact	Mitigation Measures	Mitigation [11]Cost(NPR)	Responsibility	Timeline	Remarks
	information disclosure	● Preparation of Stakeholder Engagement Plan	cost for others.		Operation Period	
9	Issues of GRM and GBV	● GRC at subproject level will be established ● GBV will be punishable	No extra cost	ESCO/Contractor	Construction Period	
10	Affect on existing social infrastructures	● Rehabilitation of construction sites especially trenches for laying penstock pipe, transmission and distribution lines	Cost required for compensation of land will be borne separately by ESCO	ESCO/Contractor	Construction Period	
11	Issues related to disturbance to community	● Separate construction camps for man and woman will be made ● Make aware about social activities, customs, traditional, cultural and religious activities to construction crew ● Checking of unnecessary and untimely movement of construction crew ● Code of Conduct (CoC) including SEA/SH for subproject staff will be prepared and implemented	Cost required for compensation of land will be borne separately by ESCO	ESCO/Contractor	Construction Period	
12	Issues of Child Labour	● Prohibition of child labour in works ● Record keeping of labour with identity card showing age	2,000.00 (Record Keeping)	ESCO/Contractor	Construction Period	
13	Issues related with COVID-19 Pandemic	● Minimum distance will be maintained ● Uses of PPEs is compulsory ● Isolation wards will be made ● Uses of masks and sanitizers will be made compulsory	100,000.00	ESCO/Contractor	Construction Period	
Operation Phase						

SN	Environment & Social Impact	Mitigation Measures	Mitigation [11]Cost(NPR)	Responsibility	Timeline	Remarks
1	Occupational health and safety issues	● OHSP will be prepared ● Safety signs, warning symbol boards will be placed in powerhouse ● All necessary safety equipment will be provided to workers ● Emergency firefighting system will be provisioned in the camps and the powerhouse ● Powerhouse workers will be made aware of the safety issues inside the powerhouse.	100,000.00 (For safety sign); 25,000.00 (Safety equipment); 25,000.00 (Firefighting system)	ESCO	Operation Period	
2	Public Safety Related Issues/Movement of people in dangerous places	● Restriction people in dangerous area ● Safety signs and posts will be erected at critical areas ● Build mechanism to control trespassing of local people in the subproject area	50,000.00	ESCO	Operation Period	
3	Issues related to benefit sharing	● Provision of shares ● Implementation of ESMP ● Benefit from CSR ● Local development from revenue	No extra cost	ESCO/Local Government	Operation Period	
4	Issues related to tariff of electricity	● Tariff will be fixed in coordination with local people	No extra cost	ESCO	Operation Period	
5	Issues relating to sudden release of water	● A siren system will be installed ● local people will be made aware about the siren system	25,000.00 (Siren System)	ESCO/Contractor	Operation Period	
6	Issues of Withdrawal of economic opportunity	● Priority for employment during operation will be given to local people		ESCO	Operation Period	
5	Issues of	● Purchases of electricity generated	Cost required for	ESCO	Operation Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation [11]Cost(NPR)	Responsibility	Timeline	Remarks
	management of existing micro hydro	from existing micro hydro and distribution to community	compensation of existing will be borne by ESCO			
Protected Areas and OUV						
● **Construction Period**						
	Slope Stabilty	● Gabion protection of length 100 m and cross-sectional area of 6m^2 will be construction on landslide area along penstock alignment.		ESCO/Contractor	Construction Period	
1	Impacts on landscape	● Excavation of construction materials from designated sites ● Deposition of spoils at specified area ● Rehabilitation and restoration of excavated sites for material collection, laying of penstock, distribution and transmission lines immediately ● Plantation of local grasses/plants at rehabilitated sites of penstock laying and excavation sites for materials.		ESCO/Contractor	Construction period	
2	Impacts on ecological integrity	● No poaching and hunting activities will be allowed. ● Restriction on visit in forest area ● Restriction on collection forest produces from forest ● Prohibition of use of fire in forest area ● Biodiversity conservation awareness raising activities to workers as well locals				
3	Impacts on Scenic	● Rehabilitation and restoration of				

SN	Environment & Social Impact	Mitigation Measures	Mitigation [11]Cost(NPR)	Responsibility	Timeline	Remarks
	beauty	excavated sites for material collection, laying of penstock, distribution and transmission lines immediately ● Plantation of local grasses/plants at rehabilitated sites of penstock laying and excavation sites for materials.				
4	Impacts on Social and Cultural Integrity	● Preparation and implementation of code of conduct for subproject staffs/workers ● Orientation on norms and values of subproject affected communities ● Organization of regular ethical behavioral programs to outside workers before work session to respect local people, their culture and traditions ● Prohibition of Gambling and alcohol drinking within the camp and working sites.				

CHAPTER 7: STAKEHOLDER ENGAGEMENT AND GRM

7.1 Stakeholder Engagement

Stakeholder engagement is an essential process, conducted throughout the subproject life cycle. It is required to do in all different phases of subproject intervention (from design through to implementation) in a time frame. It enables meaningful consultations with stakeholders to express their views on subproject risks, impacts, and mitigation measures. In most of cases, there are three major types of stakeholders – affected parties, other interested parties and disadvantages/vulnerable individuals or groups.

7.1.1 Mapping of Stakeholders

The potential stakeholders of the AMHSP have been identified by the stakeholder mapping. In additional to subproject-affected parties, key identified stakeholders include: local governments, civil society, teachers, political leaders, women groups, local user groups (forest, water etc.), security personnel (army), travel agency, and travelers.

7.1.2 Affected Parties

Indigenous Peoples (IPs) and their organizations and Networks, Other different Social Groups—Women Groups; Mother Groups; Youth clubs, Buffer Zone User Groups (BZUGs), Local affected communities; Ward No. 4 of KPLRM, KPLRM, SNP, NGOs/CBOs and Associations working at local levels; Local Security, Air Service Providers.

7.1.3 Other Interested Parties

General Groups include Civil society, Mother Groups, Youth clubs; Buffer Zone Users' Committee, BZUGs, NGOs/CBOs and Associations working at local levels; Trade centres; Local Security, Media, Health Institutions, *Government Line Agencies* include AEPC, Department of National Park and Wildlife (DNPWC), Ministry of Forest and Environment, and The World Bank.

7.1.4 Methods of Stakeholder Engagement and Public Consultations

Household survey, Focus Group Discussions (FGD), Key Informants Interviews (KII), mixed group discussions and Public Hearing were employed tools for consultations with different stakeholders. The stakeholder consultation, carried out during ESIA preparation, covers the issues of indirectly affected groups including local government line agencies.

Consultation and discussions with locals were made at various times from beginning of the project. During Detail Feasibility Study and Detail Engineering Design, an interaction program was organized at Pangboche on 8 March 2020 (2076/11/25 BS). A total of 61 people participated in the interaction program (**Annex XIV**). Similarly, community consultations were done at two places—Phortse and Upper Pangboche— on 13 and 14 Nov. 2021 respectively. The consultation meetings were basically focused to identify the key issues in perspectives of local people towards the proposed subproject. Both consultation meetings were conducted in presence of Chief Warden of SNP, Mr. Bhumi Raj Upadhyaya. Altogether 20 people participated in consultation meeting at Phortse while 34 were in Upper Pangboche. Meeting minutes are attached in **Annex XIV.** Summary of meeting minutes has already presented in **Table 3, Section 1.3.7.**

7.1.5 Involvement in Subproject Monitoring

The social and environmental safeguard implementation will be monitored regularly in implementation phase. The team comprises of the representatives of stakeholders and ESCO will monitor the subproject site in the initial, construction, post construction and operational phase of subproject to ensure that all environmental and social issues related to each subprojects are well addressed and comply with the requirements mentioned in ESIA. Quarterly progress reports will be prepared and submitted them to the AEPC.

7.2 Grievance Redress Mechanism

The subproject GRM addresses overall subproject-related grievances. The construction-related issues, impacts related to land acquisition and compensation, relocation and rehabilitation of public utilities, impact on private and public structures, impacts on forest and natural resources, issues of landslide, draining management, and community-related grievances etc. will be covered by the subproject-level GRM. Local Consultative Forum (LCF) has been envisioned as a single door system to put the grievances by locals. Local Consultative Forum (LCF) may have representatives of elected persons from RM, members of PAFs, government officials of RM, representative of SNP, representative of ESCO and representative of local people from PA. LCF can directly communicate with Grievances Redress Unit (GRU), established under the Subproject Organizational setup. This GRU office will be under direct supervision of Director of AMHSP. It has been proposed that it will have four sections namely Land Acquisition and Rehabilitation Section (LARS), Project Information Center (PIC), Mitigation Implementation Section (MIS) and Workers' Grievance Unit (WGU). All four sections have unique responsibility regarding the implementation of different action. LARS will be responsible for the implementation of land acquisition and rehabilitation program whereas public disclosure work will be conducted through PIC. The MIS will implement mitigation measures proposed in ESIA report especially the program proposed in biological and socioeconomic environment. The MIS will coordinate with line agencies. The WGU will deal with worker-related grievances such as accommodation (health and sanitation), availability of safety gazettes, and equal wages to male and female for works of similar nature, delay in payments, hiring of labours without contract document and GBV and other related issues.

Local households and stakeholders will be informed about the setting up of the RRM by ESCO or representative of ESCO (RoE) of information officer of subproject. The information board will be in place at construction site with specific information related to the construction works and will provide in local language the description of subproject and grievance mechanism, where and to whom stakeholders can deliver their complaints, and in what form: verbal or written. A social mobilizer will be deployed and mobilized in order to help grievant to file the complaints to the concerned agency. Grievant will be exempted from all administrative fees incurred, pursuant to the grievance redressed procedures except for cases filed in court Proposed mechanism for grievance resolution is given below:

First Level of GRM: Initially, grievances will be resolved by providing correct and complete information early in the subproject development process. The LCF formed in subproject area and GRU will be responsible to listen and provide information to APs and resolve their issues. The ESCO may take the assistance of the subproject safeguards specialists to help resolve the issue. The GRU will keep records the grievances as in the given formats as : (i) the name of person (s), (ii) date of the received complaint, (iii) nature of the complaint, (iv) location, and (v) how the complaint was resolved (if resolved). GRU They will try to resolve

the received grievances within10 days. If it is not resolved at the local level, they will forward it to the Project Safeguard Unit.

Second Level of GRM: If the grievance remains unresolved, the LCF and GRU forwards the complaint to the Project Safeguard Unit (E&S team of AEPC). The person (filing the grievance) will be notified by the LCF and GRU that his/her grievance has been forwarded to the Project Safeguard Unit. The EA will answer queries and find resolution for grievances regarding various issues including social, or livelihood impacts and environmental impacts. The subproject safeguard specialist will undertake the corrective measure/s in the field within 7 days of the decision.

Third Level of GRM: If the grievance remains unresolved, it will be referred to Grievance Redress Committee (GRC). The GRC will be headed by the PM, with other members made up of the chairperson of the subproject rural municipality, Ward Secretary, representative of APs and Chairperson of LCF. The AP will be given the opportunity to present his/her concern and GRC will suggest corrective measures within 10 days. The subproject safeguard specialist will work as secretary of the GRC and will be responsible for processing and placing all papers before the GRC, recording decisions, issuing minutes of the meetings, and taking follow-up action to see that formal orders are issued and the decisions are carried out.

Fourth level of GRM: If all of the above resolution methods fail, a legal redress mechanism can be adapted through Nepal's judicial or appropriate administrative system

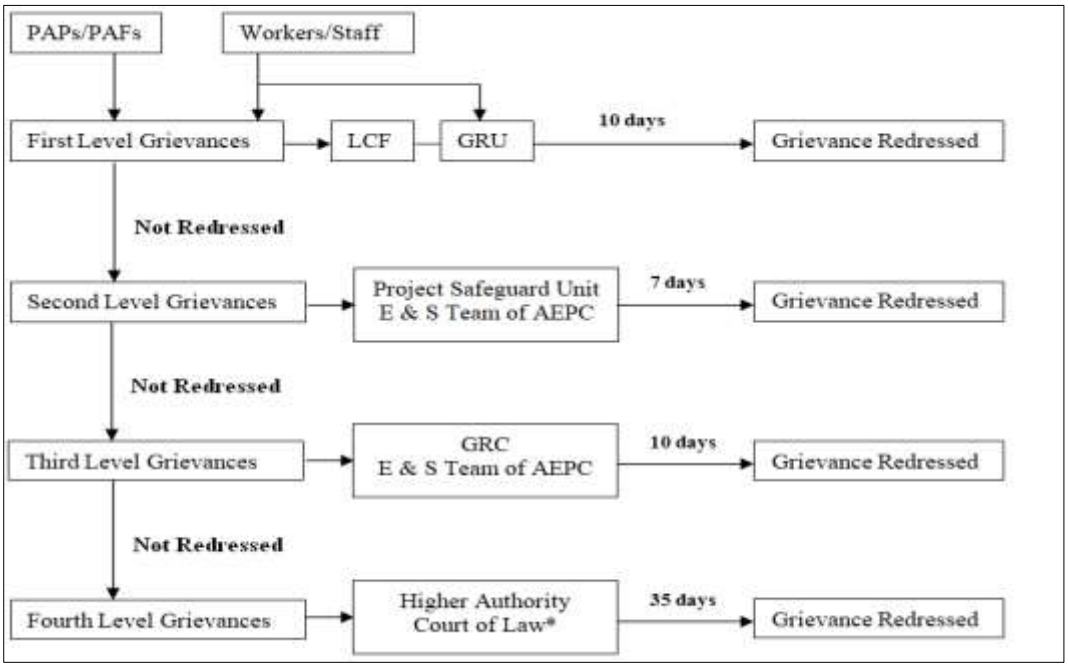

Figure 15: GRM Structure at Subproject Cycle

[SPAPs=Subproject Affected Person, SPAFs=Subproject Affected Families, LCF=Local Consultative Forum, GRU=Grievance Redressed Unit, E &S =Environment and Social, AEPC=Alternative Energy Promotion Center. *Aggrieved person may also access the country's legal system at any stage (of the four stages) of the grievance redress mechanism.]

** Need to have a sub-head here highlighting about the grievance related to GBV

CHAPTER 8: INSTITUTIONAL ARRANGEMENT

Institutional arrangements are intended to make sure that the National laws are not violated during the pre-construction, construction and operational stages of the subproject. This chapter will provide an E&S institutional arrangement within the institutional structure of the ESCO of the subproject. The E&S institutional arrangement has clearly spelled out the roles and responsibilities of each position for the implementation of the identified mitigation measures.

8.1 Institutions and Their Roles

8.1.1 Ministry of Forest and Environment

Ministry of Forest and Environment (MoFE) is the concerned ministry for preparation and implementation of environment related policy, plan, rule s and regulations in the country. It the concerned authority to approve the Scoping Document, Terms of Reference and EIA report of the subproject. It is also a concerned Ministry for providing approval letter EIA study within National Partk through Department of National Park and Wildlife.

8.1.2 Ministry of Energy, Water Resources and Irrigation

Ministry of Energy, Water Resources and Irrigation (MoEWRI) is the line ministry and will provide oversight to AEPC. It has mandates to formulate and implement environmental policies, plans and programs at national level although it has no direct responsibility in the subproject. It has the role of facilitation as and when needed on environmental and social safeguard.

8.1.3 UNESCO, World Heritage Center

UNESCO, World Heritage Center has the overall monitoring of the heritage sites worldwide and plays a role of watch dog. It evaluates risks and threats (both natural and manmade) on the sites and suggests for appropriate actions to tackle the problems. Without permission of the institution, any kind of development activities cannot be implemented in world heritage sites. As the SNP is also the World Heritage Site under criteria (vii) from 1979. Thus the subproject can be implemented only after the permission of UNESCO.

8.1.4 The World Bank

The World Bank will support AEPC to ensure effective implementation of E&S risk management measures for the subproject. It will review E&S instruments and provide clearance. It also supports AEPC in E&S capacity enhancement.

8.1.5 Project Management Team at AEPC

Project Management Team (PMT) at AEPC has overall responsibility from selection of subprojects to implementation fulfilling the requirements (Technical, Environmental and Social) of GoN and World Bank. It supports for studies to conduct Detail Feasibility Study and E&S studies as per the Project Operational Manual (POM) of MGEAP.

8.1.6 Department of National Park and Wildlife Conservation

Department of National Parks and Wildlife Conservation (DNPWC), established in 1980 AD, is the institution for overall conservation and management of wildlife and biodiversity of the country. It works under the MoFE and governs all the conservation and management activities in protected areas of Nepal through field-based offices.

8.1.7 Sagarmatha National Park (SNP)

The SNP is responsible for following activities:

- All activities will be cleared with them in advance,
- Permits will be obtained for all workers entering the park,
- Park authorities will be encouraged and supported to inspect project activities on a regular basis.

8.1.8 Khumbu Pasanglhamu Rural Municipality (KPLRM)

The KPLRM RM is the concerned authority to provide generation license. It has right for monitoring activities of subproject.

8.1.9 Partner Banks

Partner Banks (PBs) will take active part in the E&S screening, assessment, and monitoring cycle in order to better understand their risks. PBs will be specifically responsible for providing matching loan to ESCO as per an agreement between ESCO and PB.

8.1.10 Energy Service Company (ESCO)

The ESCO will be responsible for the preparation of DFS/DED, andESIA as required by and the WB and Environmental Impact Assessment (EIA) as required by GoN. ESCOs may hire consulting firms to conduct ESIA. However, it will be sole responsibility of ESCOs to implement ESMP effectively. The ESCOs will prepare monthly progress reports and submit it to the AEPC/MGEAP. The AEPC/MGEAP will prepare quadrimester monitoring reports and submit to the WB and these reports will be made available to all relevent stakeholders from the information center established in subproject area. AEPC/MGEAP and the World Bank may assign Verification Specialists or Officials or Consultants to inspect and verify the subprojects on need basis.

8.1.11 Grievances Redress Committee (GRC)

There will be two GRC – one is formed at project level and another one will be formed at subproject level (field level) for the management of the any grievances related to the subproject. The GRC, headed by the Subproject Manager will be responsible to resolve the grievances if other mechanism to handle the grievances fails to address or resolve the grievances/ complaints lodged related to the subproject development activities.

8.1.12 Buffer Zone Management Committee

Buffer Zone Management Committee (BZMC) is the apex body to manage the buffer zone management activities of SNP. It can play an important role in effective implementation and monitoring of proposed subproject.

8.1.13 Buffer Zone User Committee (BZUC)

Under BZMC of SNP, there are three Buffer Zone User Committees (BZUCs). The subproject lies under Khumbi Hulya BZUC. It can also an important role in effective implementation and monitoring of proposed subproject.

8.1.14 Buffer Zone Use Groups

Under Khumbi Hulya BZUC, there are 9 Buffer Zone User Groups (BZUGs). Out of 9, 6 BZUGs lies in PA and they can coordinate for effective implementation and monitoring of proposed subproject.

8.1.15 Grievances Redress Unit

GRU established at field level, has the responsibilities to resolve the local grievances and also of workers at field level within 10 days of grievance logged.

8.1.16 Construction Contractor

Construction here refers to civil construction works including minor civil works related to hydromechanical installation works, electromechanical installation works and transmission/distribution works. Construction will be carried out by the contractor as specified in the contract agreement. The construction contractor will be responsible for implementation of mitigation measures specified in the ESIA and contract and compliance with the tender clauses. The contractor will be responsible for the implementation of spoil disposal, waste management, occupational safety, structural bioengineering measures, air, noise and water quality protection measures, etc.

8.1.17 Construction Management/Supervision Consultant

The coordination of the compliance monitoring and mitigation program allocated under the contractor will be the responsibility of Consultant. Environment Monitoring Unit of the subproject will work for the monitoring of compliance issues and report to the Subproject Manager. The Consultant will also be responsible for the supervision and quality control of the works conducted by Contractor.

8.1.18 Local Consultative Forum

It is the forum formed at local level as a platform for locals to keep their concerns, suggestions and grievances, and coordinates to addresses these issues. It will forward the concerns, suggestions and grievances to GRU.

8.2 Implementation Arrangement of ESMP

Table 42 defines the roles and responsibilities of different administrative structure during the subproject cycle i.e., pre-construction, construction and operation phases.

Table 42: Roles and Responsibilities of Various Institutions for ESMP Implementation

SN	*Institutions*	*Roles and Responsibilities*
1	Ministry of Forest and Environment	Leading roles on formulation, implementation and monitoring of national law on environment; approval agency for EIA; authorized agency for environmental auditing.
2	Ministry of Energy, Water Resources and Irrigation	Being line Ministry, has mandates to formulate and environmental policy, plans and programs but no direct responsibility in the subproject.
3	UNESCO, World Heritage Center	Monitoring activities of the world heritage sites worldwide and playing a role of watch dog; Evaluation of risks and threats (both natural and man made) on the sites and suggestion for appropriate actions to tackle the problems; authorized agency to provide permission for the implementation of proposed subproject.
4	The World Bank	Partner of the subproject and has supportive roles to ensure effective implementation of overall subproject Ensure effectiveness of E&S risk management measures for the subproject, review E&S instruments and provide clearance Support AEPC in E&S capacity enhancement.
5	Project Management Office at AEPC	Overall responsibility from selection to implementation of subproject.

SN	***Institutions***	***Roles and Responsibilities***
6	DNPWC	Coordinates overall management of SNP from central level; provides required suggestion for the subproject implementation.
7	Sagarmatha National Park	• Implementation and monitoring of the proposed subproject. • All activities will be cleared with them in advance, • Permits will be obtained for all workers entering the park, • Park authorities will be encouraged and supported to inspect project activities on a regular basis.
8	Khumbu Pasang Lhamu Rural Municipality	Concerned authority to provide generation license and approval agency for Brief Environmental Study Report as per prevailing law of Nepal with monitoring responsibilities of subproject.
9	Partner Bank	Has roles in the E&S screening, assessment, and monitoring cycle in order to better understand their risks, and specifically responsible for providing matching loan to ESCO as per subproject policy.
10	ESCO (Amadablam Khola Mini Hydro Pvt. Ltd.)	responsible for the preparation of DFS including DED and ESIA according to WB requirements Preparation of EIA and get approval from the MoFE Monitoring of the subproject Preparation of monitoring and progress report and submit it to the AEPC.
11	GRC	responsible to resolve the grievances at third level came through field level to Subproject Safeguard Unit, E &S Team of AEPC
12	BZMC	can play an important role in effective implementation and monitoring of proposed subproject
13	BZUC	an important role in effective implementation and monitoring of proposed subproject
14	BZUGs	can coordinate for effective implementation and monitoring of proposed subproject
15	GRU	the responsibilities to resolve the local grievances and also of workers at field level
16	Construction Contractors	responsible for implementation of mitigation measures specified in the ESIA and the contract and compliance with the tender clauses
17	Construction Management/Supervision Consultant	coordination of the compliance monitoring and mitigation program
18	LCF	a platform for locals to keep their concerns, suggestions and grievances, and coordinates to addresses these issues

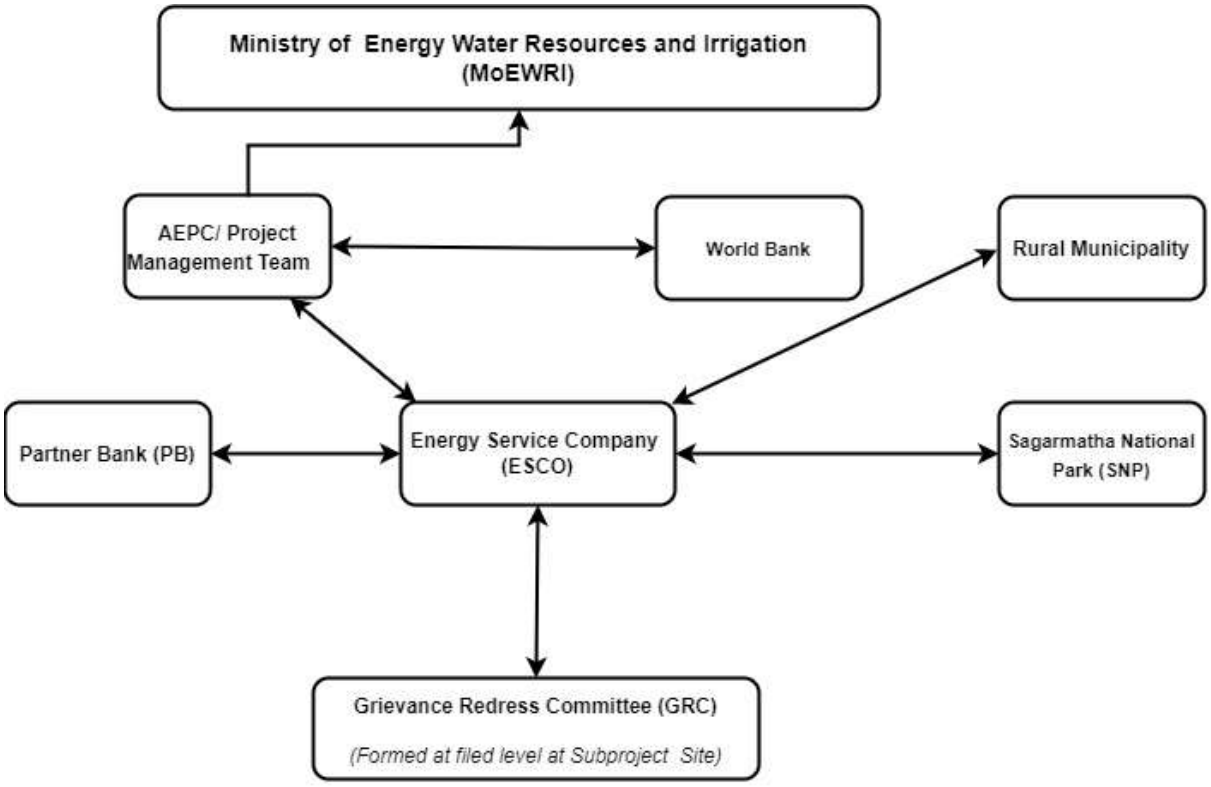

Figure 16: Organogram of the Subproject

8.3 Reporting

The ESCO will prepare monthly progress reports and submit them to the AEPC/MGEAP. The AEPC/MGEAP will prepare quadrimester monitoring reports and submit to the WB and these reports will be made available to all the stakeholders from the information center established in subproject area. AEPC/MGEAP and the World Bank may assign Verification Specialists or Officials or Consultants to inspect and verify the subprojects on need basis.

CHAPTER 9: MONITORING AND REPORTING PLAN

9.1 Environmental Monitoring Plan

This chapter will discuss the monitoring and reporting mechanism. The National EIA Guidelines of 1993 propose three types of monitoring. They are baseline monitoring, compliance monitoring and impact monitoring; the plans for which are presented in this chapter.

9.1.1 Baseline Monitoring

Baseline monitoring is required to compile and maintain the database on environmental conditions prior to the implementation of the subproject. The primary concern during this phase will be to implement field data collection programs to obtain the baseline conditions, such as scientific and sociological information needed to finalize the design and cost of the mitigation measures. This is especially important if the subproject is delayed due to unforeseen circumstances. For AMHP, if the subproject comes under construction within 2 years from the data collection for this ESIA study, the baseline data and information presented in this ESIA report will serve as baseline and hence baseline monitoring will not be required. However, under any unforeseen circumstances, if the proposed AMHP gets delayed for more than two years (from the data collection for the present ESIA), the subproject requires to carry out a baseline monitoring prior subproject construction. A plan for the baseline monitoring for the proposed AMHP is presented in **Table 43.**

Table 43: Plan for Baseline Monitoring

SN	Parameter	Indicators	Method	Location	Time	Cost (NPR)	Responsibility
A. Physical and Chemical Environment							
1	Topography	Degrees of slopes	Site observation	Construction area	Before Construction	150,000.00	ESCO
2	Land use	Area of land under different land use such as forest, cultivated lands etc.	Site observation, GIS Mapping	subproject Area	Before Construction		
3	Hydrology	Discharge and flood level	Direct discharge measurements, gauge readings	Cholunche Khola	Before Construction		
4	Geology	Stability of slopes, Occurrence of land slides	Field observation	Subproject Area	Before Construction		
5	Water Quality	Temperature, pH, Turbidity, Electrical conductivity, TSS, TDS, Iron, Sulphate, BOD, COD, DO, Alkalinity, Total Hardness, Total Coliform	Field measurements, Water sampling and lab testing	Cholunche Khola	Before Construction		
6	Noise	Loudness and intensity of noise	Field measurement using a dB meter	Headworks and Powerhouse	Before Construction		
7	Solid waste	Quantity and composition of waste	Observation and questionnaire survey	Subproject Area	Before Construction		
B. Biological Environment							
8	Forest and vegetation	Vegetation composition, fuelwood NTFPs, forest use, Energy use	Observation, GIS mapping, measurements (Quadrate sampling for grass), household surveys, FGD	Subproject Area	Before Construction	250,000.00	ESCO

SN	Parameter	Indicators	Method	Location	Time	Cost (NPR)	Responsibility
9	Wildlife (including mammals, avian fauna and herpetofauna)	Wildlife habitat, wildlife species, hunting and poaching activities, crop and animal depredation, human wildlife conflicts	Observation, Transect survey, Questionnaire surveys, FGD, KII	Subproject Area	Before Construction	250,000.00	ESCO
C. Socioeconomic and Cultural Environment							
10	Demographic characteristics	Household numbers, population, ethnicity, religion, language spoken, migration, education and literacy, occupation and skills	Secondary sources, Household survey, FGD	Subproject Area	Before Construction	300,000.00	ESCO
11	Agriculture and livestock	Land ownership, land holding, cultivated area, cropping practices, crop production, crop yield, agro-biodiversity Livestock ownership and holding, livestock products Crop and livestock product market	Secondary sources, Household survey, FGD	Subproject area	Before Construction		
12	Economy	Occupation and skills, markets, annual income and expenditures, food sufficiency	Household survey, FGD	Subproject area	Before Construction		
13	Sanitation and health	Drinking water source, treatment practices, toilet availability and types, cooking practices, waste	Secondary sources, Household survey, FGD	Subproject Area	Before Construction		

SN	Parameter	Indicators	Method	Location	Time	Cost (NPR)	Responsibility
		management practices Diseases, treatment practices, disability, natality and mortality					
14	Culture	Religious shrines, festivals	Discussions with the local people, Rural Municipality wards and observation, Questionnaire surveys	Subproject area	Before Construction		
15	History and archaeology	Sites of archaeological and historic significance	Secondary Sources, FGD	Subproject area	Before Construction		
16	Gender	Property ownership in women, participation of women in community groups, decision making by women	Household survey, FGD	Subproject area	Before Construction		
17	Infrastructures	Bridge, School, health facilities, drinking water system, community building, watermills, and shrines, Cremation sites etc.	Secondary Sources, FGD, Rural Municipality surveys	Subproject area	Before Construction		

9.1.2 Compliance Monitoring

Compliance Monitoring employs a continuous recording of specific environmental quality indicators in order to ensure subproject compliance with recommended environmental protection standards. The main objective of the compliance monitoring is to ensure that all conditions set forth and commitments made in the approved ESIA report and other applicable regulatory requirements and standards, the subproject documents including subproject contracts and specifications etc. An early compliance assessment is also required to check if the environmental mitigation activities prescribed in the approved ESIA report are well integrated in subsequent subproject documents such as detailed engineering design and tender documents.

Table 44 gives the compliance monitoring plan, which includes compliance parameters, indicators for measuring compliance, methods to be followed and guiding document to be referred, responsible parties for compliance monitoring and the schedule for compliance check.

Table 44: Plan for Compliance Monitoring

S.N.	Parameter	Indicators	Method/ Guiding Document	Location	Time	Cost (NPR)	Responsibility
1	ESIA mitigations	Incorporation of ESIA mitigation measures recommendations into contractual documents	Review of detailed design, subproject specification and tender documents/ Approved ESIA	Office	Following completion of tender documents	10,000.00	Consulting engineers/ ESCO/AEPC
2	Environmental Considerations	The presence of each of the environmental considerations from the tender documents in the work plan	Review of proposed work plans/ Approved ESIA	Office/Subproject Area	During contract negotiations	10,000.00	Consulting engineers/ ESCO/AEPC
3	Contractor's compliance in carrying out environmental mitigation activities prescribed in ESIA, subproject contract documents and subproject specification documents	Forest clearance, Excavation of lands for subproject construction, spoils management, work area, application of slope stability measures, air quality protection, water quality protection, noise minimization, solid waste management, over extraction of aggregates, felling of trees, intrusion in the surrounding forest, pre-employment screening of subproject workers, safety equipment for workers and safety assurance practices in area, public safety assurance practices, subproject camp management (drinking water, toilets, cooking fuel), control of social disorder (alcoholism, gambling, prostitution)	Site observation and discussion with subproject management, subproject staffs and local people using a checklist/ Approved ESIA, Subproject Contract and Specification document, Regulatory documents of GON	Subproject Area	Continuous during the construction period	900,000.00	Consulting engineers/ ESCO/AEPC/RM
4	Contractor's compliance to GON's amd	Water quality, air quality, noise, forest clearance, employment, occupational health and safety	Review of the regulatory documents, enlisting of the relevant clauses, site	Subproject Area	Continuous during the construction		Consulting engineers/ ESCO/AEPC/RM

S.N.	Parameter	Indicators	Method/ Guiding Document	Location	Time	Cost (NPR)	Responsibility
	WB's regulatory requirements (Acts, Regulations, Guidelines, Standards)		inspection and observation/All the documents mentioned in Chapter 3.		period		
5	Subproject ESCO's compliance in carrying out activities prescribed in environmental mitigation and environmental enhancement activities	Compensation, soil erosion and landslide control, compensatory plantation, staff employment, implementation of trainings, income generating programmes, awareness programs, support to social institutions and all others mentioned in Chapter 6 of this ESIA report	Review of subproject correspondence letters, evidence documents, observations, interviews with the concerned subproject authority, interviews with the subproject affected households/ Approved ESIA	Subproject Area	Continuous during the construction period	400,000.00	AEPC/RM
6	Subproject ESCO's compliance GON's regulatory requirements	Land acquisition and compensation, subproject staff employment, environmental protection	Review of the regulatory documents, enlisting of the relevant clauses, site inspection and observation/ All the regulatory documents mentioned in point 4 above (of this table) including Land Acquisition Act (1977)		Continuous during the construction period		AEPC/RM

9.1.3 Impact Monitoring

Impact monitoring measures the physical, chemical, biological, socio-economic and cultural parameters within the subproject area during the construction and operation phases in order to detect environmental changes that occur as a result of subproject implementation. It involves actual measurement of the impacts of construction activities on the environment, such as water quality samples being taken at regular intervals to assess pollution concentrations in the river from construction work camps, after mitigation steps are taken.

Table 45: Plan for Impact Monitoring

S. N.	Parameter	Indicators	Methods	Location	Schedule (Time)	Cost (NPR)	Responsibility
A. Physical/Chemical Environment							
1	Land use	Change in area under different land use	Observation, GIS Mapping	Subproject Area	One time after completion of subproject construction	100,000.00	ESCO/AEPC/RM
2	Soil Erosion and land stability	Development of rill and gullies, occurrence of landslides, drainage failures, river bank cutting	Observation	Construction area, spoil disposal areas, River bank	Continuous throughout subproject construction		ESCO/AEPC/RM
3	Water Quality	Temperature, pH, Turbidity, TDS, TSS, Conductivity, alkalinity, hardness, iron, BOD, COD, SO_4, DO, Total Coliform	Water sampling and laboratory test	Cholunche Khola downstream of weir and drinking water of subproject camp	Twice a year during construction phase in dry and wet season; two-time monitoring of subproject permanent camp drinking water and Headwork area		ESCO/AEPC/RM
4	Noise	Noise intensity level	Measurement of noise using dB meter	Major construction areas, settlements	During peak construction period		ESCO/AEPC/RM
5	Solid waste	Proliferation of waste	Observation	Subproject area	Continuous throughout subproject construction and one year of subproject operation		ESCO/AEPC/RM
6	E-flow	Minimum volumes of water flow release from the reservoir	Salt dilution method	Reservoir, Downstream	Monthly during operation phase	-	ESCO
B. Biological Environment							
7	Grassland	Change in grassland area	Observation, GIS mapping	Headworks, Penstock Pipe	One time monitoring after completion of	50,000.00	ESCO/AEPC/BZMC/BZUG/SNP

S. N.	Parameter	Indicators	Methods	Location	Schedule (Time)	Cost (NPR)	Responsibility
				alignment, forests in the subproject area	subproject construction		
8	Protected species	No of protected species cleared	Records of clearance of species	Headworks, Penstock Pipe alignment	During clearance in each area		
9	Wildlife	Poaching events, crop depredation frequency	Interviews with local people	Subproject area	Continuous throughout subproject construction		ESCO/AEPC/BZMC/BZUG/SNP
10	Critical Natural Habitat Species	No of critical endangered species spotted in the subproject area Human wildlife conflict	Consultation with local communities to know if the species are still present or if there has been any change as a result of the subproject.	Subproject area	During construction		ESCO/AEPC/RM/ Contractor
C. Socioeconomic and Cultural Environment							
11	Affected households	Livelihood conditions of the affected households by land and property acquisition	Household survey using structured questionnaires	Affected households	End of every year during construction period; at the end of the first year of operation	300,000.00	ESCO/AEPC/BZMC/BZUG/SNP/RM
12	Affected community	Quality of community life in subproject area	Observation, Interviews, FGD	Affected Rural Municipality	End of every year during construction period; at the end of the first year of operation		ESCO/AEPC/BZMC/BZUG/SNP/RM
13	Employment	No of local as well as migrant employees working for the Contractor and the ESCO	Records of employees	Subproject Work	Every month during construction phase; one time monitoring in the beginning of operation		ESCO/AEPC/RM
14	Community	Pressures in existing	Records of particular	Service institutions	Every four months		ESCO/AEPC/RM

S. N.	Parameter	Indicators	Methods	Location	Schedule (Time)	Cost (NPR)	Responsibility
	services	service institutions and facilities such as schools, health posts, drinking water etc.	service institution such as health posts and school, interviews with schools, teachers, health personnel, water user groups	in the subproject area	during construction, one-time monitoring at the end of first year of operation		
15	Community health and safety	Incidence of communicable diseases, STDs, accidents	Interviews, structured questionnaire surveys, reports from health institutions	Subproject area	Every three months during construction, one time monitoring at the end of first year of operation	300,000.00	ESCO/AEPC/Contractor
16	Occupational health and safety	Injuries, deaths, accidents of construction workforce	Subproject reports, interviews with construction workers	Construction areas	Every month during construction, one time monitoring at the end of first year of operation		ESCO/AEPC/Contractor
17	Conflicts	Conflicts between locals and outside workforce	Interviews, record keeping	Subproject area	Every months during construction		ESCO/AEPC/RM
18	Law and order	Events of burglary, fights	Interviews, record keeping	Subproject area	Every month during construction		ESCO/AEPC/RM/Police Post
19	Environmental Enhancement Programs	People perception of environmental enhancement programs	Discussions with the beneficiary of enhancement programs	Subproject area	Every six-month during subproject construction, one time at the end of first year of operation		ESCO/AEPC/RM

9.2 Reporting

The monthly reporting will be undertaken by ESCO and share with the AEPC. AEPC will be preparing Quarterly Report based on monthly reports and share with the WB within two weeks from the completed quarter.

CHAPTER 10: ENVIRONMENTAL AUDIT

10.1 Introduction

An environmental auditing will compare monitoring results with information generated during the preconstruction period. Comparisons can be made with similar projects or against standard norms. It helps to evaluate the accuracy and adequacy of ESIA predictions by relating actual impacts with predicted impacts.

Impact monitoring provides raw data, which can be used to undertake an environmental audit. Such audit can be effective tools by providing control authorities with an overall picture of the main impacts of the subproject and identifying issues of concern, where actual impacts have exceeded norms. AEPC will carry out the environmental and social audit through independent consultant during implementation. It helps to examine the actual environmental impacts, accuracy of predictions, effectiveness of environmental impact mitigation and enhancement measures and functioning of monitoring mechanisms.

The environmental audit for physical, biological and socio-economic and cultural environment is described in following sub sections. The environmental audit shall include, but not be limited to, the following tasks.

10.2 Physical Environment

Following aspects shall be covered under the physical environment:

- Changes in baseline condition in the physical environment of the subproject area after the subproject construction such as topography, land use, landslide, hydrology;
- Accuracy of the predicted impacts;
- Magnitude of the predicted impacts;
- Effectiveness of the implemented mitigation measures;
- Compliance with the ESIA report;
- Compliance with environmental clauses of tender document;
- Identification of numbers and area of non-compliances; and
- Effectiveness of compliance monitoring system.

10.3 Biological Environment

Following aspects shall be covered under the biological environment:

- Changes in baseline condition in the biological environment of the subproject area after the subproject construction;
- Accuracy of the predicted impacts;
- Magnitude of the predicted impacts;
- Effectiveness of the implemented mitigation measures;
- Compliance with the ESIA report;
- Compliance with environmental clauses of tender document;
- Identification of numbers and area of non-compliances; and
- Effectiveness of compliance monitoring system

10.4 Socio-economic and Cultural Environment

Following aspects shall be covered under the socio-economic and the cultural environment:

- Changes in baseline condition in the socio-economic and cultural environment of the subproject area after the subproject construction;
- Accuracy of the predicted impacts;
- Magnitude of the predicted impacts;
- Effectiveness of the implemented mitigation measures;
- Positive and negative impacts of the subproject on local community;
- Compliance with the EIA report;
- Compliance with environmental clauses of tender document;
- Identification of number and area of non-compliances;
- Effectiveness of compliance monitoring system; and
- Impact of the subproject on the regional and national economy

10.5 Approach and Methodology

Environmental audit of the subproject will be conducted according to EPR 2020 by Ministry of Forest and Environment. The first audit will be conducted after 2 years of operation of the subproject, and will be continued as need basis.

10.6 Required Human Resources

Environmental audit requires a team of multidisciplinary experts with relevant experiences in hydropower project. Following team is proposed for environmental audit of the proposed Project.

- Team Leader/ Environmental Expert;
- Hydropower Engineer/ Civil Engineer;
- Forestry Expert/ Ecologist/Wildlife Expert;
- Socio-economic Expert; and
- Support staff

10.7 Organizational Responsibility

Ministry of Forest and Environment (MoFE) is the responsible agency for environmental audit.

CHAPTER 11: ENVIRONMENTAL AND SOCIAL SAFEGUARD PLANS

Various Environmental and Social Safeguard Plans (ESSPs) have to be developed as necessity to ensure the implementation of environmental and social protection measures and make subproject environmentally friendly and sustainable. It has included 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. Moreover, Standard Operating Procedure (SOP) has been prepared for construction and operation phase considering the current pandemic situation of COVID-19. Different legislative frameworks and directives of the GON have been taken into account while developing these plans.

Majority of the population are from indigenous Sherpa community. The implementation of the subproject provides beneficial impacts during construction and operation phase. The energy provided from the subproject can be used for various purposes such as cooking, lighting, & heating, business and enterprises and many more. In addition, local people will get 10% share of the subproject. Hence, this AMHP has beneficial impacts in the subproject area. Therefore, Vulnerability Community Development Plan (VCDP) is not required.

This chapter includes following given management plans. The required cost will be managed from ESMP cost provided in design cost, which is in line with DFS (approx. 1 % of project base cost). If ESMP cost is not enough during implementation, the extra cost will be borne by the ESCO.

11.1 Construction Site and Temporary Facilities Rehabilitation Management Plan

Goals: Reinstate the acquired land for temporary uses in natural state
Responsible institution: ESCO/Contractor

Table 46: Rehabilitation Management Plan

Activities	Schedule	Location	Responsibilities
Rehabilitate the excavated slopes and area of the construction areas using appropriate bioengineering, plantation/vegetation	Post construction	Headworks, penstock area, powerhouse, tailrace, foot trails (transmission and distribution lines)	ESCO/ Contractor
Rehabilitation the drainage networks as to the requirement	Post construction	Headworks, penstock area, powerhouse, tailrace, foot trails (transmission and distribution lines)	ESCO/ Contractor
Demolition of all unnecessary structures, their foundations, clean up and reclaim the sites to pre-construction phase	Post construction	Temporary residential camps, storage yards, mechanical yards, batching plant, aggregate crushers, etc.	ESCO/ Contractor
Rehabilitation the muck disposal site with proper drainage facility as per approved plan. Use the saved top soil	Post construction	Spoil disposal site	ESCO/ Contractor

Activities	Schedule	Location	Responsibilities
on the top of the spoil sites to develop the land in an usable land for afforestation or other purpose			
Rehabilitation of the quarry area in such that puddles and depressions are not left out	Post construction	Quarry area	ESCO/ Contractor
Rehabilitate the temporarily acquired cultivable land by tilling and spreading the top soil saved.	Post construction	Temporary camp and storage area	ESCO/ Contractor
Handover the temporary land acquired sites to the respective owners and get a certificate of handover	Post construction	Labour camps	ESCO/ Contractor

11.2 Occupational Health and Safety Plan

Goals: Maintain a safe workplace for employees
Responsible Institution: ESCO/Contractor

Table 47: OHS Plan

Activities	Timing of Action	Location	Responsibilities
Pollution Control activities	During construction	All subproject sites	ESCO/ Contractor
Preparation of occupational health and safety plan and submission to AEPC for approval	Pre-construction	All subproject sites and all workforce	ESCO/ Contractor
Provision of First aid facilities	Construction phase	All active construction sites and yards	ESCO/ Contractor
Medical checkup of the workforce before employment	Construction phase	All construction sites and workers	ESCO/ Contractor
Regular medical checkup of the construction workers every 6 months	Construction phase	All construction sites and workers	ESCO/ Contractor
Potable water supply facility	Construction	Subproject camp	ESCO/ Contractor
Establishment of construction waste collection system and management	Construction	All construction sites	ESCO/ Contractor
Provision of Personal Protective Equipment (such as boots, gloves, masks, ear plugs, helmets, safety goggles etc.) to the construction workers as appropriate to the requirement and risk of the working area and implement the use effectively	Construction	All construction sites	ESCO/ Contractor
Regular training as required to the construction workers and health and safety issues of the construction work	Before and during construction	All construction workers	ESCO/ Contractor

Activities	Timing of Action	Location	Responsibilities
Regular training to operation staff as required on occupation health and safety issues	Operation	All construction workers	ESCO/ Contractor
Insurance of workers	Pre-construction	All workers	ESCO/ Contractor

11.3 Community Health and Safety Plan

Goals: Maintain a safe place for community and other visitors/Tourist
Responsible Institution: ESCO/Contractor

Table 48: Community Health and Safety Plan

Activities	Timing of Action	Location	Responsibilities
Pollution Control Activities	During construction	All subproject sites	ESCO/ Contractor
Provision of using First aid facilities for locals and visitors/tourists	Construction phase	All active construction sites and yards	ESCO/ Contractor
Medical checkup of locals while doing same of workers	Construction phase	All construction Sites	ESCO/ Contractor
Support to Health facilities (intermittent health camps, strengthening health post nearby the subproject) to local public as per the CSP	Construction phase	Subproject Area	ESCO
Potable water supply facility for locals as per the CSP	Construction and post construction	Subproject Area	ESCO
Fencing of all construction sites and danger zones, and restriction on entry to the outsiders others than authorized person	Construction/post construction	All active construction Sites/Power house/Switchyard	ESCO/ Contractor
Appropriate danger signs in all active construction sites and operation sites as to the degree of risk in the site	Construction/post construction	All active construction Sites/Power house/Switchyard	ESCO/ Contractor
Provision of Personal Protective Equipment (such as boots, gloves, masks, ear plugs, helmets, safety goggles etc.) to the visitors as appropriate to the requirement and risk of the working area and implement the use effectively	Construction/post construction	All active construction Sites/Power house/Switchyard	ESCO/ Contractor

11.4 Emergency Response Plan

Goals: Provide emergency facility to workers
Responsible Institution: ESCO/Contractor

Table 49: Emergency Response Plan

Activities	Schedule	Location	Responsibilities
Provision of helipad for emergency evacuation of injured or other people	Preconstruction	Construction sites	ESCO/ Contractor
Provision of standby stretcher to evacuate the injured at the earliest to the nearest health post/hospital	Construction	Construction sites/Camp	ESCO/ Contractor
Provision of medical stock particularly for water borne disease to tackle the epidemic in the camp or in the villages surrounding the subproject site	Construction	Health care facility at subproject site	ESCO/ Contractor
Provision of firefighting equipment and regular firefighting training as needed	Construction/post-construction	Construction Sites/Powerhouse/Switchyard	ESCO/ Contractor
Provision of sirens to inform people of the emergencies (fire hazards, chemical hazard, accidents, earthquake etc.)	Construction/post-construction	Powerhouse, camp sites, headwork	ESCO/ Contractor
Emergency preparedness training (GLOF, floods, release of water from weir, epidemic outbreak, earthquake etc.) at least every year	Construction/post-construction	All subproject site/ powerhouse	Operation Manager

11.5 Benefit Sharing Plan

Goals: Provide benefits to local community
Responsible Institution: ESCO

Table 50: Benefit Sharing Plan

Activities	Schedule	Location	Responsibilities
Opportunity for employment	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Environmental Enhancement Activities (Awareness on biodiversity conservation, plantation, water source conservation etc.)	Construction/Post-construction	Subproject Area	ESCO/ Contractor

Community Development and Local Infrastructure (improvement of foot trails, education institutions, health facilities, support local youth clubs, women groups and so on)	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Trainings (Agriculture, Tourism, Electrical Appliances and other skilled work trainings)	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Preferential Electricity rates (Negotiation with local community and agreement on tariff)	Pre-construction	Subproject Area	ESCO
Equity Investment	Pre-construction/ Construction/Post-construction	Subproject Area	ESCO
Community Development Fund	Post Construction	Subproject Area	ESCO

11.6 Labour Management Plan

Table 51: Labour Management Plan

Activities	Schedule	Location	Responsibilities
Equal Opportunity and Non-discrimination	Construction/Post-construction	Construction Area/Camp	ESCO/ Contractor
Timely payment	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Working hours and overtime (40 hour working time in a week)	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Prevents use of all forms of forced labour and child labour	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Provision of Occupation and Health Safety Measures	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Access to grievance redress mechanism	Construction/Post-construction	Subproject Area	ESCO/ Contractor
No Gender based violence at work place	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Access on health facility	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Provision of Insurance	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Provision of health and Sanitation Facility	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Provision of Workers' Right as per laws in Nepal	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Proper and adequate space for workers in camp	Construction	Subproject Area	ESCO/ Contractor
Separate room for male and female workers	Construction	Subproject Area	ESCO/ Contractor
Separate toilet for male and female workers with adequate supply of water and toiletries	Construction	Subproject Area	ESCO/ Contractor

Table 52: Waste Management Plan

Activities	Schedule	Location	Responsibilities
Waste segregation for organic and inorganic waste	Construction/Post-construction	Construction Area/Camp site	ESCO/ Contractor
Composting of organic waste	Construction/Post-construction	Construction Area/Camp site	ESCO/ Contractor
Management of waste at construction site by following 3 R (Reduce, Reuse and Recycle) principle	Construction/Post-construction	Construction Area/Camp site	ESCO/ Contractor
Construction of septic tank for waste water management	Construction/Post-construction	Construction Area/Camp site	ESCO/ Contractor

11.7 Transport Management Plan

Table 53: Transport Management Plan

Activities	Timing of actions	Location	Responsibilities
Pre-information to the local people and concerned stakeholders on the start date of subproject preparation works and the range of activities to be undertaken	Pre-construction	Subproject Area	ESCO/ Contractor
Preparation of a Guideline for use of helicopter and mules for material transportation	Pre-construction	Subproject Area	ESCO/ Contractor
Preparation of sites for material storage and staying facilities for helicopter and mules	Construction	Subproject Area	ESCO/ Contractor
Installation of information board regarding on-going activities	Construction	Subproject Area	ESCO/ Contractor
Monitoring of related activities	pre-construction and construction		ESCO/ Contractor

11.8 Gender Equality and Social Inclusion (GESI) Plan

Table 54: GESI Plan

Activities	Schedule	Location	Responsibilities
Equal Opportunity to all, and No-discrimination based on caste, ethnicity, religion and gender on employment opportunity	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Timely payment for all and No-discrimination based on caste, ethnicity, religion and gender on payment	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Working hours and overtime (40 hour working time in a week) and No-discrimination based on caste, ethnicity, religion and gender on working hour	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Provision of Occupation and Health Safety Measures for all, and No-discrimination based on caste, ethnicity,	Construction/Post-construction	Subproject Area	ESCO/ Contractor

religion and gender on this provision			
Access to grievance redress mechanism to all workers, and No-discrimination based on caste, ethnicity, religion and gender on this provision	Construction/Post-construction	Subproject Area	ESCO/ Contractor
No Gender based violence at work place	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Orientation to subproject staff and labour on SEA/SH. Procedure/mechanism to register complaints of SEAH will be developed and implemented. Code of conduct related to SEA/SH will be implemented.	Construction/Post-construction	Subproject Area	AEPC/MGEAP & ESCO
Access on health facility to all, and and No-discrimination based on caste, ethnicity, religion and gender on the access on health facility	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Provision of Insurance to all workers, and and No-discrimination based on caste, ethnicity, religion and gender on the provision.	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Provision of health and Sanitation Facility for all, and and No-discrimination based on caste, ethnicity, religion and gender on the provision	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Provision of Workers' Right as per law to all and and No-discrimination based on caste, ethnicity, religion and gender on the provision	Construction/Post-construction	Subproject Area	ESCO/ Contractor

11.9 COVID-19 Pandemic Management Plan and SoPs

Table 55: COVID-19 Pandemic Management Plan and SOPs

Activities	Schedule	Location	Responsibilities
Appointment or designation of a contact person to deal with COVID-19	Construction	Subproject Area	ESCO/Contractor
Avoiding entry of new workers from known hotspots of COVID 19.	Construction	Subproject Area	Contractor
Display poster on the symptoms of COVID-19 in the workplace	Construction	Subproject Area	ESCO/Contractor
Instruction to workers for isolation if symptoms are seen and provision of test for COVID-19	Construction	Subproject Area	Contractor
Provision of posters showing safety measures for COVID-19	Construction	Subproject Area	ESCO/Contractor
Provision of working condition with social distancing	Construction	Subproject Area	Contractor
Provision of hand sanitizer stations at entry and exit points and around the workplace.	Construction	Subproject Area	Contractor
Provision of masks and sanitzers at	Construction	Subproject Area	Contractor

work place and camp			
Provision of Daily thermal screening and symptom checking of workers	Construction	Subproject Area	Contractor
Provision of restriction of Worker movement to settlements and vice versa	Construction	Subproject Area	Contractor
Provision of health facility for COVID-19	Construction	Subproject Area	ESCO/Contractor

11.10 Stakeholder Engagement Plan

Table 56: Stakeholder Engagement Plan

Stage	Target stakeholders	Topic of Engagement	Methods	Location/ Frequency	Responsibilities
Stage 1: Project Preparation (Project Design, Scoping, ESIA Disclosure	Project Affected People/ Beneficiaries	Scope of subproject, Requirement of official documents, management of existing micro hydro, Electricity Tariff, ESIA preparation and disclosure, E & S principles, Grievance mechanism process	Face to Face meeting, FGD, Public Meeting, Public Notice, Public Consultation, Public Hearing, Mass/social media communication (as needed), Written Notice Affixation	Project Implementation Area; Continuous communication throughout DES/DED/ ESIA preparation	ESCO/ Consultant
	Other interested Parties	Scope of subproject, ESIA preparation and disclosure, E &S principles, Grievance mechanism process	Public Notice, Public Consultation, Public Hearing, Mass/social media communication (as needed), Written Notice Affixation	Project Implementation Area; Continuous communication throughout DES/DED/ ESIA preparation	ESCO/ Consultant
Stage 2: Construction and Mobilization Activities	Project Affected People/ Beneficiaries	Grievance mechanism, Health and Safety impacts, ESMP, community health and safety, community concerns, employment opportunities, project status	Public meetings, trainings/workshops Separate meetings as needed for women and vulnerable Individual outreach to PAPs as needed Disclosure of written information: brochures, posters, flyers, website Information boards, Notice board at construction sites, Grievance mechanism	Project Area; Monthly meetings during construction seasons, Communication through mass/social media as needed, Notice boards updated weekly if needed, Routine interactions	ESCO/ Supervision Consultant/ Contractor
	Other Interested	Project information - scope and rationale and E&S principles,	Joint public/community meetings, trainings/workshops	As needed (monthly during Construction)	ESCO/ Supervision

Stage	Target stakeholders	Topic of Engagement	Methods	Location/ Frequency	Responsibilities
	Parties	Project status, Health and safety impacts, Employment opportunities, Environmental and social concerns, Grievance mechanism process, Training on ESMP and other management plan, Worker Grievance mechanism	Disclosure of written information: brochures, posters, website, Information boards, Notice board at construction sites Grievance mechanism		Consultant/ Contractor
Stage 3: Operation and Maintenance	Project Affected People/Beneficiaries	Satisfaction with engagement activities and GRM, Grievance mechanism process, Benefit Sharing, Community Support Programs, Supply System of Electricity, Tariff, , Environmental and Social Concerns, Public Safety	Community Meeting, Grievance mechanism, website Face-to-face meetings, Submission of reports as required	As needed	ESCO
	Other interested Parties	Grievance mechanism process, Issues of concern Status and compliance reports, Benefit sharing, Environmental and Social Concerns, Public Safety	Grievance mechanism, website Face-to-face meetings, Submission of reports as required	As needed	ESCO

CHAPTER 12: CONCLUSION AND RECOMENDATION

Amadblam Mini Hydro Pvt. Ltd will implement the proposed AMHP in the Sagarmatha National Park (SNP) which will generate 7,225,781.76 kWh of annual average energy. Apart from the generation of the hydroelectric power, the subproject will provide a number of benefits during construction and the operational stages. During construction, some of the beneficial impacts include employment generation, increase in local economy and enhancement of technical skills. It will have long-term beneficial impact for the development of the local area along with fulfillment of clean energy demand replacing biomass-based energy. This ultimately imparts positive impacts on ecological integrity and conservation of the SNP. The SNP is additionally recognized by UNESCO as the world heritage site under criterion (vii).

The subproject will also result in some adverse impacts of different magnitudes, in different locations and even for the long-term duration. The major adverse impacts include land acquisition. The subproject intends to acquire about 5.711 ha of the government land. Out of this, the subproject will also require 5.085 ha land temporarily while remaining 0.626 ha permanently. Out of 0.626 ha land required for permanently, only 0.226 ha land will be occupied surficial while 0.400 ha of land required for penstock pipe will be used underground area only. The T&D lines require 4.550 ha of land temporarily as these structures will be underground except river crossing. There is no need of tree felling. The water will be diverted for power generation in the river stretch of about 3.5km between the proposed intake and confluence between Imja Khola and Cholunche Khola (dewatered zone). The maximum water reduction in this river stretch is 48.28% in April. As per the national policy, 50% of mean monthly flow as the minimum discharge will be maintained in the river. In addition, water in the dewatered zone is not used for irrigation, drinking and not any livelihood purposes by local communities. Similarly, as per the consultation with SNP officials (Chief Warden and Assistant Warden) and locals, due to high slope gradient, altitude and extreme cold water the presence of fishes in Cholunche Khola is not reported. Thus, impacts on fishes and other aquatic life and livelihood of local community due to the reduction of river flow in dewatered zone is not observed. The impact of the subproject on OUV of the SNP is mostly insignificant and occurs during construction period only. Red Panda, Himalayan Musk Deer and Himalayan Black Beer are some of the critical wild fauna found in the SNP. As per the consultation with local people and other stakeholders (SNP & BZMC) these animals rarely moves around the proposed subproject area nonetheless these animals are not territorial. Some of the indirect impact might be an influx of workers which could disturb Red Panda and Musk Deer populations through illegal hunting or through the introduction of domestic dogs. During ESIA study SNP and Buffer Zone Management Plan (2016-2020) was also referred for information on flora, mammalian and avian fauna, fisheries etc.

This ESIA report includes mitigation measures for each identified adverse impacts as well as proposed enhancement measures for the beneficial impacts. ESMP has been prepared and budget has been allocated for the mitigation and enhancement measures. The ESCO will implement the the proposed subproject ensuring effective implementation of the proposed ESMP. The ESCO will also compensate/mitigate any other impact encountered in the ESMP. According to GoN requirements, EIA is required for the subproject which will be approved by the MoFE. No further environmental study will be required for subproject.

CHAPTER 13: REFERENCES

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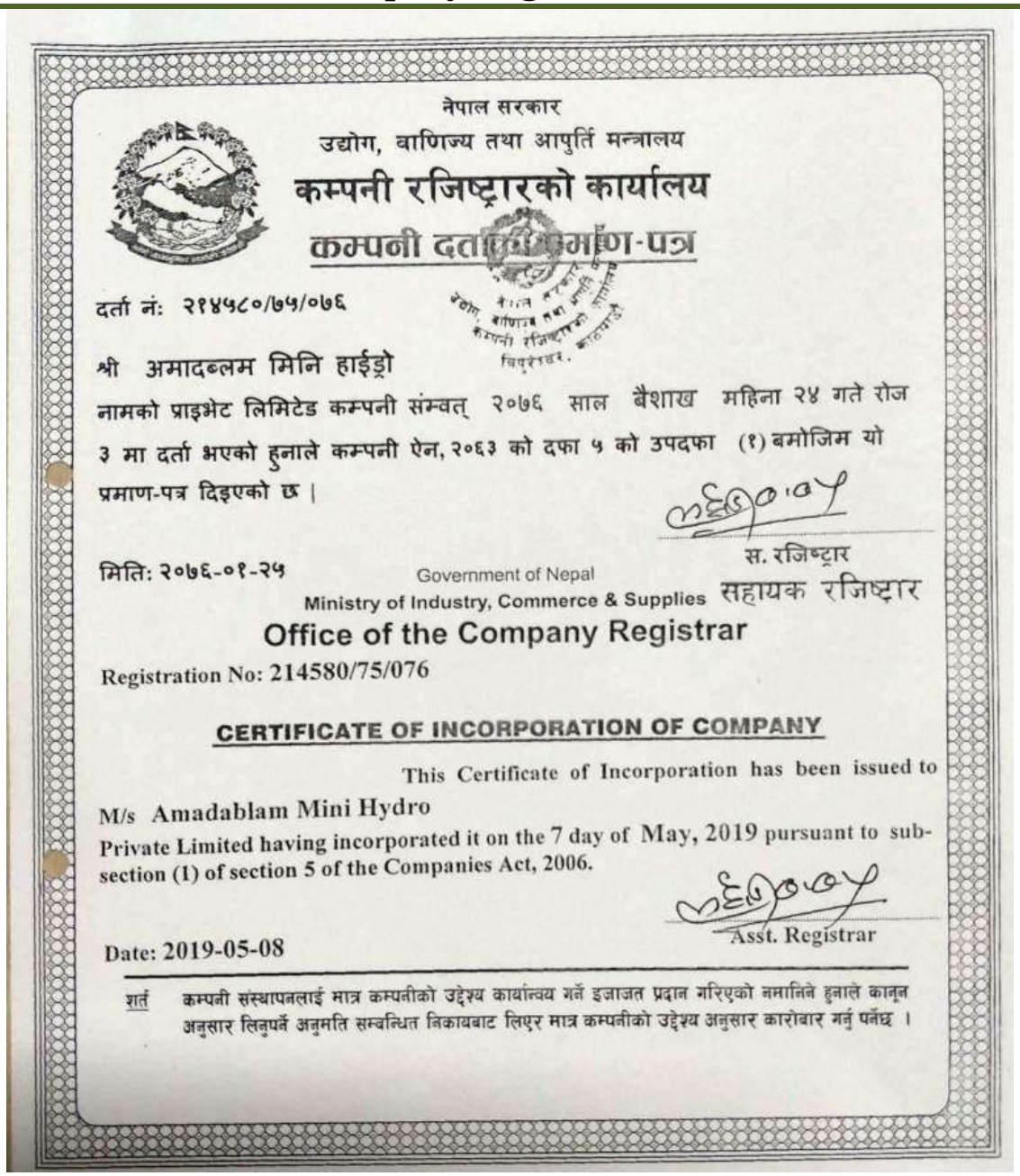
ANNEXES

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 ।

मिति: २०७६-०१-२५

स. रजिष्ट्रार

सहायक रजिष्टार

Government of Nepal

Ministry of Industry, Commerce & Supplies

Office of the Company Registrar

Registration No: 214580/75/076

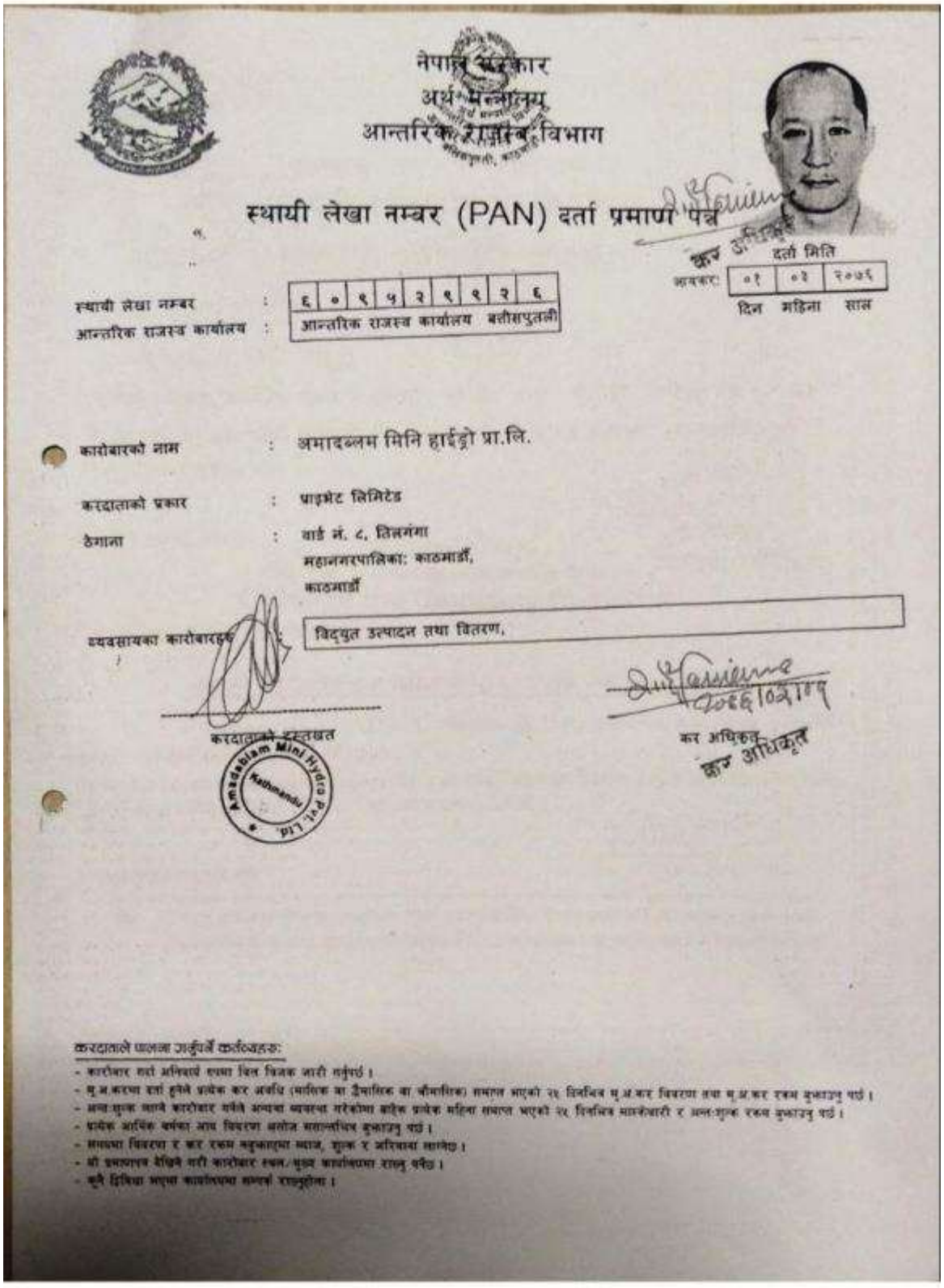
CERTIFICATE OF INCORPORATION OF COMPANY

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

दर्ता मिति
आयकर: ०१ ०३ २०७६
दिन महिना साल

स्थायी लेखा नम्बर : ६०९५३९९३६
आन्तरिक राजस्व कार्यालय : आन्तरिक राजस्व कार्यालय बबरमहल

कारोबारको नाम : अमादब्लम मिनि हाईड्रो प्रा.लि.

करदाताको प्रकार : प्राइभेट लिमिटेड

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

व्यवसायका कारोबारहरु : विद्युत उत्पादन तथा वितरण,

करदाताले दस्तखत

Amadablam Mini Hydro Pvt. Ltd. Kathmandu

कर अधिकृत

करदाताले पालना गर्नुपर्ने कर्तव्यहरु:

- कारोबार सुरु भएदेखि सात दिन भित्रमा 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 गर्ने अन्यथा व्यवस्था गरेकोमा बाहेक प्रत्येक महिना समाप्त भएको २५ दिनभित्र मासिकवारी र अन्तःशुल्क रकम बुझाउनु पर्छ ।
- प्रत्येक आर्थिक वर्षका आय विवरण अनिवार्य सम्बन्धित बुझाउनु पर्छ ।
- समयमा विवरण र कर रकम नबुझाएमा ब्याज, शुल्क र जरिवाना लाग्नेछ ।
- यो प्रमाणपत्र देखिने गरी कारोबार स्थल/मुख्य कार्यालयमा राख्नु पर्नेछ ।
- कुनै हिसिवा भएमा कार्यालयमा सम्पर्क राख्नुहोला ।

Annex II: Technical Clearance from DoED

नेपाल सरकार

ऊर्जा, जलस्रोत तथा सिंचाइ मन्त्रालय

विद्युत विकास विभाग

(...........अनुमतिपत्र महाशाखा...............)

फोन नं. ४४११०७८, ४४११५२०, ४४११९६८, ४४१९५०१, ४४४५०७२, ४४३०११९, ४४९३६२

फ्याक्स ४४६३९०३

पोष्ट बक्स नं. २५०७

सानोगौचरण

काठमाडौं, नेपाल

पत्र संख्या :-२०७६/०७७

चलानी : 1020

मिति २०७६/१०/१२

विषयः- Technical Clearance उपलब्ध गराइएको सम्बन्धमा ।

श्री खुम्बु पासाङल्हामु गाउँपालिका

गाउ कार्यपालिकाको कार्यालय,

चौरीखर्क,सोलुखुम्बु ।

प्रस्तुत विषयमा तहाँको पत्र संख्या २०७६/०७७ , च.नं.३०८ को प्राविधिक परामर्श(सफाई) सम्बन्धी पत्र प्राप्त भइ व्यहोरा अवगत भयो ।

प्रस्तावित आमादब्लम मिनी जलविद्युत आयोजना (off-grid) को लागि तहाँबाट माग भएको Technical Clearance सम्बन्धमा कारवाही हुँदा विभागको Database अनुसार अन्य आयोजनाहरु संग दोहोरो पर्ने नदेखिएको तथा सो आयोजनाको क्षमता प्रोब्याब्लिटी अफ एक्सीडेन्स Q४० मा १(एक)मे.वा. भन्दा कम देखिएकोले प्रचलित कानुन अनुसार विकास गर्न प्राविधिक रुपमा बाधा नपर्ने हुँदा तपसिल बमोजिमको सर्वेक्षण क्षेत्रमा Technical Clearance उपलब्ध गराइएको व्योहोरा विभागको मिति २०७६/१०/०५को निर्णयानुसार जानकारी गराइन्छ । साथै उक्त आयोजना विकास सम्बन्धी तहाँ बाट भए गरेको निर्णय कार्यान्वयनको जानकारी यस विभागलाई उपलब्ध गराइदिनु हुन अनुरोध छ ।

तपसिल:

अक्षांश: २७° ५१' ४०" देखि २७° ५०' ५०" सम्म

देशान्तर: ८६° ४९' १५" देखि ८६° ४८' ००" सम्म

(प्रदिप कुमार राउत)

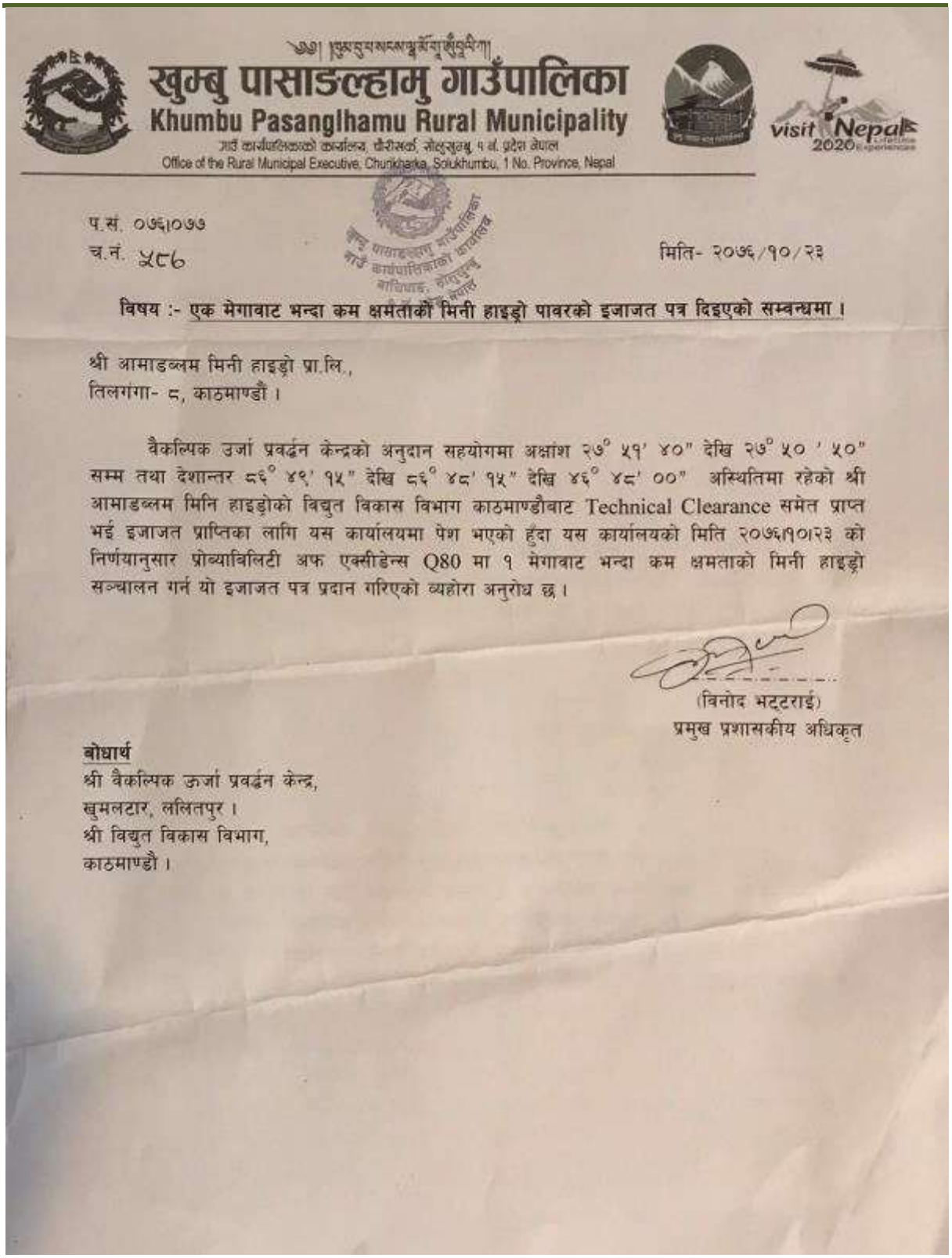
इञ्जिनियर

बोधार्थ:

१.श्रीमान महानिर्देशकज्यू,विद्युत विकास विभाग

२.श्री आमादब्लम मिनी हाइड्रो प्रा.लि. ,तिलगंगा ,काठमाडौं,९८०१०६५९२८

Annex III: Generation License from RM



खुम्बु पासाङल्हामु गाउँपालिका
Khumbu Pasanglhamu Rural Municipality
गाउँ कार्यपालिकाको कार्यालय, चौरीखर्क, सोलुखुम्बु, १ नं. प्रदेश नेपाल
Office of the Rural Municipal Executive, Chunkharka, Solukhumbu, 1 No. Province, Nepal

visit Nepal 2020

प.सं. ०७६।०७७
च.नं. ४८६

मिति- २०७६/१०/२३

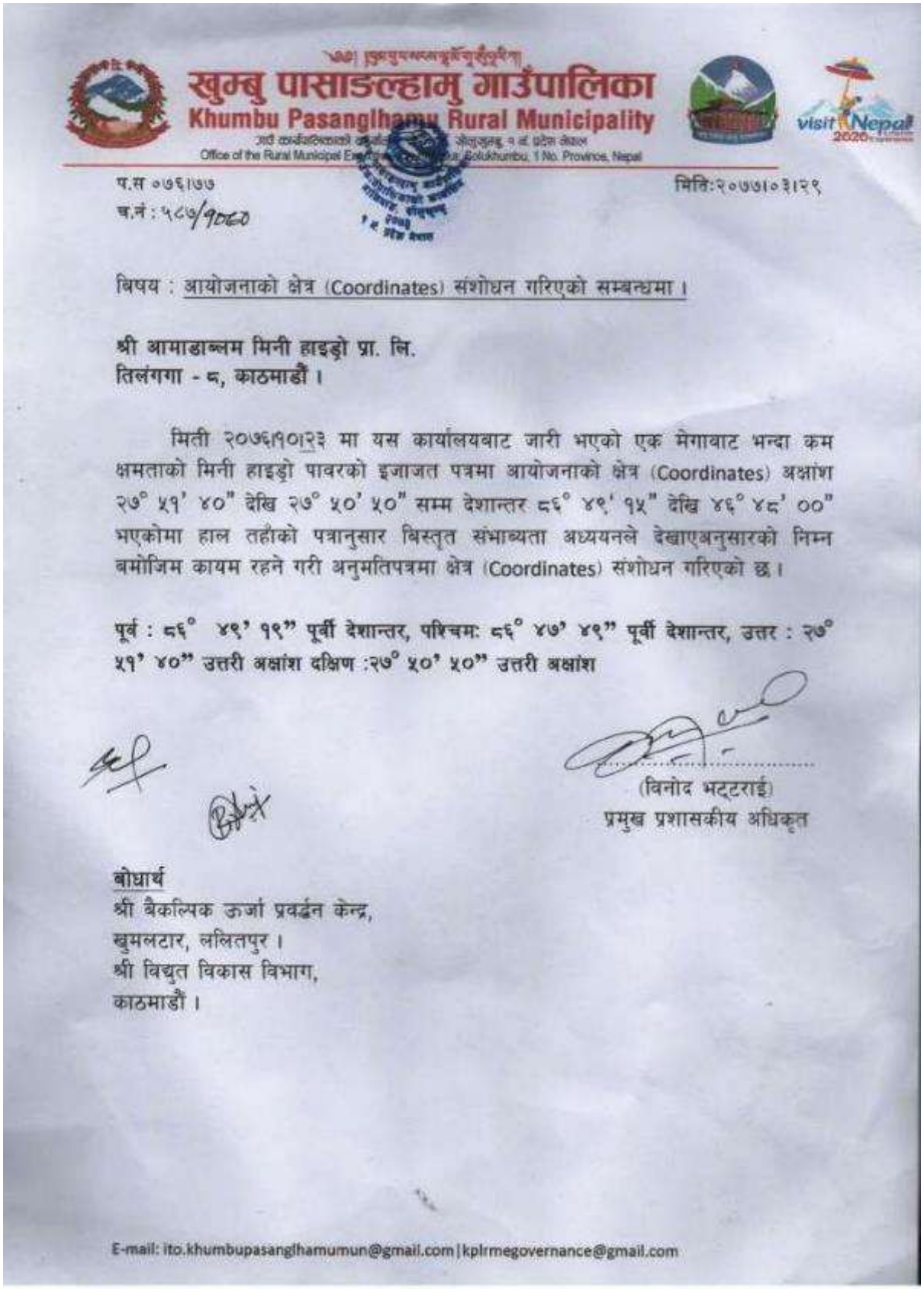
विषय :- एक मेगावाट भन्दा कम क्षमताको मिनी हाइड्रो पावरको इजाजत पत्र दिइएको सम्बन्धमा ।

श्री आमाडब्लम मिनी हाइड्रो प्रा.लि.,
तिलगंगा- ८, काठमाण्डौं ।

वैकल्पिक उर्जा प्रवर्द्धन केन्द्रको अनुदान सहयोगमा अक्षांश २७° ५१' ४०" देखि २७° ५० ' ५०" सम्म तथा देशान्तर ८६° ४९' १५" देखि ८६° ४८' १५" देखि ४६° ४८' ००" अस्थितिमा रहेको श्री आमाडब्लम मिनि हाइड्रोको विद्युत विकास विभाग काठमाण्डौबाट Technical Clearance समेत प्राप्त भई इजाजत प्राप्तिका लागि यस कार्यालयमा पेश भएको हुंदा यस कार्यालयको मिति २०७६।१०।२३ को निर्णयानुसार प्रोव्याबिलिटी अफ एक्सीडेन्स Q80 मा १ मेगावाट भन्दा कम क्षमताको मिनी हाइड्रो सञ्चालन गर्न यो इजाजत पत्र प्रदान गरिएको व्यहोरा अनुरोध छ ।

(विनोद भट्टराई)
प्रमुख प्रशासकीय अधिकृत

बोधार्थ
श्री वैकल्पिक ऊर्जा प्रवर्द्धन केन्द्र,
खुमलटार, ललितपुर ।
श्री विद्युत विकास विभाग,
काठमाण्डौं ।



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

मिति:२०७७।०३।२९

विषय : 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 विस्तृत संभाव्यता अध्ययनले देखाएअनुसारको निम्न बमोजिम कायम रहने गरी अनुमतिपत्रमा क्षेत्र (Coordinates) संशोधन गरिएको छ ।

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

(विनोद भट्टराई)
प्रमुख प्रशासकीय अधिकृत

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

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

Annex IV: Permission Letter for EIA Study from MoFE

पत्रोत्तरमा पत्र संख्या मिति उल्लेखित हुन अपेक्षित छ ।

नेपाल सरकार

वन तथा वातावरण मन्त्रालय

वातावरण तथा जैविक विविधता महाशाखा

EX: पो.ब.नं. :३४८७
सिंहदरबार, काठमाण्डौं

पत्र संख्या:-
चलानी नं. २४३
जैविक विविधता/२०७८/०७९

मिति २०७८/६/२४

विषय: वातावरणीय प्रभाव मूल्याकंन अध्ययन गर्ने सहमति सम्बन्धमा ।

श्री अमादब्लम मिनी हाइड्रो प्रा.लि,
तिलगंगा-८, काठमाण्डौं ।

प्रस्तुत विषयमा तहाँ कम्पनीबाट प्रर्वद्धन गरिने सोलुखुम्बु जिल्लामा सगरमाथा राष्ट्रिय निकुञ्ज क्षेत्र भित्र पर्ने अमादब्लम मिनी जलविद्युत आयोजनाको लागि वातावरणीय प्रभाव अध्ययन गर्न सहमति माग भएको सम्बन्धी फाइलमा कार्वाही हुँदा निम्न बमोजिमका शर्तहरुको पूर्ण पालना गर्ने गरी वातावरणीय प्रभाव मूल्याकंन अध्ययन गर्न सहमति दिने भनि वन तथा वातावरण मन्त्रालय (सचिवस्तर) बाट मिति २०७८/६/२० मा निर्णय भएको व्यहोरा अनुरोध छ ।

शर्तहरु

१) प्रस्तावित आयोजनाको वातावरणीय प्रभाव मूल्याकंन अध्ययन प्रतिवेदन तयार गर्दा UNESCO को Operational guidelines, विश्व सम्पदा सूचिमा सूचिकृत सगरमाथा राष्ट्रिय निकुञ्ज सम्बन्धी उपलब्ध विवरण, स्थलगत अध्ययनको क्रममा संकलन गरिने तथ्य र तथ्याकंको आधारमा विषय विज्ञबाट वस्तुगत विश्लेषण गरी/गराई सगरमाथा राष्ट्रिय निकुञ्ज विश्वव्यापी महत्वको सम्पदा भएको हुँदा यसमा पर्ने प्रभाव सम्बन्धमा अध्ययन प्रतिवेदनमा प्रष्ट रुपमा उल्लेख गर्नुपर्ने ।

२) वातावरणीय प्रभाव मूल्याकंन प्रतिवेदन उपर UNESCO, WHC बाट प्राप्त हुने राय सुझाव प्रतिवेदनको अभिन्न अङ्ग हुनुपर्ने ।

३) वातावरणीय अध्ययन गर्दा सगरमाथा राष्ट्रिय निकुञ्ज कार्यालयका अधिकृतस्तरका प्राविधिक कर्मचारीलाई अनिवार्य संलग्न गराउने र साथै कार्यालयका कर्मचारीहरु, व्यवस्थापन समितिका पदाधिकारीहरु र स्थानिय सरोकारवालाहरुसँग अनिवार्य अन्तर्क्रिया गरी प्राप्त राय सुझाव र कार्यालयसँग नियमित तवरमा राय परामर्श लिने साथै कार्यालयबाट प्राप्त हुने राय/सुझाव अन्तिम प्रतिवेदनको अङ्ग हुनेगरी समावेश गर्ने व्यवस्था मिलाउनु पर्ने ।

४) वातावरणीय अध्ययन गर्दाको सर्वे चरणहरुमा सगरमाथा राष्ट्रिय निकुञ्ज मध्यवर्ती क्षेत्र व्यवस्थापन समितिको सहभागिता सुनिश्चित गर्ने ।

५) अध्ययनको क्रममा स्थानीय जनता र सरोकारवाला निकायहरुबाट उठान भएका आर्थिक, सामाजिक, जैविक प्रभाव सम्बन्धी सवालहरु सम्बोधन गर्ने सम्बन्धमा अवलम्बन गर्नुपर्ने न्यूनीकरण उपायहरु प्रतिवेदनको अभिन्न अङ्गको रुपमा समेटिनुपर्ने ।

६) आयोजना निर्माण क्षेत्र वन्यजन्तुको प्रमुख बासस्थान (Ecological Hotspot) नपर्ने गरी अध्ययन गर्नुपर्ने ।

७) वातावरणीय अध्ययन गर्दा विभिन्न विकल्पहरु अध्ययन गरी सो विकल्पहरु मध्ये तथ्य र तथ्याङ्कको आधारमा जैविक विविधता र समग्र वातावरणमा न्यून नकारात्मक प्रभाव पुऱ्याउने विकल्पको छनौट गरी प्रतिवेदन तयार गर्नुपर्ने ।

८) अध्ययन टोलीमा वन्यजन्तु वन तथा वातावरण विज्ञ र जैविक विविधता विज्ञ अनिवार्य सहभागी गराइ आयोजनाले ग्रस्त क्षेत्रका रैथाने वन्यजन्तुहरुको आवतजावत र विभिन्न मौसममा बसाइसराइ गरी आउने जाने वन्यजन्तुहरुलाइ कस्तो नकारात्मक प्रभाव पर्ने हो र त्यसका न्यूनिकरण र विकल्पका उपायहरु सम्बन्धी विस्तृत अध्ययन गरी यथार्थपरक र मापनयोग्य तथा प्रतिफलमूलक कार्यक्रम र बजेट वातावरण व्यवस्थापन योजनामा प्रस्ताव गर्ने व्यवस्था हुन ।

९) प्रस्तावित आयोजनाको लागि निर्माण गर्न प्रस्ताव गरिएका संरचनाहरुको GPS कोअर्डिनेट सहित GIS प्रविधि समेत प्रयोग गरी तयार गरिएको टोपोनक्सा प्रतिवेदनमा समावेश भएको हुनुपर्ने ।

१०) आयोजना निर्माणका लागि Biodiversity Hotspot नपर्ने गरी स्थानको अध्ययन हुनुपर्ने साथै वन वन्यजन्तु वनस्पति स्थानिय वातावरण र प्राकृतिक सौन्दर्यताका साथै सो क्षेत्रको आर्थिक सामाजिक धार्मिक र पुरातात्विक महत्वका सम्पदामा आयोजना निर्माण कार्यबाट क्रम भन्दा क्रम नकारात्मक प्रभाव गर्ने बारे कममा ३ वटा विकल्पको अध्ययन हुनुपर्ने ।

सचिव : ४२११४६७, फ्याक्स: ४२११८६८

पत्रोत्तरमा पत्र संख्या मिति उल्लेखित हुन अपेक्षित छ ।

नेपाल सरकार

वन तथा वातावरण मन्त्रालय

EX: पो.ब.नं. :३४८७
सिंहदरबार, काठमाण्डौं

पत्र संख्या:-
चलानी नं.: २४३
प्राप्त पत्र संख्या र मिति:-

१) संरक्षित क्षेत्रभित्र भौतिक पूर्वाधारहरु निर्माण तथा सञ्चालन सम्बन्धी कार्यनीति-२०६५ को बुँदा ५ र ९ ले गरेको व्यवस्था बारे अध्ययन हुन ।

२) राष्ट्रिय निकुञ्जको क्षेत्रभित्र अन्य कुनै क्रियाकलाप र निर्माणका कार्य हुन नपाउने गरी राष्ट्रिय निकुञ्ज तथा वन्यजन्तु संरक्षण ऐन, २०२९ दफा (६) हिमाली राष्ट्रिय निकुञ्ज नियमावली-२०३६ नियम (३०) र संरक्षित क्षेत्र भित्र भौतिक पूर्वाधारहरु निर्माण एवं सञ्चालन सम्बन्धि कार्यनीति, २०६५ को कार्यनीतिको उद्देश्य (क) र कार्यनीति प्रयोग गर्नुपर्ने अवस्था (क) को व्यवस्था अनुरुप वातावरण संरक्षण ऐन २०७६ र वातावरण संरक्षण नियमावली २०७७ अनुसार हुनेगरी प्रस्तावित आयोजनाको वातावरणीय प्रभाव मूल्याकंन अध्ययन हुनुपर्ने ।

.....
(ज्ञानेन्द्र कायस्थ)
स.व.अ.

बोधार्थ:
श्री राष्ट्रिय निकुञ्ज तथा वन्यजन्तु संरक्षण विभाग, बबरमहल, काठमाण्डौं ।
श्री सगरमाथा राष्ट्रिय निकुञ्ज कार्यालय, नाम्चे सोलुखुम्बु।

सचिव : ४२११४६७, फ्याक्स: ४२११८६८

Annex V: Checklist Used For NTFPs

Check List Date:

PLANT RESOURCES

Name of Respondent: ..... Sex: ..... Age: .....Yrs

Institution: ..... Position: ..... Address: .....

SN	Name of plants	Uses			Others
		Fuel-wood	Fodder	Medicine	

Note:.....

.....

.....

Annex VI: Checklist Used For Agrobiodiversity

Date:

Name of Respondent:…….. Sex:…… Age:…… Yrs:……

Institution:……Position:……...Address:…….

SN	Name of Plants/Crops	Uses			
		Food (Cereals/Pulses/Oil seed)	Fruits	Vegetables	Spices

Annex VII: Checklist Used For Wildlife

Check List Date:

WILDLIFE AND BIRDS

Name of Respondent: ..... Sex: ..... Age: .....Yrs
Institution: ..... Position: ..... Address:
.....
ID Number:

SN	Wildlife/Bird	Mammal/Reptile/Bird	Frequency		Remarks
			Regular	Rare	

Note:.....
.....
.....

Annex VIII: Household Survey Form

प्रभावित क्षेत्रको घरधुरी सर्वेक्षण:

१. घरमुलीको नाम: २. ठेगाना:

३. शिक्षा: ४. मुख्य पेशा:

५.. धर्म : ..... ६. मातृभाषा : ..

७. वसाई सराई गरी आएको भए , क) कहाँबाट ख) कतिवर्ष पहिले

ग) वसाई सरी आउनुको कारण

८. घरको जनसंख्या तथा अन्य विवरण:

क्र.सं.	नाता	लिंग	उमेर	शिक्षा	पेशा	कैफियत

९. आम्दानीको श्रोतहरु:

क्र. सं.	श्रोत	बार्षिक आम्दानी (रू.)	कैफियत
१.	कृषि तथा पशुपालन		
२.	जागिर		
३.	बैदेशिक रोजगार		
४.	व्यापार ब्यबसाय		
५.	अन्य....		
६.	अन्य....		

१०. कृषि तथा पशुपंछी सम्बन्धि विवरण

१०.१ जग्गाको छेत्रफल:

१०.२ मुख्य बाली तथा उत्पादन:

क्र.सं.	बाली	लगाएको छेत्रफल	गत बर्षको उत्पादन (के.जी.)	खाध्यान्नको उपलब्धता (१=बर्षभरि पुग्ने;२= ९ महिना सम्म पुग्ने; ३= ६ महिनासम्म पुग्ने; ४= ३ महिनासम्म पुग्ने)	कैफियत (बेचबिखन गरि आम्दानी लिने गरेको छ छैन उल्लेख गर्ने)

१०.३ पशुपंक्षी

क्र.सं.	पशुपंक्षी	संख्या	कैफियत (बेचबिखन गरि आम्दानी लिने गरेको छ छैन उल्लेख गर्ने)

११. संघसंस्थासंगको संलग्नता

क्र.सं.	संस्थाको नाम	सदस्यता छ/छैन

१२. खानेपानी, सरसफाई तथा स्वास्थ्य

१२.१ खानेपानीको श्रोत:

१२.२ चर्पी भए/नभएको ....., भए, चर्पीको प्रकार .....

१२.३ गत २ बर्षमा परिवारमा बिरामी भए/नभएको, यदि भएको भए,

क्र.सं.	बिरामीको नाम	उमेर	रोगको नाम	रोगलागेको समय	उपचार गरेको स्थान

१३. इन्धन

१३.१ उज्यालोको लागि: १३.२ खाना पकाउन:

१३.३ दाउरा प्रयोग भए त्यसको श्रोत .....

१४. धर्म तथा संस्कृति:

१४.१ धर्म .....

१४.२ चाडपर्वहरु

.....

समाप्त

Annex IX: Settlement Information Form

बस्तीको जानकारी:

१ ठेगाना: **२ बस्तीको नाम:**

३. घरधुरी संख्या: **४. जनसंख्या:**

५. मुख्यजातजातिहरु:

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 वर्षभन्दा 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)	
बाखा		कुखुरा	
भेंडा		अन्य भएमा उल्लेख गर्ने	

११. नजिकैको बजार:

१२. स्थानीय सरकारी, 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. वि.			
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			

क्रमशः

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 चाडपर्वहरु:

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		

Annex X: Water Quality

NEPAL ACADEMY OF SCIENCE & TECHNOLOGY
CENTRAL OFFICE
NAST

Environment and Climate Study Laboratory

Water Analysis Report

Date: 2078-08-16

Date Received: 2078-08-05
Received From: Khumbu Pasang Lamu
Source: Cholunche khola
Location: Solukhumbu
Lab Code: 078/08/15

S.N.	Parameters	Test Results	Standards #
	Physical Tests		
1.	Temperature (°C)	18.5	
2.	pH	8.05	6.5-8.5*
3.	Conductivity (µS/cm)	21	1500
4.	Turbidity (NTU)	1.75	5(10)
5.	Total Dissolved Solids (mg/L)	10.29	
6.	Total Suspended Solids (mg/L)	28	
	Chemical Tests		
7.	Total Hardness (as $CaCO_3$)	12	500 mg/L
8.	Chloride Content (mg/L)	2.84	250 mg/L
9.	Iron Content (mg/L)	0.1	0.3(3) mg/L
10.	Arsenic Content (mg/L)	ND	0.05 mg/L
11.	Ammonia (mg/L)	ND	1.5 mg/L
12.	Nitrate (mg/L)	2	50 mg/L
13.	Dissolved Oxygen (mg/L)	7.6	
14.	Biological Oxygen Demand (mg/L)	1.2	
15.	Chemical Oxygen Demand (mg/L)	ND	
	Microbiological Test		
16.	Total Coliform Count	20↑	0/100 mL

Nepal Drinking Water Quality Standard, 2062
*These Values show lower and upper limit

ND- Non- Detected >-Greater than
( ) refers the acceptable values only when alternatives is not available.

Comments:
The water sample contains total coliform count beyond the standard at the time of analysis.

Approved by
Tista

Dr. Tista Prasai Joshi
Scientific Officer

Notes:

- The result refers only to the parameters tested for the sample received in the laboratory for analysis.
- The reproduction of this report wholly or partially cannot be used as evidence in the court of law and should not be used in any advertising media without the written approval of the laboratory

Address : Khumaltar, Lalitpur, Nepal, GPO Box 3323 Kathmandu, E-mail: Info@nast.gov.np
Telephone: 977-1-5547715, 5547720,5547721,5553132 Fax: +977-1-5547713

NEPAL ACADEMY OF SCIENCE & TECHNOLOGY
CENTRAL OFFICE
NAST

Environment and Climate Study Laboratory

Water Analysis Report

Date: 2078-08-16

Date Received: 2078-08-05
Received From: Khumbu Pasang Lamu
Source: Pangboche drinking water supply
Location: Pangboche
Lab Code: 078/08/17

S.N.	Parameters	Test Results	Standards #
	Physical Tests		
1.	Temperature (°C)	18.5	
2.	pH	7.70	6.5-8.5*
3.	Conductivity (µS/cm)	36	1500
4.	Turbidity (NTU)	0.56	5(10)
5.	Total Dissolved Solids (mg/L)	18.02	
6.	Total Suspended Solids (mg/L)	2	
	Chemical Tests		
7.	Total Hardness (as $CaCO_3$)	16	500 mg/L
8.	Chloride Content (mg/L)	5.68	250 mg/L
9.	Iron Content (mg/L)	ND	0.3(3) mg/L
10.	Arsenic Content (mg/L)	ND	0.05 mg/L
11	Ammonia (mg/L)	ND	1.5 mg/L
12.	Nitrate (mg/L)	2	50 mg/L
13.	Dissolved Oxygen (mg/L)	8.08	
14.	Biological Oxygen Demand (mg/L)	2.02	
15.	Chemical Oxygen Demand (mg/L)	52	
	Microbiological Test		
16.	Total Coliform Count	>300↑	0/100 mL

Nepal Drinking Water Quality Standard, 2062
*These Values show lower and upper limit

ND- Non- Detected >-Greater than
( ) refers the acceptable values only when alternatives is not available.

Comments:
The water sample contains total coliform count beyond the standard at the time of analysis.

Approved by

Tista

Dr. Tista Prasai Joshi
Scientific Officer

Notes:

- The result refers only to the parameters tested for the sample received in the laboratory for analysis.
- The reproduction of this report wholly or partially cannot be used as evidence in the court of law and should not be used in any advertising media without the written approval of the laboratory

Address : Khumaltar, Lalitpur, Nepal, GPO Box 3323 Kathmandu, E-mail: Info@nast.gov.np
Telephone: 977-1-5547715, 5547720,5547721,5553132 Fax: +977-1-5547713

Annex XI: Notice Publication for Public Hearing

वर्ष १७ | अंक ५१ | काठमाडौं | बिहीवार, १८ कार्तिक २०७८ | Thursday, 4 November 2021 | पृष्ठ ८ | मूल्य रु. १०

आर्थिक अभियान

हरेक दृष्टि, आर्थिक कोण

www.abhiyandaily.com

राष्ट्रिय दैनिक

अभियान बिहीवार, १८ कार्तिक २०७८ | Thursday, 4 November 2021 बजार ३

www.abhiyandaily.com

आमादब्लम मिनी हाईड्रो परियोजनाको वातावरणीय प्रभाव मुल्यांकन तयारीका लागि क्षेत्र निर्धारण सम्बन्धि सार्वजनिक सूचना

(प्रथम पटक प्रकाशित मिति:२०७८।०७।१८ गते)

१ नं. प्रदेश सोलुखुम्बु जिल्लासुम्बु पासाङ्ल्हामु गा.पा. वडा नं.४मा आमादब्लम मिनी हाईड्रो प्रा.लि. द्वारा निम्न बमोजिमको प्रस्ताव कार्यान्वयन गर्न लागिएको छ ।

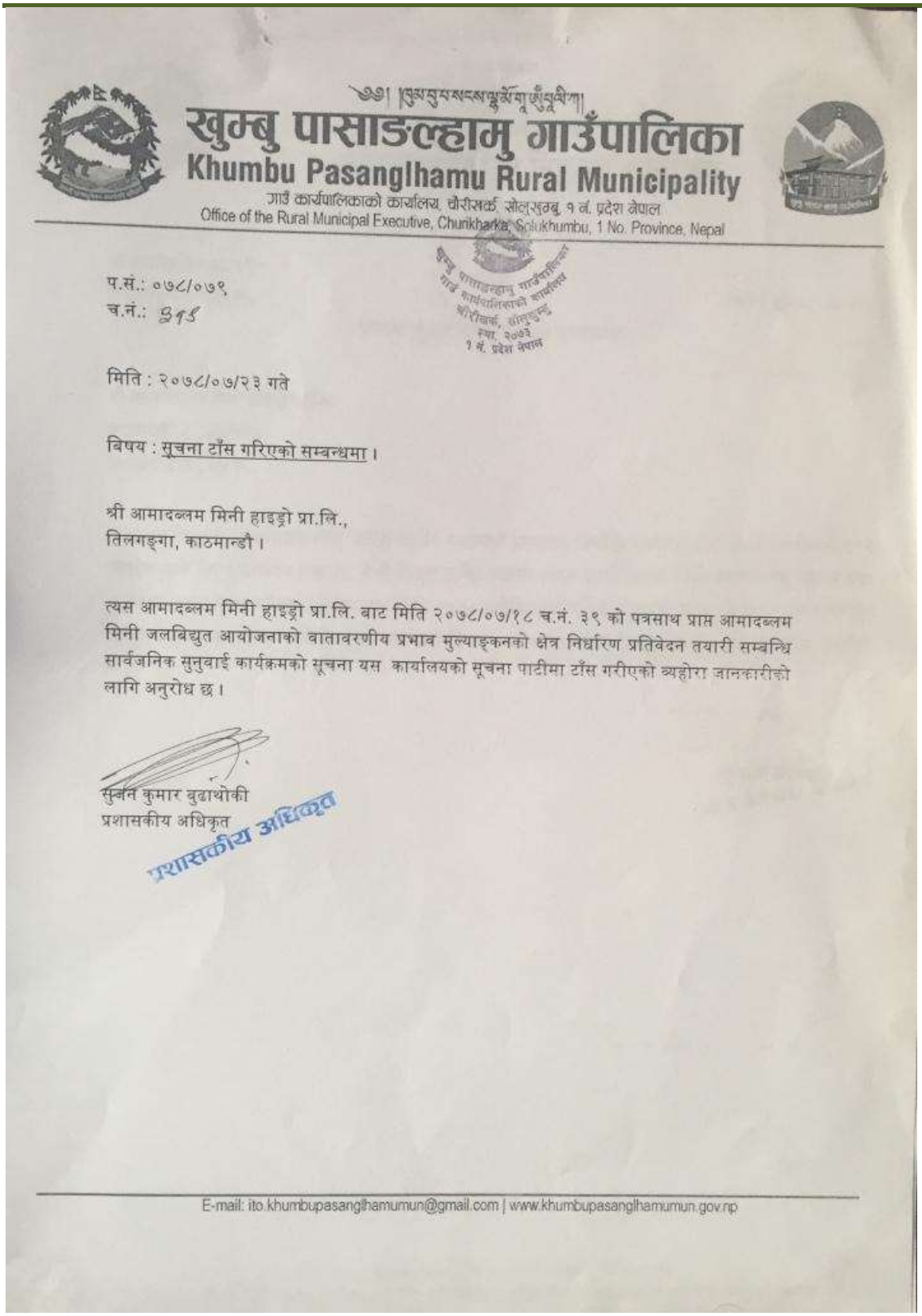
प्रस्तावकको नाम र ठेगाना	**आमादब्लम मिनी हाईड्रो प्रा. लि.** काठमाडौं-८, तिलगंगा बागमती प्रदेश, नेपाल ईमेलः amadablammminihydro@gmail.com फोन नं.:०१-४४६४२२२, ०१-४४६४३३३
प्रस्तावको व्यहोरा	नेपाल सरकार, वैकल्पिक ऊर्जा प्रवर्द्धन केन्द्र तथा विश्व बैंकको आर्थिक तथा प्राविधिक सहयोगमा प्रदेश नं. १, सोलुखुम्बु जिल्लाको खुम्बु पासाङ्ल्हामु गा.पा. वडा नं. ४, सगरमाथा राष्ट्रिय निकुन्ज क्षेत्र भित्र पर्ने चोलुन्खे खोलाको पानीबाट नदी प्रवाहमा आधारित (RoR) रहेर ९११ किलो वाट (कि.वा.) क्षमताको विद्युत निकाल्ने योजना रहेको छ । समुद्री सतहबाट ४४२३ मिटर (मि.) उचाईमा बाँध बाँधेर प्रति सेकेन्ड ०.२५ घन मिटर (घ.मि.) पानीसाई २९३० मि. लामो पेनस्टक पाइप मार्फत् समुद्री सतहबाट ३९५० मि.उचाईमा निर्माण गरिने विद्युतगृहमा जडान गरिने ४८५ कि.वा. क्षमताको २ वटा टर्वाइनमा खसाली वार्षिक उर्जा ७२,३१,७५८ कि.वा. घण्टा उत्पादन गर्ने लक्ष्य रहेकोछ । यस जलविद्युत परियोजनाको डिजाईन डिस्चार्ज ०.२५ घन मिटर प्रति सेकेन्ड, ग्रस हेड ४७१.८७ मि. र नेटहेड ४४८.८६ मि.रहेकोछ । प्रस्तावित परियोजनाका संरचनाहरु अन्तर्गत हेडवर्क, ग्रावेल ट्राप, डिस्यानडिंग बेसिन, पेनस्टक पाईप, विद्युत गृह र टेलरेस पाइप चोलुन्खे खोलाको बायाँतर्फ रहने छन् । प्रस्तावित परियोजना बाट उत्पादित विद्युत ६३ कि.मि. लामो प्रसारण लाईन बाट स्थानीयवासीहरुलाई वितरण गरिनेछ । यस आयोजनाको अनुमानित कुल लागत रु. ५२,२०,४८,१८४.०० रहेकोछ भने प्रति कि.वा. लागत रु.५७३०४९.६० रहेको छ ।**
प्रभाव पर्न सक्ने जिल्ला/गा.पा.	सोलुखुम्बु जिल्ला, पासाङ्ल्हामु गा.पा. वडा नं. ४

माथि उल्लेखित प्रस्तावको वातावरणीय प्रभाव मुल्यांकन (EIA)अध्ययन सम्बन्धि क्षेत्र निर्धारण (Scoping) गर्ने क्रममा सो क्षेत्रहरुको भौतिक तथा रासायनिक प्रणाली, जैविक प्रणाली, सामाजिक(आर्थिक प्रणाली र सांस्कृतिक प्रणालीमा के कस्तो प्रभाव पर्दछ भनि यकिन गर्न सो स्थानको गा.पा. तथा त्यस क्षेत्रका विद्यालय, अस्पताल, स्वास्थ्य चौकी तथा सरोकारवाला व्यक्ति वा संस्थाको लिखित राय सुझाव लिन आवश्यक भएकोले यो सार्वजनिक सूचना प्रकाशन भएको मितिले १० (दश) दिनभित्र निम्न ठेगानामा आइपुग्ने गरि लिखित राय सुझाव उपलब्ध गराई दिनहुन अनुरोध गरिन्छ ।

राय सुझावको लागि पत्राचार गर्ने ठेगानाहरु

प्रस्तावकको नाम र ठेगाना	**परामर्शदाताको नाम र ठेगाना**
आमादब्लम मिनी हाइड्रो प्रा. लि. काठमाडौं-८, तिलगंगा बागमती प्रदेश, नेपाल ईमेलः amadablammminihydro@gmail.com फोन नं.:०१-४४६४२२२, ०१-४४६४३३३	**ईको फ्रेण्ड इन्टरनेशनल प्रा.लि.** ललितपुर-२, सानेपा इमेल:ecofriend.nepal@gmail.com फोन नं.:९८५९१२७८६७

Annex XII: Deeds of Public Notice



खुम्बु पासाङल्हामु गाउँपालिका
Khumbu Pasanglhamu Rural Municipality
गाउँ कार्यपालिकाको कार्यालय, चौरीखर्क, सोलुखुम्बु, १ नं. प्रदेश नेपाल
Office of the Rural Municipal Executive, Chunkharka, Solukhumbu, 1 No. Province, Nepal

प.सं.: ०७८/०७९
च.नं.: ३९

मिति : २०७८/०७/२३ गते

बिषय : सूचना टाँस गरिएको सम्बन्धमा ।

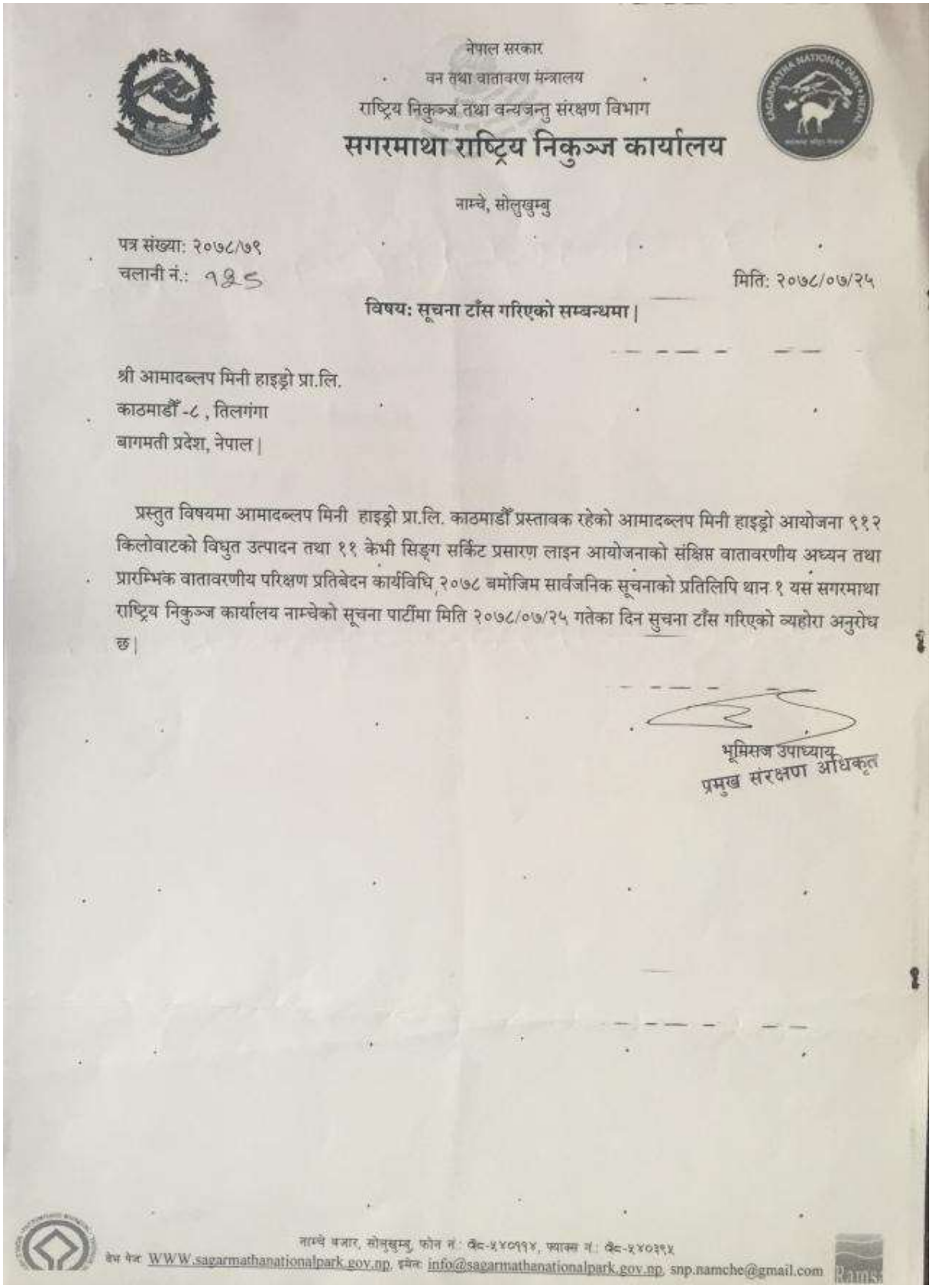
श्री आमादब्लम मिनी हाइड्रो प्रा.लि.,
तिलगङ्गा, काठमान्डौ ।

त्यस आमादब्लम मिनी हाइड्रो प्रा.लि. बाट मिति २०७८/०७/१८ च.नं. ३९ को पत्रसाथ प्राप्त आमादब्लम मिनी जलबिद्युत आयोजनाको वातावरणीय प्रभाव मुल्याङ्कनको क्षेत्र निर्धारण प्रतिवेदन तयारी सम्बन्धि सार्वजनिक सुनुवाई कार्यक्रमको सूचना यस कार्यालयको सूचना पाटीमा टाँस गरीएको व्यहोरा जानकारीको लागि अनुरोध छ ।

सुजन कुमार बुढाथोकी
प्रशासकीय अधिकृत

प्रशासकीय अधिकृत

E-mail: ito.khumbupasanglhamumun@gmail.com | www.khumbupasanglhamumun.gov.np



नेपाल सरकार
वन तथा वातावरण मन्त्रालय
राष्ट्रिय निकुञ्ज तथा वन्यजन्तु संरक्षण विभाग

सगरमाथा राष्ट्रिय निकुञ्ज कार्यालय

नाम्चे, सोलुखुम्बु

पत्र संख्या: २०७८/७९
चलानी नं.: १४५

मिति: २०७८/०७/२५

विषय: सूचना टाँस गरिएको सम्बन्धमा।

श्री आमादब्लप मिनी हाइड्रो प्रा.लि.
काठमाडौँ -८ , तिलगंगा
बागमती प्रदेश, नेपाल।

प्रस्तुत विषयमा आमादब्लप मिनी हाइड्रो प्रा.लि. काठमाडौँ प्रस्तावक रहेको आमादब्लप मिनी हाइड्रो आयोजना ९१२ किलोवाटको विधुत उत्पादन तथा ११ केभी सिङ्गल सर्किट प्रसारण लाइन आयोजनाको संक्षिप्त वातावरणीय अध्यन तथा प्रारम्भिक वातावरणीय परिक्षण प्रतिबेदन कार्यविधि,२०७८ बमोजिम सार्वजनिक सूचनाको प्रतिलिपि थान १ यस सगरमाथा राष्ट्रिय निकुञ्ज कार्यालय नाम्चेको सूचना पार्टीमा मिति २०७८/०७/२५ गतेका दिन सुचना टाँस गरिएको व्यहोरा अनुरोध छ।

भूमिसज उपाध्याय
प्रमुख संरक्षण अधिकृत

नाम्चे बजार, सोलुखुम्बु, फोन नं: ०३८-५४०१९४, फ्याक्स नं: ०३८-५४०३९५
वेब पेज: WWW.sagarmathanationalpark.gov.np, इमेल: info@sagarmathanationalpark.gov.np, snp.namche@gmail.com

Govt. Regd.: 2052/053/057
MMDC: 2419

पाङबोचे गुम्बा व्यवस्थापन समिति
Pangboche Monastery Management Committee
Khumbu Pasang Lhamu Rural Municipality-4, Pangboche, Solukhumbu, Nepal

प.सं.
च.नं.

मिति: २०७८-०७-२८

श्री आमाडब्लम मिनी हाइड्रो प्रा.लि.
काठमाडौं –८ तिलगंगा
बागमती प्रदेश , नेपाल

विषय:सुचना टास गरिएको सम्बन्धमा

लिखितम आमाडब्लम मिनी हाइड्रो प्रा.लि. काठमाडौ प्रस्ताबक रहेको आमाडब्लम मिनि हाइड्रो आयोजना ९१२ किलोवाटको विद्युत उत्पादन तथा ११ के°भि° सिङ्गल सर्किट प्रसारण लाइन आयोजनाको वातावरणीय प्रभाव मुल्यांकनको क्षेत्र निर्धारण प्रतिवेदन तयार गर्नका लागि प्रदेश वातावरण संरक्षण ऐन तथा नियमावली बमोजिम सार्बजनिक सुचनाको प्रतिलिपी थान-१ यस सोलुखुम्बु जिल्ला पसाङ ल्हामु गा.पा. वडा –४ पाङ्बोचे गुम्बाको सूचना पाटिमा आज मिति २०७८-०७-२८ गतेका दिन ५ बजे हामीहरुको रोहबरमा टाँस गरि यो मुचुल्का सहि छाप गरि दियौ।

तपशिल
सोलुखुम्बु जिल्ला खुम्बु पसाङ ल्हामु गा.पा. वडा न.४ बस्ने बर्ष २८ को कुङ्गा ग्याजु शेर्पा

सोलुखुम्बु जिल्ला खुम्बु पसाङ ल्हामु गा.पा. वडा न.४ बस्ने बर्ष ३५ को छेवाङ दोर्जी शेर्पा

इति २०७८ साल ७ महिना २८ गते रोज ०१ सुभम

Regd. No: 06/068/069

आमाडब्लम युवा क्लब

AMADABLAM YOUTH GROUP

Khumbu Pasang Lhamu Rural Municipality-4, Pangboche

मिति: २०७८-०७-२८

श्री आमाडब्लम मिनी हाइड्रो प्रा.लि.
काठमाडौं –८ तिलगंगा
बागमती प्रदेश , नेपाल

विषय:सुचना टास गरिएको सम्बन्धमा

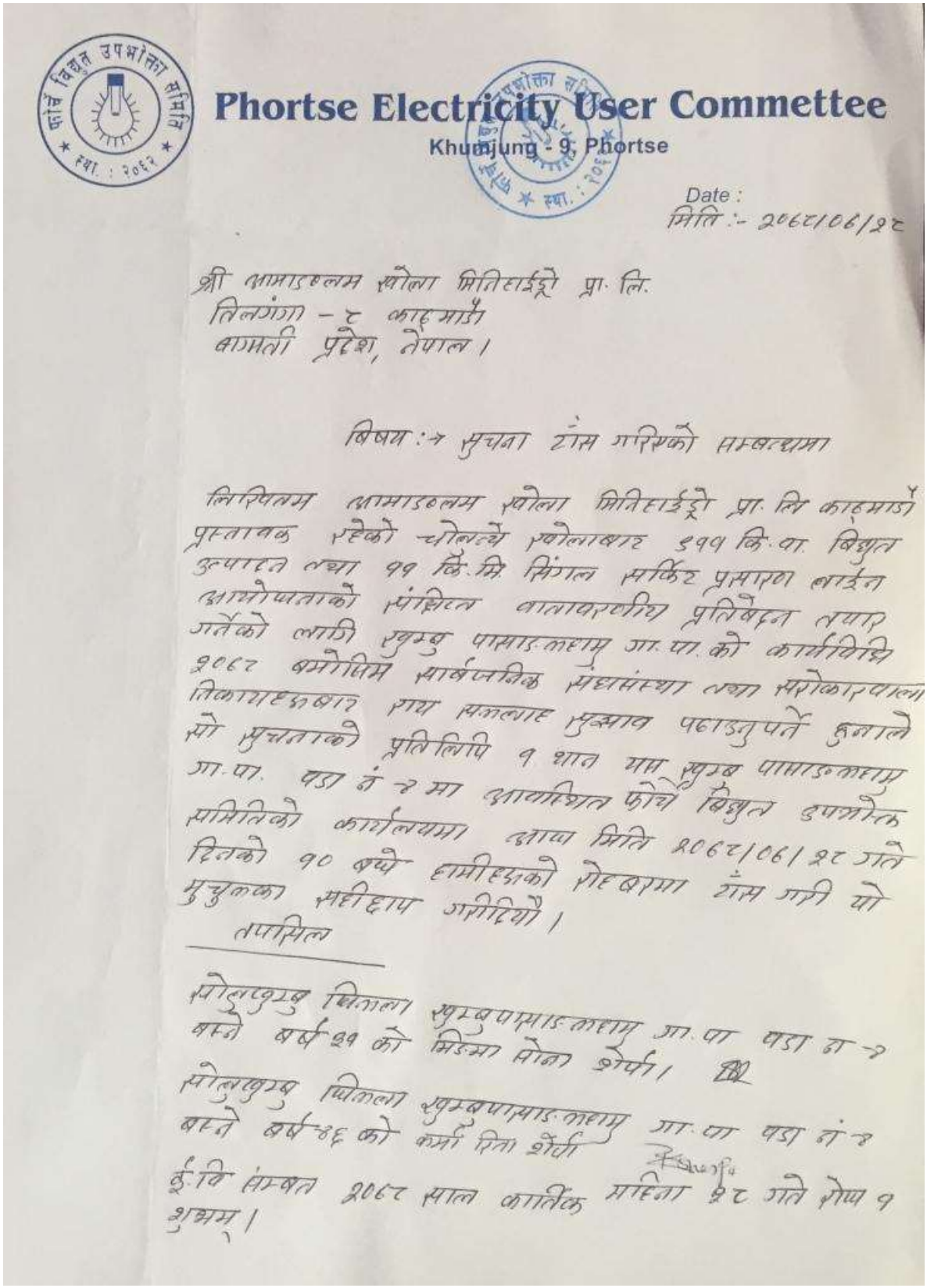
लिखितम आमाडब्लम मिनी हाइड्रो प्रा.लि. काठमाडौ प्रस्ताबक रहेको आमाडब्लम मिनि हाइड्रो आयोजना ९१२ किलोवाटको विद्युत उत्पादन तथा ११ के°भि° सिङ्गल सर्किट प्रसारण लाइन आयोजनाको वातावरणीय प्रभाव मुल्यांकनको क्षेत्र निर्धारण प्रतिवेदन तयार गर्नका लागि प्रदेश वातावरण संरक्षण ऐन तथा नियमावली बमोजिम सार्बजनिक सुचनाको प्रतिलिपी थान-१ यस सोलुखुम्बु जिल्ला पसाङ ल्हामु गा.पा. वडा –४ पाङ्बोचे गुम्बाको सूचना पाटिमा आज मिति २०७८-०७-२८ गतेका दिन ५ बजे हामीहरुको रोहबरमा टाँस गरि यो मुचुल्का सहि छाप गरि दियौ।

तपशिल

सोलुखुम्बु जिल्ला खुम्बु पसाङ ल्हामु गा.पा. वडा न.४ बस्ने बर्ष २८ को कुङ्गा ग्याजु शेर्पा

सोलुखुम्बु जिल्ला खुम्बु पसाङ ल्हामु गा.पा. वडा न.४ बस्ने बर्ष ३० को कर्मा छिरी शेर्पा

इति २०७८ साल ७ महिना २८ गते रोज ०१ सुभम



फोर्चे विद्युत उपभोक्ता समिति
स्था. : २०६२

Phortse Electricity User Commettee

Khumjung - 9, Phortse

Date :
मिति :- २०६८/०६/२८

श्री आमाडब्लम खोला मिनिहाईड्रो प्रा. लि.
तिलगंगा - ८ काठमाडौं
बागमती प्रदेश, नेपाल।

बिषय :- सुचना टाँस गरिएको सम्बन्धमा

लिखितम आमाडब्लम खोला मिनिहाईड्रो प्रा. लि काठमाडौं प्रस्तावक रहेको चोलथें खोलाबाट ४१५ कि.वा. बिद्युत उत्पादन तथा ११ कि.मि. सिंगल सर्किट प्रसारण लाईन आयोजनाको संक्षिप्त वातावरणीय प्रतिवेदन तयार गर्नेको लागी खुम्बु पासाङल्हामु गा.पा.को कार्यविधि २०६८ बमोजिम सार्वजनिक सुनुवाई तथा सरोकारवाला निकायहरुबाट राय सल्लाह सुझाव पठाउनु पर्ने हुनाले सो सुचनाको प्रतिलिपि १ थान मा खुम्ब पासाङल्हामु गा.पा. पडा नं २ मा आयोजित फोचे बिद्युत उपभोक्त समितिको कार्यालयमा आज मिति २०६८/०६/२८ गते दिनको १० बजे हामीहरुको रोहबरमा टाँस गरी यो सुचनाको प्रमाणित गरीदियौं।

तपसिल

सोलुखुम्बु जिल्ला खुम्बुपासाङल्हामु गा.पा पडा नं २ बस्ने बर्ष ३१ को मिङ्मा सेना शेर्पा।

सोलुखुम्बु जिल्ला खुम्बुपासाङल्हामु गा.पा पडा नं २ बस्ने बर्ष ३६ को कर्मा तिना शेर्पा

ई.ति संम्बत २०६८ साल कार्तिक महिना २८ गते रोज १ शुभम्।

श्री पाङ्बोचे आधारभूत विद्यालय
Shree Pangboche Basic School

खुम्बु पासाङ ल्हामु गा.पा.-४, सोलुखुम्बु
Khumbu Pasang lhamu R.M.-4, Solukhumbu
स्था: २०२० (Estd: 2020)

सञ्चालित कक्षा: प्रा.बा.शि. देखि कक्षा ५ सम्म
विद्यालय कोड नं.: ११०१८०००१
रा.बा.बैंक खाता नं.:
प्र.अ.को सम्पर्क नं.: ९८४२९७१८१८
१ नं. प्रदेश, नेपाल

पत्र संख्या (Let.No.):
चलानी नम्बर (Ref.No.): ६२।०७८

मिति (Date):

श्री आमाडब्लम मिनी हाइड्रो प्रा.लि.
काठमाडौँ-८, तिलगंगा, बाग्मती प्रदेश।

विषय (Subject): सूचना टाँस गरिएको सम्बन्धमा।

प्रस्तुत विषयमा 'आमाडब्लम मिनी हाइड्रो प्रा.लि. काठमाडौँ प्रस्तावक रहेको आमाडब्लम मिनी हाइड्रो आयोजना ४१२ किलोवाटको विद्युत उत्पादन तथा ११ के.भी. सिङ्गल सर्किट प्रसारण लाइन आयोजनाको वातावरणीय प्रभाव मूल्याङ्कनको क्षेत्र निर्धारण प्रतिवेदन तयार गर्नको लागि प्रदेश वातावरण संरक्षण ऐन तथा नियमावलीबमोजिम सार्वजनिक सूचनाको प्रतिलिपि थान-१ यस सोलुखुम्बु जिल्ला खुम्बु पासाङल्हामु गा.पा. ४ मा रहेको श्री पाङबोचे आ.वि. प्राङ्गणमा आज मिति २०७८।०६।२५ मा टाँस गरी मुचुल्का सही छाप गरी दियौं।

तपसील
१. वि.-चुडामणि कार्की-
२. प्र.अ.-चंपबहादुर तोकर-

(चंपबहादुर तोकर)
प्र.अ.
प्रधानाध्यापक

खुम्बु पासाङल्हामु गाउँपालिका
Khumbu Pasanglhamu Rural Municipality
स्वास्थ्य चौकी खुम्जुङ
सोलुखुम्बु, १ नं. प्रदेश नेपाल

प.सं. २०७८/०७९ मिति २०७८-०७-२८
च.नं. ०९

श्री आमाडब्लम मिनी हाइड्रो प्रा.ली.
काठमाडौं -०८ [illegible]
बागमती प्रदेश, नेपाल

र
श्री ईको प्लेन्ड इन्टरनेशनल प्रा.ली.
ललितपुर -२, [illegible]
बागमती प्रदेश, नेपाल

विषय : सूचना टाँस गरिएको सम्बन्धमा।

निवेदक आमाडब्लम मिनी हाइड्रो प्रा.लि. काठमाडौं प्रस्तावक रहेको आमाडब्लम मिनीहाइड्रो आयोजना ५१२ किलोवाटको विद्युत उत्पादन तथा ११ के.भी. सिङ्गल सर्किट प्रसारण लाईन आयोजनाको वातावरणीय प्रभाव मूल्याङ्कनको क्षेत्र निर्धारण प्रतिवेदन तयार गर्नको लागि प्रदेश वातावरण ऐन २०७६ तथा नियमावली बमोजिम सार्वजनिक सूचनाको प्रतिलिपि १ प्रति सोलुखुम्बु जिल्ला खुम्बु पासाङल्हामु गा.पा. वडा नं. ०४, खुम्जुङ स्वास्थ्य चौकी (फङ्बोचे) मा आज मिति २०७८-०७-२८ गते दिनको ५ बजे हामीहरुको रोहवरमा टाँस गरी यो मुचुल्का खडा गरि दियौं।

तपसिल :

- सोलुखुम्बु जिल्ला खुम्बु पासाङल्हामु गा.पा. वडा नं. ०४ बस्ने वर्ष २४ को प्रमिल राना मगर [signature]
- सोलुखुम्बु जिल्ला खु.पा.गा.पा. वडा नं. ०४ बस्ने वर्ष २२ को पासाङ फुटी शेर्पा [signature]

इति सम्वत २०७८ साल ०७ महिना २८ गते रोज ... शुभम्।

दर्ता नं.

༄༅། སྤང་ཆེ་སྦས་ཡུལ་བུད་མེད་ཚོགས་པ།

पाङबोचे बेयूल महिला समूह

Pang Boche Beyul Women Group

खुम्बु पासाङ ल्हामु गाउँपालिका ४, पाङबोचे

च.नं.

पत्र सं.

मिति : २०७८।०८।२२८

श्री ईको फ्रेण्ड इन्टरनेशनल नेपाल प्रा. लि.

ललितपुर, नेपाल ।

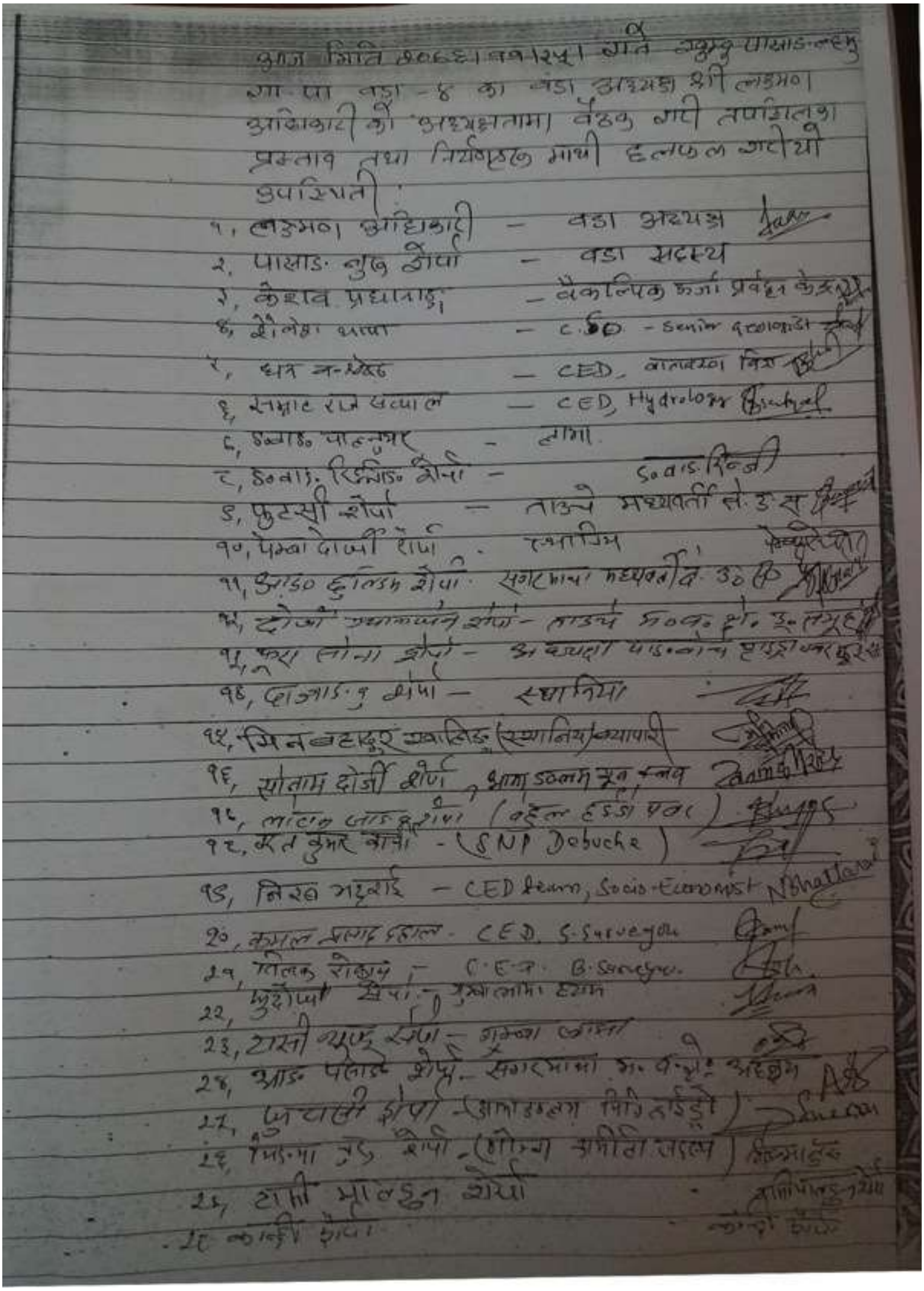
विषय: सूचना टाँस गरिएको बारे ।

लिखितम आमादब्लम खोला मिनी हाइड्रो प्रा. लि. काठमाडौं प्रस्तावक रहेको आमादब्लम मिनी हाइड्रो आयोजना ६११ कि.वा. विद्युत उत्पादन तथा ११ के.भी. सिङ्गल सर्किट प्रसारण लाइन आयोजनाको वातावरणीय प्रभाव मूल्याङ्कन तयार गर्नका लागि खुम्बु पासाङ ल्हामु गा.पा. ४ पाङबोचे अवस्थित (सरोकारवाला) संघसंस्था बाट राय सल्लाह सुझाव आवश्यक रहेकोले सो सम्बन्धि सूचना १ प्रतिलिपी यस महिला समूह कार्यालयमा टाँस गरिएको व्यहोरा अनुरोध छ ।

तपसिल: सोलुखुम्बु जिल्ला खु.पा.ल्हा.गा.पा. ४ बस्ने फुर्वी याङ्जी शेर्पा ५८ वर्ष । फुर्बा याङ्जी शेर्पा

सोलुखुम्बु जिल्ला खु.पा.ल्हा.गा.पा. ४ बस्ने दावा फुटी शेर्पा ५० वर्ष फुटी

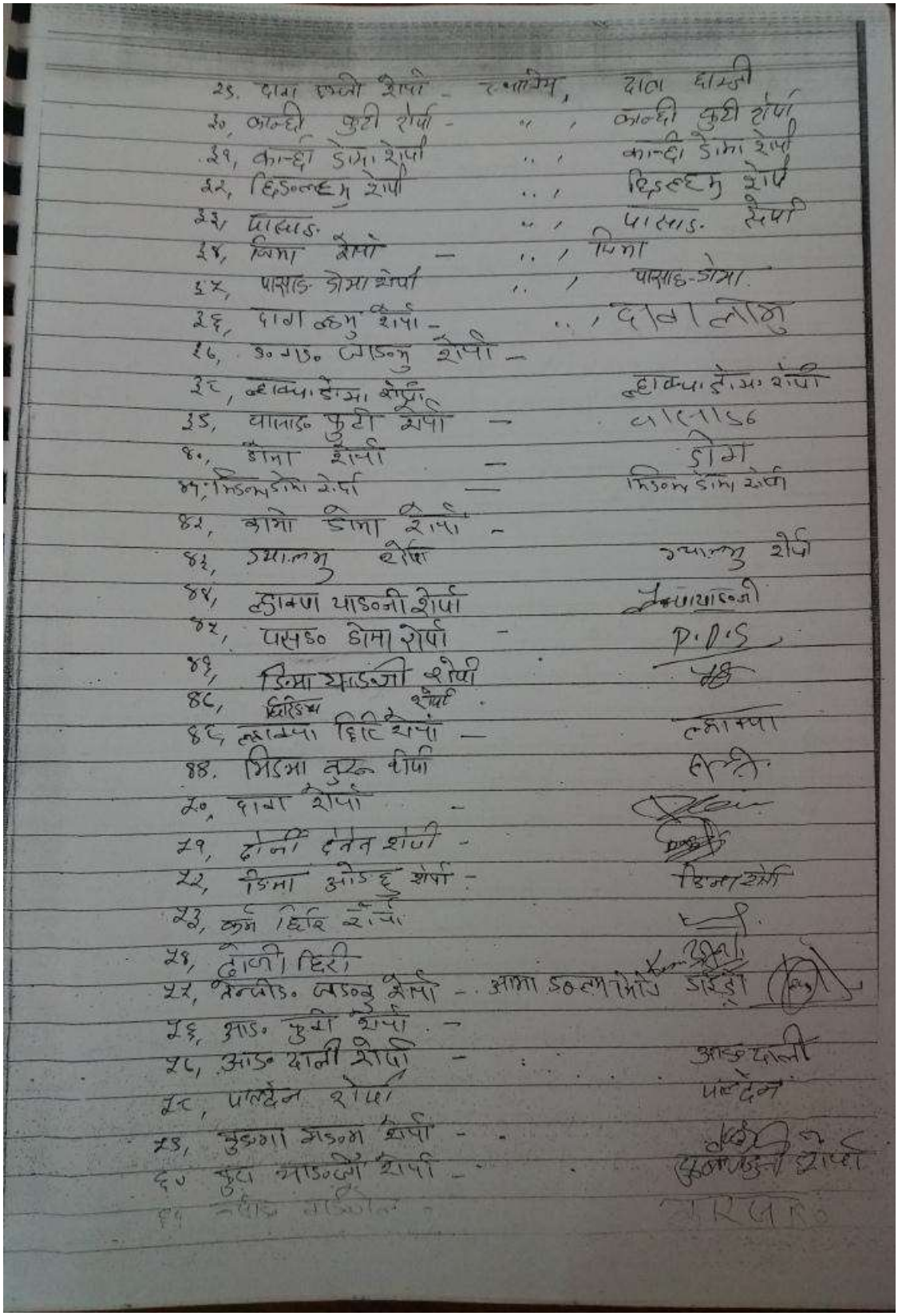
Annex XIII: Meeting Minutes of Interaction Program



आज मिति २०७६।०१।२५ । गते खुम्बु पासाङल्हामु गा.पा. वडा -४ का वडा अध्यक्ष श्री लक्ष्मण अधिकारी को अध्यक्षतामा बैठक बसी तपसिलका प्रस्ताव तथा निर्णयहरु माथी छलफल गरीयो

उपस्थिती :

१, लक्ष्मण अधिकारी — वडा अध्यक्ष
२, पासाङ नुरु शेर्पा — वडा सदस्य
३, केशव प्रधानाङ्ग — वैकल्पिक ऊर्जा प्रवर्द्धन केन्द्र
४, शैलेश थापा — C.ED - Senior Geologist
५, धन बस्नेत — CED, वातावरण विद
६, सम्राट राज सत्याल — CED, Hydrology
७, ङवाङ पाङ्नुर — लामा
८, ङवाङ रिग्जिन शेर्पा —
९, फुरस्वी शेर्पा — ताउचे मध्यवर्ती क्षे. उ.स.
१०, पेम्बा दोर्जी शेर्पा — स्थानिय
११, आङ छुलिङ शेर्पा — सगरमाथा मध्यवर्ती उ.स.
१२, दोर्जी ग्यालजेन शेर्पा — लाङ्चे म.व.क्षे. उ. समूह
१३, फुरा लोना शेर्पा — अध्यक्ष पाङबोचे ...
१४, दावा ङ शेर्पा — स्थानिय
१५, मिन बहादुर खालिङ (स्थानिय) व्यापारी
१६, सोनाम दोर्जी शेर्पा, आमा डब्लम यूथ क्लब
१७, लाक्पा ग्याल्जेन शेर्पा (होटल ...)
१८, सन्त कुमार थापा - (SNP Debuche)
१९, निरज भट्टराई — CED team, Socio-Economist
२०, कमल प्रसाद पौडेल - CED, S-Surveyor
२१, तिलक रोकाय — C.E.D. B-Surveyor
२२, छुरोप्पा शेर्पा - गुम्बा ...
२३, टासी ग्याल्जेन शेर्पा — गुम्बा लामा
२४, आङ पासाङ शेर्पा — सगरमाथा म.व.क्षे. अध्यक्ष
२५, पुचाली शेर्पा (आमाडब्लम मिनि हाइड्रो)
२६, मिङमा टेन्डी शेर्पा (... समिति अध्यक्ष)
२७, टासी मोलेन्द्र शेर्पा
२८ कान्छी शेर्पा



प्रस्ताव हरु,

१, आमादब्लम मिनी हाइड्रो कम्पनि प्राइभेट लिमिटेडले यस खुम्बु पासाङ ल्हामु गाउँपालिका वडा नं -४ पाङबोचेमा निर्माण गर्न लागेको हाइड्रो पावरको बारेमा जानकारी दिने।

२. वैकल्पिक ऊर्जा प्रवर्धन केन्द्र बाट यस आयोजनालाई गर्न सक्ने सहयोग बारे जानकारी दिने।

३. कम्युनिनेरा न हैड वुर्की डेभलपर्स प्राइभेट लिमिटेडको डिटेल फिजिबिलिटी स्टडी (D.F.S) वा वृस्तित सम्भाव्यता अध्ययन सम्बन्धी जानकारी दिने।

४. स्थानीय निकाय (गाउँपालिका र वडा) बाट यस आयोजनालाई गर्न सक्ने सहयोग बारे जानकारी दिने।

५. सगरमाथा राष्ट्रिय निकुञ्जले यस आयोजनाले गर्ने वातावरण सम्बन्धी बसान पुर्याउन पर्ने कुराहरु बारे जानकारी दिने।

६ स्थानिय वासिले यस कम्पनी दिन सक्ने सुविधा बारे जानकारी लिने र केहि विविध छ भने प्रस्ताव गर्ने।

छलफल एवम जानकारी,

१ प्रस्ताव नं १ माथि छलफल गर्दा आमादब्लम मिनी हाइड्रो कम्पनीले आयोजना सम्बन्धी जानकारी दिइयो

२. प्रस्ताव नं.२ माथि छलफल गर्दा वैकल्पिक उर्जा प्रवर्धन केन्द्रबाट यस आयोजनालाई गर्न सहयोग बारे जानकारी गराइयो।

साथै कम्पनि कम्युनिनेरा न हैड वुर्की डेभलपर्स

प्रा लि ले सबै सम्बन्धी सम्पूर्ण जानकारी प्रदान गर्यो

४. सभाध्यक्ष राष्ट्रिय निकुञ्ज द्वारा आयोजनाले पालना गर्नु पर्ने नियम बारे जानकारी दिइयो।

५. स्थानिय निकायले गर्ने सहयोग बारे जानकारी प्रदान गरियो।

६. स्थानिय वासिले आफ्नो जिल्लामा [illegible] गर्यो।

Bhattarai

Annex XIV: Meeting Minutes of Scoping Meeting

Date ______
Page ______

नेपाल सरकार वैकल्पिक ऊर्जा प्रवर्द्धन केन्द्र (AEPC) तथा विश्व बैंक (WB) को आर्थिक तथा प्राविधिक सहयोगमा आमादब्लम खोला मिनि हाइड्रो प्रा.लि बाट प्रदेश नं-१ सोलुखुम्बु जिल्लाको खुम्बु पासाङल्हामु गा.पा. वडा नं-४ मा रहेको च्यौनुन्चे खोलाको पानीबाट बन्ने ९११ कि.वा क्षमताको विद्युत निकाल्ने योजनामा रहेको र उक्त परियोजनाको वातावरणीय प्रभाव मूल्यांकन (EIA) अध्ययन सम्बन्धी क्षेत्र निर्धारण (Scoping) गर्ने क्रममा आज मिति २०७८।६।२६ गतेका दिन सगरमाथा राष्ट्रिय निकुञ्ज केन्द्रीय कार्यालयका प्रमुख ~~निरीक्षण~~ संरक्षण अधिकृत श्री भुमीराज उपाध्याय ~~ज्यू~~ ज्यूको ~~अध्यक्षतामा खुम्बु~~ व समुपस्थितिमा यस खुम्बु पासाङल्हामु गा.पा. ४, फोर्चेमा यस क्षेत्रका विद्यालय, ऐसंस्था तथा सरोकारवालाहरूको उपस्थितिमा सार्वजनिक छलफल सम्पन्न भयो।

उपस्थिति :- नाम	संस्था/पद/ठेगाना	हस्ताक्षर
१. भुमीराज उपाध्याय	रा.नि.नि.का/प्र.स.अ.	
२. विष्णु लेकाली	[illegible]	
३. केशव प्रधानाङ्ग	वै.ऊ.प्र.केन्द्र	
४. सुनिता खतिवडा	वै.ऊ.प्र केन्द्र	
५. विष्णु मणि दाहाल	स.रा.नि.का.	
६. ल्हाक्पा नुरु शेर्पा	फोर्चे युवा समूह (सचिव)	
७. तेन्जिङ ग्यालजेन शेर्पा (फोर्चे विद्युत)		
८. मिङ्मा सोना शेर्पा (फोर्चे युवा समूह (सदस्य)		
९. कामरिता शेर्पा (फोर्चे युवा समूह ,,)		
१०. मिङ्मा ग्याल्जेन शेर्पा / फोर्चे आमा समूह		
११. डवाङ तेन्जीङ शेर्पा (फोर्चे विद्युत)		
१२. ईला नुरु शेर्पा (फोर्चे युवा समूह (अध्यक्ष)		
१३. दादिरी शेर्पा	फोर्चे युवा समूह सदस्य	
१४. हिमाल शेर्पा	,, ,, सह सचिव	
१५. छिमी छिरिङ शेर्पा	मध्यवर्ती क्षेत्र उ. समिति, अध्यक्ष	
१६. जीवन हरि कुकाथोके	वै.ऊ.प्र.के.	
१७. शिव प्र. तिमल्सिना, CED		

Date ____
Page ____

१८. धन बहादुर श्रेष्ठ EFL, EIA Study team [signature]
१९. रामजी कोइराले " " [signature]
२०. उमेश अधिकारी " " [signature]

छलफलमा उठेका विषयहरु:

१. हाल संचालनमा रहेको गाउँको टाइकोको विषयलाई वातावरणीय प्रभाव मूल्याङ्कनमा समेट्नु पर्ने ।
२. विद्युत उत्पादन भइसकेपछि न्युन आयस्तर भएका घरधुरीलाई न्युनदरमा बिजुली उपलब्धता गराउनु पर्ने ।
३. नदि तथा खोलामा विद्युतिय तार क्रसिङ गराउँदा हेलिकप्टर तथा चराचुरुङ्गीलाई असर नगर्ने गरी तार टाङ्नु पर्ने ।
४. विद्युत तार अनि पोल निर्माण गर्दा निस्कने माटो ढुंगा तथा आगमनलाई पार्ने बारेमा ध्यान दिनु पर्ने ।
५. प्रस्तावित योजनाले समग्रमा धेरै फाइदा हुने जस्तै कि पाउरा कम लाग्ने, ग्याँसको मात्रा घट्ने, वन जंगल ओगट्ने जस्ता राम्रा कुराहरु हुने देखिन्छ । त्यसैले चाँडो भन्दा चाँडो यो आयोजना सम्पन्न भएको देख्न पाइयोस् ।

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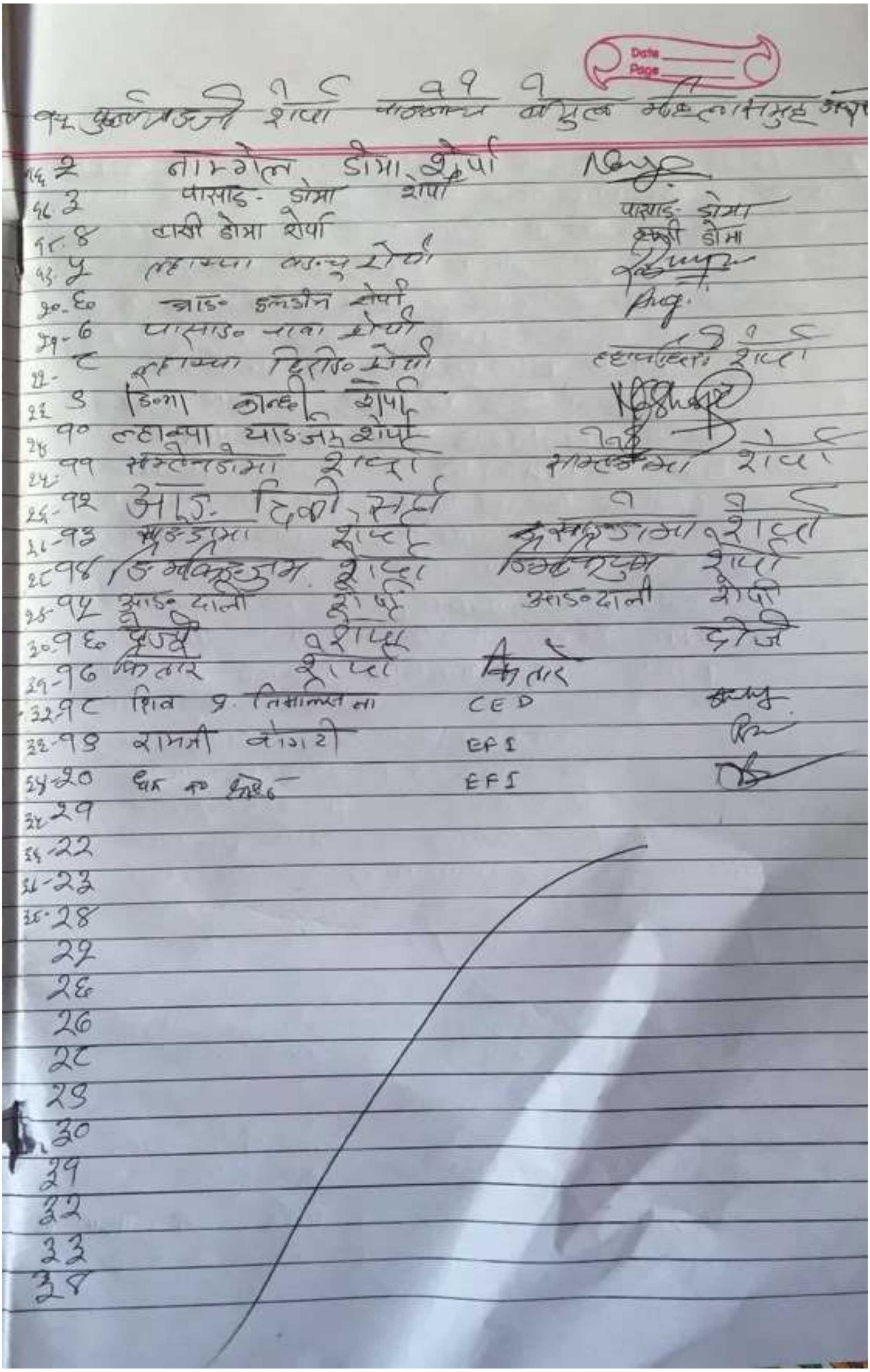
नेपाल सरकार वैकल्पिक उर्जा प्रवर्द्धन केन्द्र (AEPC) तथा विश्व बैंक (WB) को आर्थिक तथा प्राविधिक सहयोगमा आमादब्लम खोला मिनी हाइड्रो प्रा.लि. बाट प्रदेश नं. १ सोलुखुम्बु जिल्लाको खुम्बु पासाङल्हामु गाउँ पालिका वडा नं. ४ मा रहेको चोलुन्चे खोलाको पानीबाट बर्ने ९११ किलोवाट क्षमताको विद्युत निकाल्ने योजना रहेकोमा उक्त परियोजनाको वातावरणीय प्रभाव मूल्यांकन (EIA) अध्ययन सम्बन्धि क्षेत्र निर्धारण (Scoping) गर्ने क्रममा आज मिति २०७८/६/२८ गतेका दिन सगरमाथा राष्ट्रिय निकुञ्ज (SNP) का प्रमुख श्री भूमीराज उपाध्याय (प्रमुख संरक्षण अधिकृत) ज्यूको समुपस्थितीमा यस खुम्बु पासाङल्हामु गाउँ पालिका वडा नं ४ अवस्थीत माथिल्लो पाङबोचे गाउँमा यस क्षेत्रका विद्यालय, स्वास्थ्य संस्था, गुम्बा, लगायत अन्य सामाजिक संघसंस्था तथा सरोकारवालाहरुको उपस्थितिमा सार्वजानिक छलफल कार्यक्रम सम्पन्न भयो।

<u>उपस्थिती</u>

क्र.सं.	नाम	संघसंस्था/पद/स्थान	हस्ताक्षर
१.	भूमीराज उपाध्याय	स.रा.नि./प्र.सं.अ.	[illegible]
२.	बिष्णु रोकाया	" / स.सं.अ.	[illegible]
३.	दावा नुरु शेर्पा	स्थानीय	[illegible]
४	पासाङ नुरु शेर्पा	खु.पा.गा.पा.४ (वडा) वडा सदस्य	[illegible]
५	आङ पसाङ शेर्पा	सगरमाथा मं.पे. शेर्पा अध्यक्ष	[illegible]
६	आङ फुरिङ्म शेर्पा	" " उपाध्यक्ष	[illegible]
७.	अनिल राना मगर	[redacted] (हेल्थ पोष्ट इन्चार्ज)	[illegible]
८	डावा शेर्पा A.	बु तेङ्बो म उ दो अध्यक्ष	[illegible]
९	दा जाङ्बु शेर्पा	छ्योपोंछे सदस्य	[illegible]
10)	फुर्बा गेल्जे शेर्पा	[illegible]	[illegible]
11)	ल्हाक्पा दोर्जी शेर्पा		[illegible]
12)	कुङ्गा ग्याजु शेर्पा	(आमा डब्लम युवा क्लब अध्यक्ष)	[illegible]
13	पासाङ जिला शेर्पा	(	[illegible]
14	छिरिङ्ग दोर्जी शेर्पा	)	[illegible]


Date
Page
१ फुर्बाञ्जी शेर्पा अध्यक्ष [illegible] महिला समूह
२ नाङगेल डोमा शेर्पा
३ पासाङ डोमा शेर्पा पासाङ डोमा
४ टासी डोमा शेर्पा टासी डोमा
५ ल्हाक्पा [illegible] शेर्पा
६ आङ [illegible] शेर्पा
७ पासाङ [illegible] शेर्पा
८ ल्हाक्पा दिकी शेर्पा
९ डिमा [illegible] शेर्पा
१० ल्हाक्पा याङजी शेर्पा
११ मिङमा डोमा शेर्पा
१२ आङ दिकी शेर्पा
१३ [illegible] डोमा शेर्पा
१४ छिरिङ [illegible] शेर्पा
१५ आङ दाली शेर्पा आङदाली शेर्पा
१६ दोर्जी शेर्पा दोर्जी
१७ कितार शेर्पा कितार
१८ शिव प्र. तिमल्सिना CED
१९ रामजी [illegible] EFI
20 [illegible] EFI
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छलफलमा उठेका विषयहरु:

१. बस्ती भन्दा टाढा, वनमा नपर्ने, व्यक्तिगत जग्गामा नपर्ने तथा [illegible] सकेसम्म काटछाँट नपर्ने हुँदा वातावरणमा कम प्रभाव पर्ने।

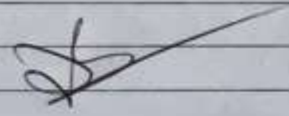
२. दाउरा, गोबर तथा ग्यासमा भर पर्नु पर्ने बाध्यता हट्ने भएकोले चाँडै बनु पर्ने।

३. स्थानीय उपभोक्ताले पनि सेयर हाल्न पाउनु पर्ने।

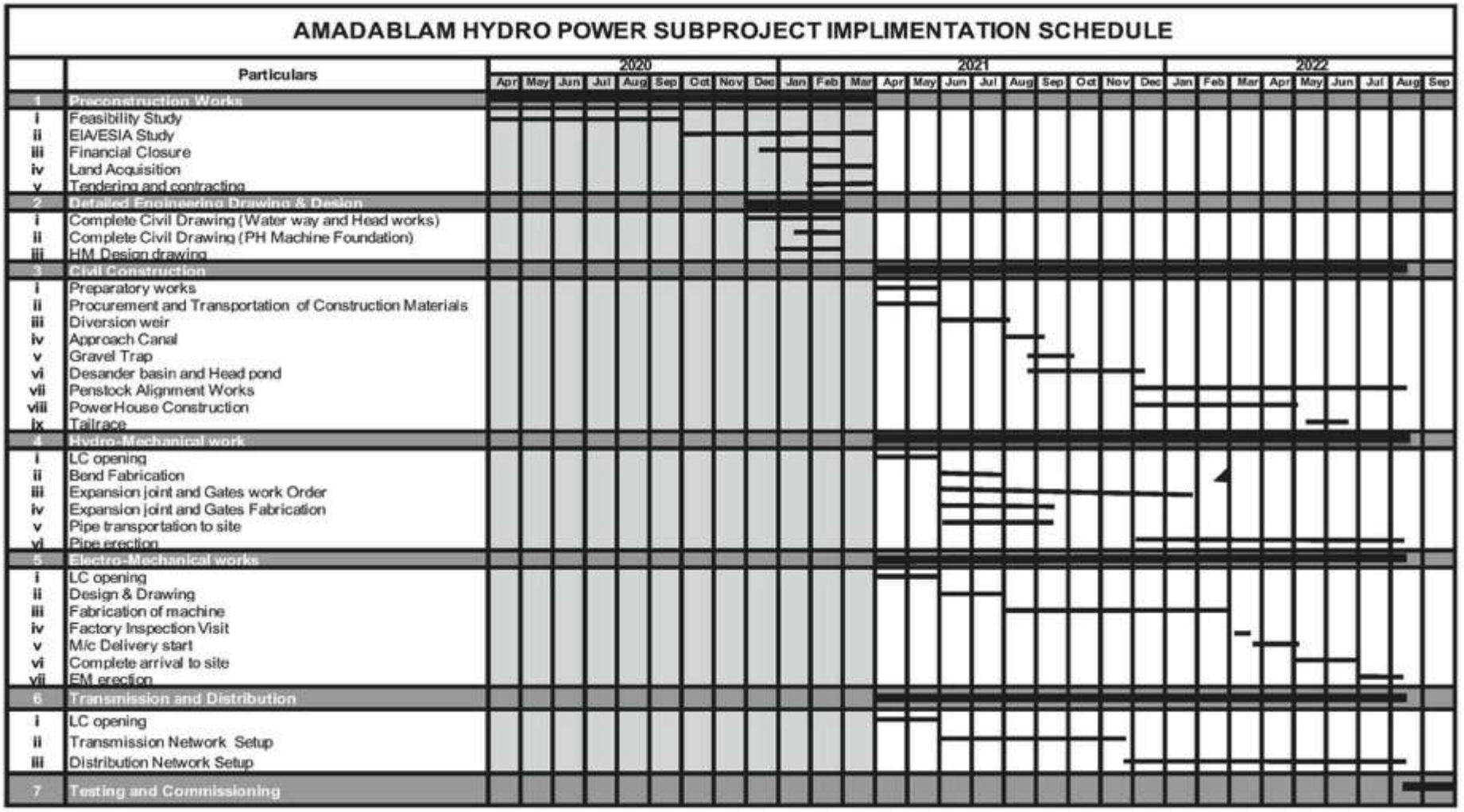
४. विद्युत उत्पादन गर्न पाए वन जंगल संरक्षणको साथै गोबर लगायत जैविक इन्धन माथि निर्भरता अन्त्य हुने।

५. प्रसारण लाइन निर्माण गर्दा पर्यटक रुट आउने वनमा गर्नु पर्ने देखिएको।

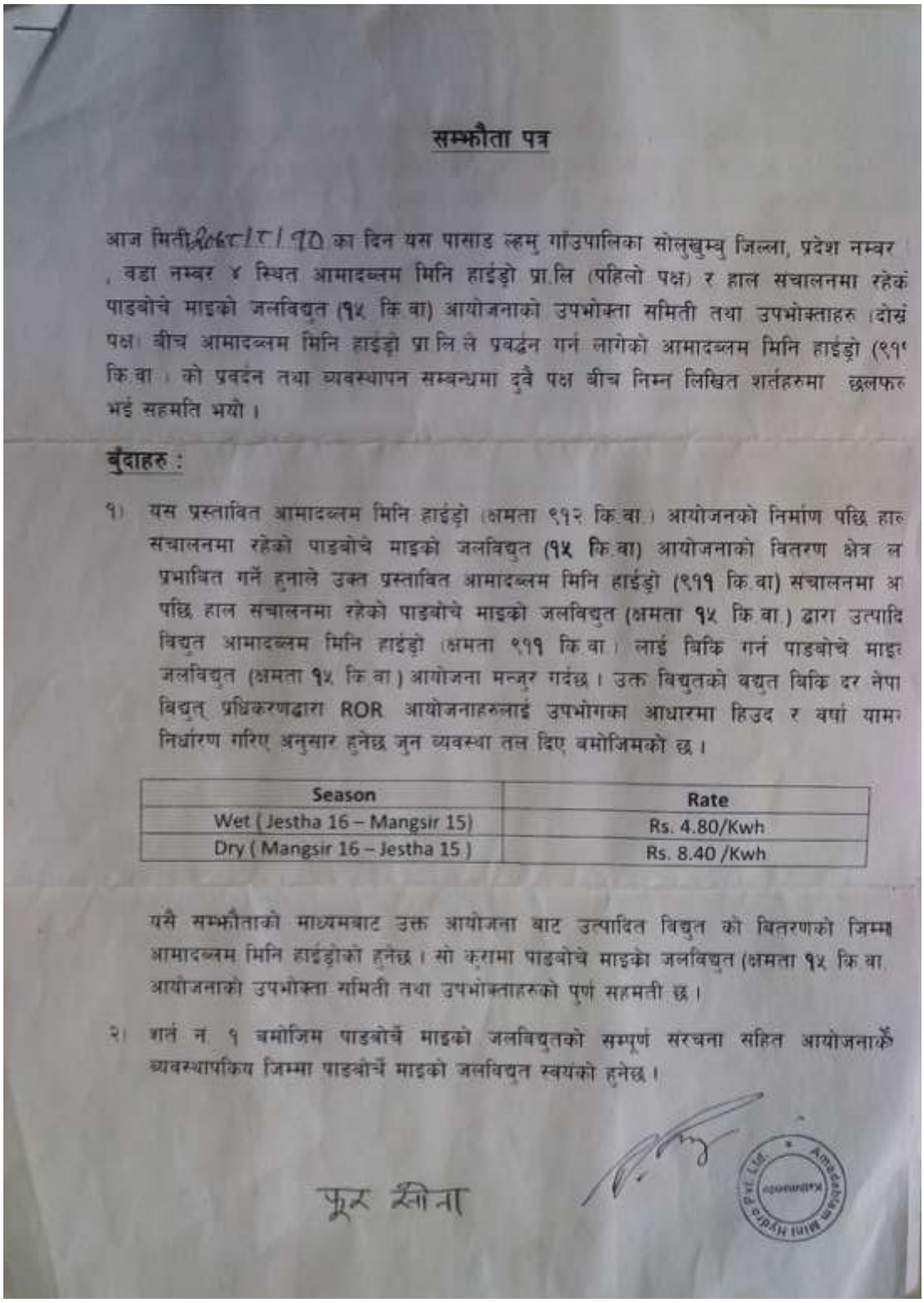
६. गाउँमा फाइदा धेरै हुने देखिएकोले गर्दा छिटो भन्दा चाँडो बनाएर संचालनमा ल्याउनु पर्ने।



Annex XV: Implementation Schedule



Annex XVI: Agreement Paper with Existing Micro Hydro



सम्झौता पत्र

आज मिती २०८२/१२/१० का दिन यस पासाङ ल्हमु गाँउपालिका सोलुखुम्बु जिल्ला, प्रदेश नम्बर १, वडा नम्बर ४ स्थित आमादब्लम मिनि हाईड्रो प्रा.लि (पहिलो पक्ष) र हाल संचालनमा रहेको पाडबोचे माइक्रो जलविद्युत (१५ कि.वा) आयोजनाको उपभोक्ता समिती तथा उपभोक्ताहरु (दोस्रो पक्ष) बीच आमादब्लम मिनि हाईड्रो प्रा.लि.ले प्रवर्द्धन गर्न लागेको आमादब्लम मिनि हाईड्रो (९१९ कि.वा.) को प्रवर्दन तथा व्यवस्थापन सम्बन्धमा दुवै पक्ष बीच निम्न लिखित शर्तहरुमा छलफल भई सहमति भयो।

बुँदाहरु :

१) यस प्रस्तावित आमादब्लम मिनि हाईड्रो (क्षमता ९१२ कि.वा.) आयोजनको निर्माण पछि हाल संचालनमा रहेको पाडबोचे माइक्रो जलविद्युत (१५ कि.वा) आयोजनाको वितरण क्षेत्र ल प्रभावित गर्ने हुनाले उक्त प्रस्तावित आमादब्लम मिनि हाईड्रो (९१९ कि.वा) संचालनमा आ पछि हाल संचालनमा रहेको पाडबोचे माइक्रो जलविद्युत (क्षमता १५ कि.वा.) द्वारा उत्पादि विद्युत आमादब्लम मिनि हाईड्रो (क्षमता ९१९ कि.वा.) लाई बिकि गर्न पाडबोचे माइक्र जलविद्युत (क्षमता १५ कि.वा.) आयोजना मन्जुर गर्दछ। उक्त विद्युतको बद्युत बिकि दर नेपा विद्युत् प्राधिकरणद्वारा ROR आयोजनाहरुलाई उपभोगका आधारमा हिउद र बर्षा याम निर्धारण गरिए अनुसार हुनेछ जुन व्यवस्था तल दिए बमोजिमको छ।

Season	Rate
Wet (Jestha 16 – Mangsir 15)	Rs. 4.80/Kwh
Dry (Mangsir 16 – Jestha 15)	Rs. 8.40 /Kwh

यसै सम्झौताको माध्यमबाट उक्त आयोजना बाट उत्पादित विद्युत को बितरणको जिम्मा आमादब्लम मिनि हाईड्रोको हुनेछ। सो कुरामा पाडबोचे माइक्रो जलविद्युत (क्षमता १५ कि.वा. आयोजनाको उपभोक्ता समिती तथा उपभोक्ताहरुको पुर्ण सहमती छ।

२) शर्त नं १ बमोजिम पाडबोचे माइक्रो जलविद्युतको सम्पुर्ण संरचना सहित आयोजनाको व्यवस्थापकिय जिम्मा पाडबोचे माइक्रो जलविद्युत स्वयंको हुनेछ।

फुर सेना

३) हालको आयोजनाहरुको सञ्चालन तथा व्यवस्थापन साथै विस्थापनको लागि उ आयोजनाहरुले सहयोगकर्ता (donor) को सहमति आवश्यक भए स्वयम्ले लिनुपर्ने प्रस्तावित आयोजनाले भविष्यमा सहयोग कर्ता (donor) बाट आउने कुनै पनि किसिमक माग दावि तथा क्षतिपूर्ति बेहोर्ने छैन ।

३) प्रस्तावित आयोजनाको निर्माणको क्रममा आवश्यक पर्ने विद्युत सविक आयोजनाले माथि बु नं १ मा उल्लेखित दरमा उपलब्ध गर्ने तथा निर्माण, प्रवर्द्धन र संचालनको लागी य सम्झौताका सम्पूर्ण पक्षहरुबाट आवश्यक सहयोग गर्ने प्रतिवद्धता व्यक्त गर्दछन् ।

४) यस आयोजनाले विद्युत वितरण गर्न थालेपछि आयोजनाले निर्धारण गरेको दरमा विद्युत खरी गर्ने सहमति भयो ।

५) पाङबोचे माइको जलविद्युत (१५ कि वा) आयोजनाले बेहोर्नु पर्ने कुनै पनि दायित्व नरहेको भविष्यमा कुनै दायित्व बापत दावि आएमा त्यसको जिम्मा प्रस्तावित आमादब्लम मिनि हाईड्रो आयोजनाले लिने छैन । उक्त दायित्वको फरफारकको जिम्मा स्वयम् पाङबोचे माइक जलविद्युत (१५ कि वा) आयोजनाको उपभोक्ता समितीले लिनु पर्ने छ ।

६) यो सम्झौता अनुसार भविष्यमा कुनैपनि विवाद उत्पन्न भएमा दुई पक्ष मिलेर सहमति गरिनेछ , दुवै पक्ष बीच सहमति नभएमा नेपालको विद्यमान कानून अनुसार सहमति गरिनेछ ।

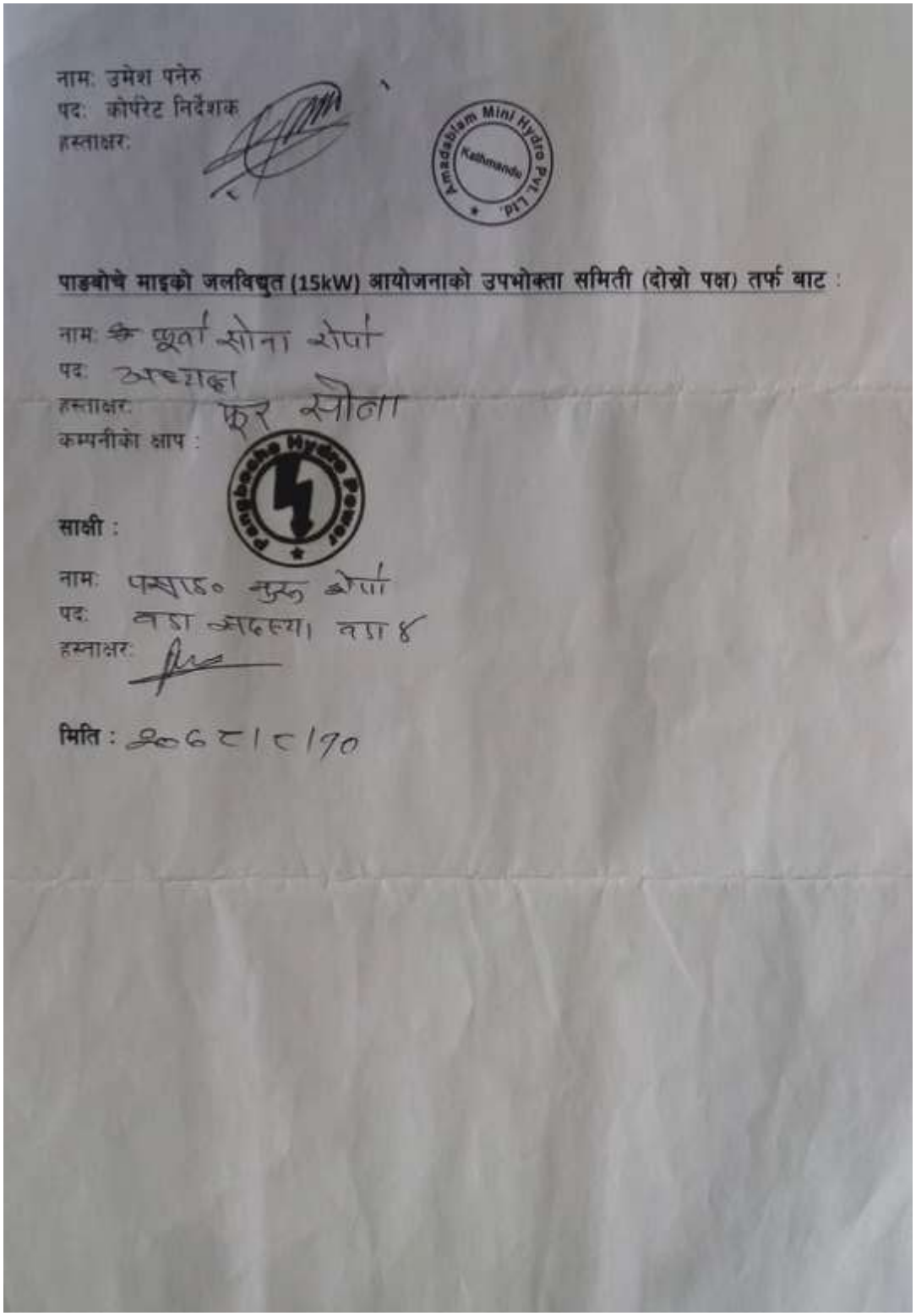
७) यो सम्झौता आजको मितीबाट लागू हुनेछ र आयोजना सचालन रहुन्जेल सम्म प्रभावकारी रहनेछ ।

आमादब्लम मिनि हाईड्रो प्रा.लि (पहिलो पक्ष) तर्फ बाट :

नाम: ल्हाक्पा सोनाम शेर्पा
पद: अध्यक्ष
हस्ताक्षर:
कम्पनीको छाप :

Amadablam Mini Hydro Pvt. Ltd. Kathmandu

साक्षी :



नाम: उमेश पनेरु
पद: कोर्पोरेट निर्देशक
हस्ताक्षर:

Amadablam Mini Hydro Pvt. Ltd. Kathmandu

पाङबोचे माइक्रो जलविद्युत (15kW) आयोजनाको उपभोक्ता समिती (दोस्रो पक्ष) तर्फ बाट :

नाम: श्री फुर्वा सोना शेर्पा
पद: अध्यक्ष
हस्ताक्षर: फुर सोना
कम्पनीको छाप :

Pangboche Hydro Power

साक्षी :

नाम: पासाङ० मुक्ति शेर्पा
पद: वडा सदस्य। वडा ४
हस्ताक्षर:

मिति : २०७८।८।१०

सम्झौता पत्र

आज मिती २०६८/८/१६ का दिन पासाङ ल्हमु गाँउपालिका ,प्रदेश नम्बर ३ ,वडा नम्बर ४ स्थित आमादब्लम मिनि हाईड्रो प्रा.लि (पहिलो पक्ष) र हाल सचालनमा रहेको पोर्त्से माइको जलविद्युत (क्षमता ५० कि.वा.) आयोजनाको उपभोक्ता समिती (दोस्रो पक्ष) बीच आमादब्लम मिनि हाईड्रो प्रा.लि ले प्रवर्द्धन गर्न लागेको आमादब्लम मिनि हाईड्रो (क्षमता ९१२ कि.वा.) को प्रवर्दन तथा व्यवस्थापन सम्बन्धमा दुवै पक्ष बीच निम्न लिखित शर्तहरुमा छलफल भई सहमति भयो।

बुँदाहरु :

१) यस प्रस्तावित आमादब्लम मिनि हाईड्रो (क्षमता ९१२ कि.वा.) आयोजनाले निर्माण पछि हाल सचालनमा रहेको पोर्त्से माइको जलविद्युत (क्षमता ५० कि.वा.) को वितरण क्षेत्र लाई प्रभावित गर्ने हुनाले उक्त प्रस्तावित आमादब्लम मिनि हाईड्रो (क्षमता ९१२ कि.वा.) सचालनमा आए पछि हाल सचालनमा रहेको पोर्त्से माइको जलविद्युत (क्षमता ५० कि.वा.) द्वारा उत्पादित विद्युत आमादब्लम मिनि हाईड्रो (क्षमता ९१२ कि.वा.) लाई बिकि गर्न पोर्त्से माइको जलविद्युत (क्षमता ५० कि.वा.) आयोजना मन्जुर गर्दछ। उक्त विद्युतको वद्युत बिकि दर नेपाल विद्युत् प्रधिकरणद्वारा ROR आयोजनाहरुलाई उपभोगका आधारमा हिउद र वर्षा याममा निर्धारण गरिए अनुसार हुनेछ जुन व्यवस्था तल दिए बमोजिमको छ।

Season	Rate
Wet (Jestha 16 – Mangsir 15)	Rs. 4.80/Kwh
Dry (Mangsir 16 – Jestha 15)	Rs. 8.40 /Kwh

यसै सम्झौताको माध्यमबाट उक्त आयोजना बाट उत्पादित विद्युत को वितरणको जिम्मा आमादब्लम मिनि हाईड्रोको हुनेछ। सो करारमा पोर्त्से माइको जलविद्युत (क्षमता ५० कि.वा.) आयोजनाको उपभोक्ता समिती तथा उपभोक्ताहरुको पुर्ण सहमती छ।

२) शर्त नं १ बमोजिम पोर्त्से माइको जलविद्युतको सम्पूर्ण संरचना सहित आयोजनाको व्यवस्थापकिय जिम्मा पोर्त्से माइको जलविद्युत स्वयको हुनेछ।

पासाङ ल्हमु गाँउपालिका

Amadablam Mini Hydro Pvt. Ltd.

३) प्रस्तावित आयोजनाको निर्माणको क्रममा आवश्यक पर्ने विद्युत सोविक आयोजनाले माथि बुंदा नं. १ मा उल्लेखित दरमा उपलब्ध गर्ने तथा निर्माण, प्रवर्द्धन र संचालनको लागी यस सम्झौताका सम्पूर्ण पक्षहरुबाट आवश्यक सहयोग गर्ने प्रतिबद्धता व्यक्त गर्दछन् ।

४) यस आयोजनाले विद्युत वितरण गर्ने थालेपछि आयोजनाले निर्धारण गरेको दरमा विद्युत खरीद बिकि गर्ने सहमति भयो ।

५) पोर्त्से माइको जलविद्युत (क्षमता ५० कि.वा.) आयोजनाले बेहोर्नु पर्ने कुनै पनि दायित्व नरहेको र भविष्यमा कुनै दायित्व बापत दावि आएमा त्यसको जिम्मा प्रस्तावित आमादब्लम मिनि हाईड्रो आयोजनाले लिने छैन । उक्त दायित्वको फरफारकको जिम्मा स्वयम् पोर्त्से माइको जलविद्युत (क्षमता ५० कि.वा.) आयोजनाको उपभोक्ता समितीले लिनु पर्ने छ ।

६) यो सम्झौता अनुसार भविष्यमा कुनैपनि विवाद उत्पन्न भएमा दुई पक्ष मिलेर सहमति गरिनेछ , दुवै पक्ष बीच सहमति नभएमा नेपालको विद्यमान कानून अनुसार सहमति गरिनेछ ।

७) यो सम्झौता आजको मितीबाट लागू हुनेछ र आयोजना संचालन रहुन्जेल सम्म प्रभावकारी रहनेछ ।

आमादब्लम मिनि हाईड्रो प्रा.लि (पहिलो पक्ष) तर्फ बाट:

नाम: लाक्पा सोनाम शेर्पा
पद: अध्यक्ष
हस्ताक्षर:
कम्पनीको छाप:

Amadablam Mini Hydro Pvt. Ltd. Kathmandu

साक्षी :

नाम: उमेश पनेरु
पद: कोर्पोरेट निर्देशक
हस्ताक्षर:

फोर्त्से माइको जलविद्युत (क्षमता ५० कि.वा.) आयोजनाको उपभोक्ता समिती (दोस्रो पक्ष) तर्फ बाट:

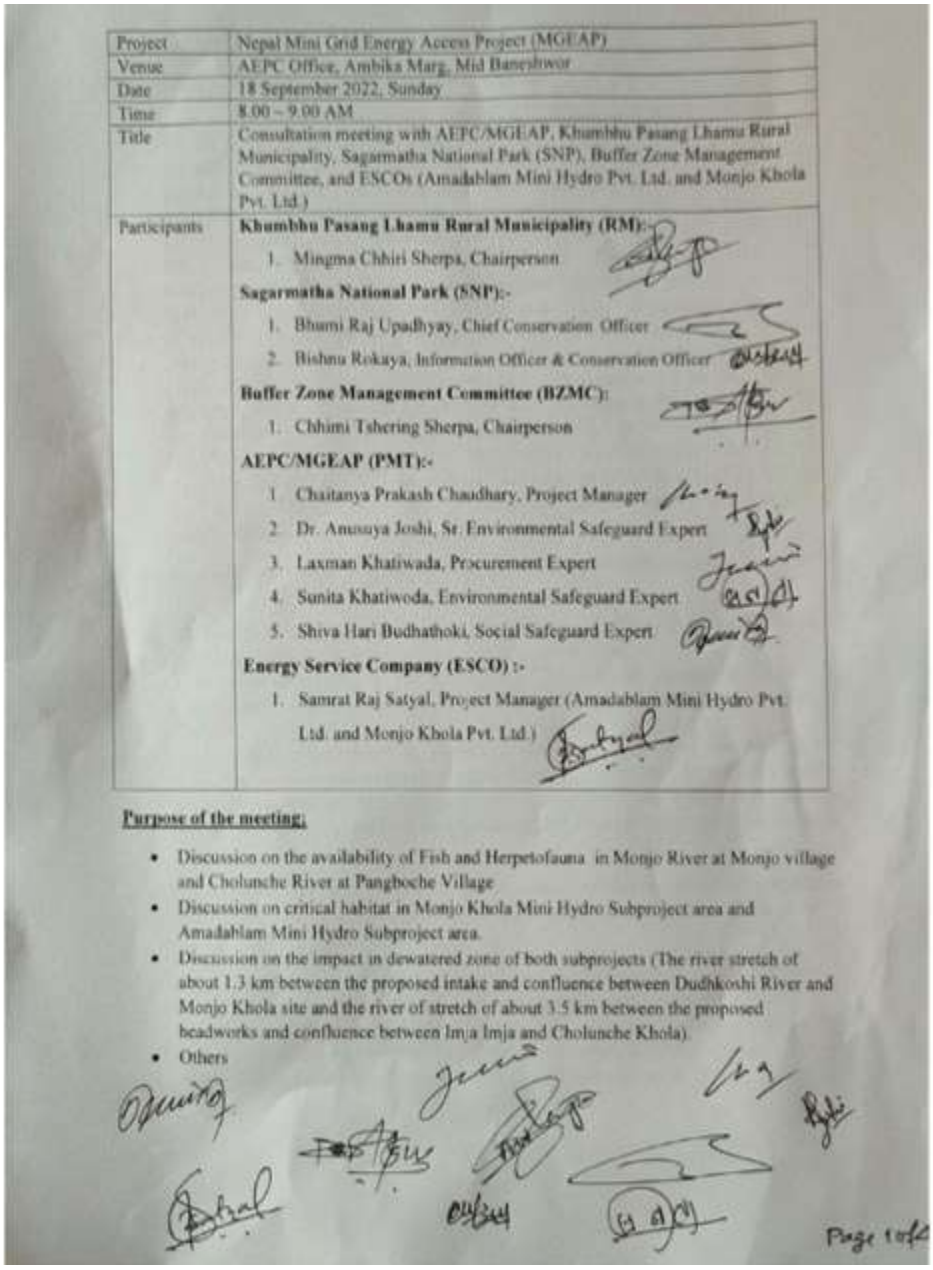
नाम: पाल्देन नाग्ये शेर्पा
पद: अध्यक्ष
हस्ताक्षर:
कम्पनीको क्षाप :

साक्षी :

नाम:
पद:
हस्ताक्षर:

मिति : २०६८/०८/१६

Annex XVII: Stakeholders Meeting Minutes



Project	Nepal Mini Grid Energy Access Project (MGEAP)
Venue	AEPC Office, Ambika Marg, Mid Baneshwor
Date	18 September 2022, Sunday
Time	8.00 – 9.00 AM
Title	Consultation meeting with AEPC/MGEAP, Khumbhu Pasang Lhamu Rural Municipality, Sagarmatha National Park (SNP), Buffer Zone Management Committee, and ESCOs (Amadablam Mini Hydro Pvt. Ltd. and Monjo Khola Pvt. Ltd.)
Participants	**Khumbhu Pasang Lhamu Rural Municipality (RM):** 1. Mingma Chhiri Sherpa, Chairperson **Sagarmatha National Park (SNP):-** 1. Bhumi Raj Upadhyay, Chief Conservation Officer 2. Bishnu Rokaya, Information Officer & Conservation Officer **Buffer Zone Management Committee (BZMC):** 1. Chhimi Tshering Sherpa, Chairperson **AEPC/MGEAP (PMT):-** 1. Chaitanya Prakash Chaudhary, Project Manager 2. Dr. Anusuya Joshi, Sr. Environmental Safeguard Expert 3. Laxman Khatiwada, Procurement Expert 4. Sunita Khatiwoda, Environmental Safeguard Expert 5. Shiva Hari Budhathoki, Social Safeguard Expert **Energy Service Company (ESCO) :-** 1. Samrat Raj Satyal, Project Manager (Amadablam Mini Hydro Pvt. Ltd. and Monjo Khola Pvt. Ltd.)

Purpose of the meeting:

- Discussion on the availability of Fish and Herpetofauna in Monjo River at Monjo village and Cholunche River at Pangboche Village
- Discussion on critical habitat in Monjo Khola Mini Hydro Subproject area and Amadablam Mini Hydro Subproject area.
- Discussion on the impact in dewatered zone of both subprojects (The river stretch of about 1.3 km between the proposed intake and confluence between Dudhkoshi River and Monjo Khola site and the river of stretch of about 3.5 km between the proposed headworks and confluence between Imja Imja and Cholunche Khola).
- Others

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Main point of discussion:

Following points were discussed and agreed during the meeting:

- A discussion was conducted on the presence of fishes in both Monjo Khola (Monjo Village) and Cholunche Khola (Pangboche Village) with the representative of RM, SNP, and BZMC. As per the discussion, there is no availability of fishes in the both rivers which could be mainly due to high slop gradient with series of tall natural water falls (mainly fall located in Khari Khola near Bupsa in Ward No. 1 of Khumbu Pasanglhamu Rural Municipality, apprx. 20 km arial distance from the Subproject site of Monjo Khola MHP), high altitude and cold & freezing water. Mr. Bhumi Raj Upadhyay, Chief Conservation Officer of SNP also mentioned that the *"Sagarmatha National Park and its Buffer Zone Management Plant 2016 – 2020, Section:5.3.2.2"* published by Government of Nepal's Institution SNP, also highlight that there is no evidence of aquatic life in the river systems around the both subproject areas. They also confirmed the observation of local people living in the nearest settlements of both subproject areas, that the local people have not seen fishes in both rivers till date. According to the representative from RM, SNP and BZMC, the nearest point from the both subprojects where the fishes can be found is Khari Khola, Ward No. 1 of Pasanglhamu RM, downstream of the waterfall, which is approx. 20 km away from Monjo Khola (Monjo Khola Mini Hydro Subproject Site) and approx. 35 km away from Cholunche Khola (Amadablam Mini Hydro Subproject Site).

During the meeting the participants shared following historical and local experience information data:

1. Till now there is no information regarding existence of fish in those areas. No local people have seen fish in Monjo Khola and Cholunche Khola.
2. It was also shared that as the water is cold, the nutrition opportunity for fish is approximately non-existence because of which fish cannot survive and no fish is available.
3. During COVID-19 pandemic, local believed that PAHA (Himalayan toad found in the river) that increases immunity and strength, so catching PAHA by local was very popular and common. Most of the local young were engaged in catching PAHA in those rivers and during that also no fish was found or caught and this also further confirms that there is no fish in those areas.

With these evidences and report of SNP, the participants of meeting recommended that there is strong evidence and experience of not having fish in Chounche Khola and Monjo Khola.

- It is also discussed in the meeting that whether the development of both subprojects' components impact on the habitat of any endangered species or not. As Mr. Bhumi Raj Upadhyay and Bishnu Rokaya from SNP and Chhimi Tshering Sherpa from BZMC have visited and observed both subprojects development areas, they have confirmed that the subprojects components do not fall in the route of any migratory birds. Though some

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mammals like Jharal, Himalayan Musk Deer, Himalayan Black Bear, Snow Leopard and Red Panda are seen in some parts of national parks and in its buffer zone area, they are moving animals and are not territorial in both subproject areas.

- A discussion was conducted on the potential adverse impact that might be caused by only 10% release of water (as per GoN policy) in the river stretch of about 1.3 km between the proposed intake and confluence between Dudhkoshi River and Monjo Khola which has been identified as a dewatered zone for Monjo Khola Mini Hydro Subproject. Mr. Mingma Chhiri Sherpa, Chairperson of the Khumbu Pasanglhamu Rural Municipality confirmed that the water in this segment of river is not used for drinking, irrigation and not any livelihood purposes by local communities. The source of water supply for drinking, irrigation and other uses is from Jorsalle (Chhu Thal Thal spring). In addition, Mr. Bhumi Raj Upadhyay reiterated that there is not presence of any fishes in Monjo Khola so that impacts on fishes and other aquatic life due to the reduction of river flow in dewatered zone is not envisaged.

- A discussion was conducted on the potential impact that might be caused by 50% release of water (as GoN Policy) in river section of about 3.5 km between the proposed headworks and confluence between Imja Khola and Cholunche Khola for Amadablam Mini Hydro Subproject. Chairperson of the Khumbu Pasanlahamu Rural Municipality that there is not the presence of any human settlement near the Cholunche Khola and the river water is not used for drinking, irrigation and other livelihood purposes. Moreover, Mr. Bhumi Raj Upadhyay and Bishnu Rokaya reiterated that there is no presence of any fishes in Cholunche Khola so that impacts on fishes and other aquatic life due to the reduction of river flow in dewatered zone is not envisaged.

- AEPC/MGEAP has informed and discussed about the progress status of both subprojects and requested RM, SNP, and BZMC to support in the days to come for the effective implementation of the project.

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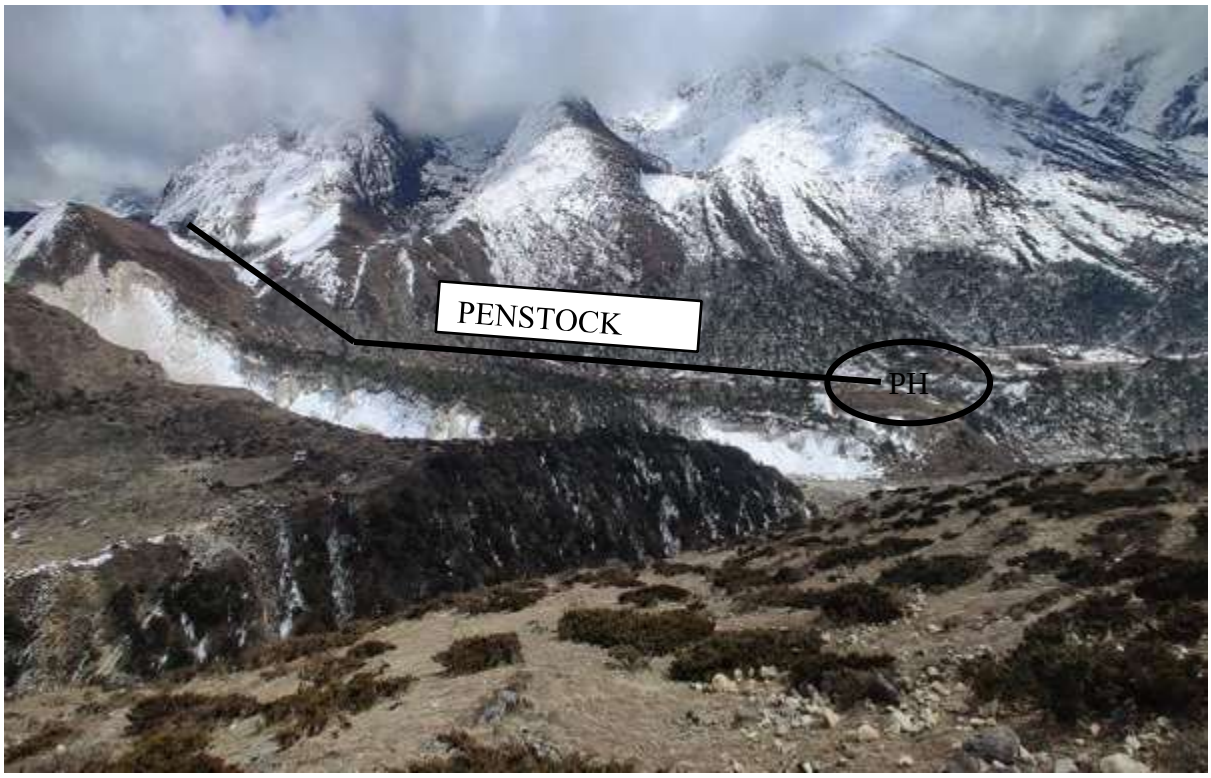
Photo of Participants in meeting

Annex XVIII: Photographs

Headworks Area

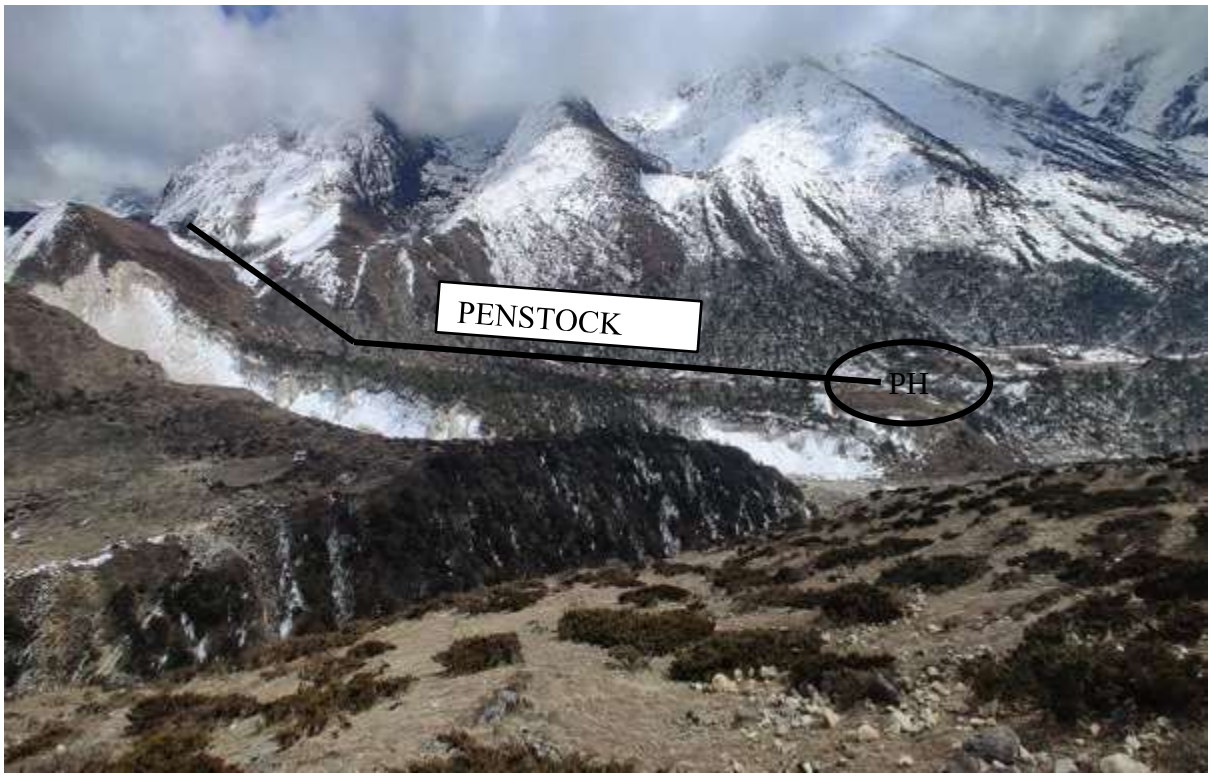


Penstock Alignment and Powerhouse Site

Meeting at Phortse

Meeting at Pangboche

Headworks Area



Penstock Alignment and Powerhouse Site

(Photo Source: DFS Report)